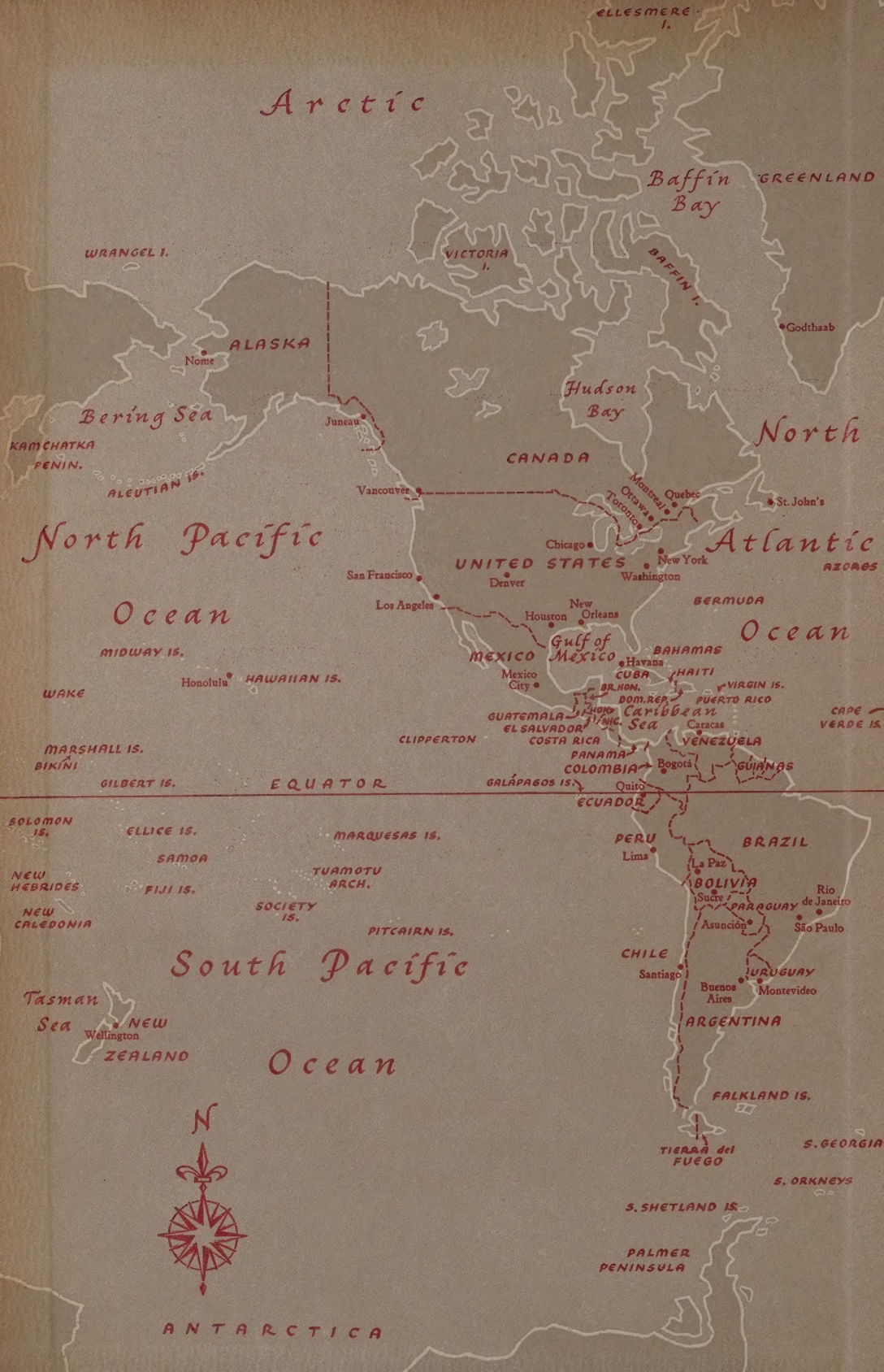
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AZORES
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Denver
Washington
Ocean
Los Angeles
New Orleans
BERMUDA
Houston
Ocean
Gulf of Mexico
MIDWAY IS.
MEXICO
BAHAMAS
Havana
Honolulu
HAWAIIAN IS.
Mexico City
CUBA
HAITI
WAKE
DR.HON.
VIRGIN IS.
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PUERTO RICO
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Caribbean Sea
CAPE VERDE IS.
EL SALVADOR
Caracas
MARSHALL IS.
CLIPPERTON
COSTA RICA
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Bogotá
GUIANAS
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EQUATOR
GALÁPAGOS IS.
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ECUADOR
SOLOMON IS.
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La Paz
NEW HEBRIDES
TUAMOTU ARCH.
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Sucre
Rio de Janeiro
PARAGUAY
NEW CALEDONIA
SOCIETY IS.
Asunción
São Paulo
PITCAIRN IS.
CHILE
South Pacific
Santiago
URUGUAY
Tasman Sea
Buenos Aires
Montevideo
NEW ZEALAND
Wellington
ARGENTINA
Ocean
FALKLAND IS.
N
TIERRA del FUEGO
S. GEORGIA
S. ORKNEYS
S. SHETLAND IS.
PALMER PENINSULA
ANTARCTICA

THE WORLD

ENCYCLOPEDIA AMERICANA MAP

BY HAROLD K. FAYE

THE Encyclopedia AMERICANA

COMPLETE IN
THIRTY VOLUMES

1829 1954

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VOLUME XVIII

M—MEXICO

M the thirteenth letter of the English and most of the other west European languages, is one of the four liquids, or semivowels; it is also classed as a labio-nasal, its sound being produced when, with lips closed and the whole uvula lowered, the breath makes a humming noise as it issues through the nostrils. The lips play the same part in the pronunciation of *m* as in that of *b*, but in pronouncing *b* the nasal passage has no part. Hence when that passage is obstructed or closed the sound produced is that of *b*, not of *m*.

The *M* as a capital letter has the same form in the Greek and the Latin alphabets and in all the alphabets derived from them, and in all those alphabets generally the same sound value.

In English there are a few words of Greek origin, mostly technical, in which *mn* begins a syllable or a word: in such cases the *m* is silent, for example, mnemonic, nemonic.

In many words derived from other languages the *m* of the original word is changed to *n* in English, for example: *comitatus* (Lat.), county; or contrariwise *n* is changed to *m:* Anglo-Saxon *henep* becomes hemp. Often *p* is added after *m* to give that letter greater distinctness, for example, *eximere* (Lat.), take out, *exemptus,* exempt.

MAARTENS, mär'tĕns, **Maarten** (pseudonym of the Dutch author, Joost Marius Willem van der Poorten-Schwartz): b. Amsterdam, Aug. 15, 1858; d. Zeist, Aug. 4, 1915. He passed his early life in England, was educated in Germany and at the University of Utrecht, was admitted a barrister but chose literature as a profession, and in 1889 published his first important work, *The Sin of Joost Avelingh,* which at once arrested the attention alike of critics and of the reading public. This, like all his volumes, was written at first hand in English, not, as has been sometimes supposed, translated from a Dutch manuscript. Maartens thus presented the curious instance of an author electing to address wholly a foreign public. Indeed it was only with reluctance that he published his books in Dutch, and the public in the Netherlands was generally hostile to them. His novels are chiefly characterized by spiritual conflict and the workings of conscience. The best known is probably *God's Fool* (1895); others include *An Old Maid's Love* (1891); *A Question of Taste* (1891); *The Greater Glory* (1894); *My Lady Nobody* (1895); *The Price of Lis Doris* (1909) and *Eve* (1912); besides short stories and plays.

MAASIN, mä-ä'sĭn, municipality, Philippines, on the southwestern coast of Leyte Island, 78 miles south of Tacloban. It is a well-built port and has an active coastwise trade. The chief export is hemp. Pop. (1939) 29,264.

MAASS, Otto, Canadian chemist: b. New York, N. Y., July 8, 1890. After a course at the Montreal High School, he studied at McGill, Berlin, and Harvard universities. In 1917 he became professor in charge of physical chemistry at McGill and in 1923 was named Macdonald professor of physical chemistry there. He became chairman of the department of chemistry at McGill in 1937. He became general director of the Canadian Pulp and Paper Research Institute in 1940. In 1940–1941 he was president of Section III of the Royal Society of Canada. He published *Introduction to Physical Chemistry* in 1931 (rev. ed. 1939), and papers dealing with pulp and paper, and physical chemistry.

MAASTRICHT, mäs-trĭkt' (or Maestricht), commune, Netherlands, capital of Limburg Province, 2.5 miles from the Belgian border; a rail and water transportation center on the Maas (Meuse) River. In Roman times a town grew up here at the crossing (Lat. *trajectus*) of the Maas, whence the name Maastricht. The town was the seat of a bishopric, 382–721, and was well fortified by the 13th century. Its walls, much strengthened thereafter, were torn down during the 1870's. For joining the cause of the prince of Orange, William I, the town was sacked by the Spaniards under Alessandro Farnese in 1579; recovered by the Dutch under Prince Frederick Henry in 1632, and retained by them at the Peace of Westphalia (1648), although later captured by the French in 1673, 1748 and 1794. It was captured by the Germans in 1940 and retaken by the Americans, Sept. 15, 1944. The most notable structures are the Romanesque Church of St. Servatius (St. Servaas), founded in the 6th century (oldest part now standing built about 900 A.D.), the oldest church in the Netherlands; the Church of Our Lady (11th-century Romanesque; rebuilt 1764); the town hall built by Pieter Post (completed 1683; now a museum); and a 13th-century bridge (rebuilt 1683) over the Maas to Wijk, a suburb. Nearby are the great labyrinths of the sandstone quarries of Pietersberg, which have been worked since Roman times. Important manufactures include textiles, paper, ceramics, glass, cement and chemicals. Pop. (1948 est.) 75,276.

MAB, the fairy queen of Connaught and a familiar name in Celtic folklore. Mab has been celebrated by Shakespeare and other English poets. The name is of uncertain origin, being variously derived from the Midgard of the Eddas, the Habundia or Dame Abonde of Norman fairy lore, and from the Cymric *mab,* a child. According to Voss, Mab was not the fairy queen, the same as Titania, this dignity having been ascribed to her only by mistaking the use of the old English word *queen,* which originally meant only a woman. Queen Mab is mentioned in Shakespeare's *Romeo and Juliet,* Ben Jonson's *Satyr,* Thomas Randolph's pastoral *Amyntas,* Thomas Drayton's *Nymphidia* and Milton's *L'Allegro.*

MABERY, mā'bĕr-ĭ, **Charles Frederic,** American chemist: b. North Gorham, Me., Jan. 13, 1850; d. Portland, Me., June 26, 1927. He was graduated at the Lawrence Scientific School in 1876, and was assistant instructor in chemistry there from 1875 to 1883, when he became professor of chemistry in the Case School of Applied Science, serving until 1911; emeritus professor thereafter. In the investigation of the composition of American petroleum his work brought him into special prominence. He also did valuable work in connection with electric smelting. The results of his original investigations after 1876 were published in the *Proceedings* of the American Academy of Arts and Sciences and in various chemical journals at home and abroad.

MABIE, Hamilton Wright, American editor, critic and essayist: b. Cold Spring, N. Y., Dec. 13, 1845; d. Summit, N. J., Dec. 31, 1916. He was graduated at Williams College in 1867 and from the Columbia University Law School in 1869. He joined the staff of the *Christian Union* (after 1893, the *Outlook*) in 1879 and in 1884 became associate editor with Lyman Abbott, a position which he occupied until his death. Through his journalistic work, as well as his lectures and papers, he constantly advocated an improvement in the standards of education and in social conditions, and did much to forward American literary taste. His books for children were especially notable in the latter category. Among his works are *Norse Stories Retold from the Eddas* (1882); *My Study Fire,* 1st series (1890), 2nd series (1894); *Short Studies in Literature* (1891); *Essays in Literary Interpretation* (1892); *Nature and Culture* (1897); *Books and Culture* (1897); *Work and Culture* (1898); *William Shakespeare: Poet, Dramatist and Man* (1900); *American Ideals, Character and Life* (1913); *Japan To-day and To-morrow* (1914); and a children's series, *Myths* (1905), *Fairy Tales* (1905), *Heroes* (1906), *Legends* (1906), and *Heroines* (1908) *that Every Child Should Know.*

MABILLON, mà-bē-yôn', **Jean,** French ecclesiastic and author: b. Saint-Pierre-du-Mont, Champagne, Nov. 23, 1632; d. Paris, Dec. 27, 1707. Having joined the Benedictines of Saint Maur (Maurists) at Reims in 1653, he was sent, in 1664, to the literary center of his order, St.-Germain-des-Prés, at Paris. There he was chosen to assist Dom Jean Luc d'Achery in the compilation of his *Spicilegium Veterum Scriptorum* and subsequently edited the works of Saint Bernard (1690) in the series of the fathers published by his congregation. In 1683 he was sent to Germany by Louis XIV to collect documents relating to French history; and the applause with which his *Iter Germanicum,* a narrative of the journey, was received, induced the king to send him to Italy in 1685 to make purchases for the royal library. A result of this tour was his *Musaeum Italicum* (1687–1689), a work of great value. Later he was selected by his superiors to refute Jean de Rancé, abbot of La Trappe, who had condemned the custom of permitting monks to study. His *Essay on Monastic Studies* (*Traité des études monastiques*) which appeared in consequence in 1691, and *Réflexions sur la réponse de M. l'abbé de la Trappe* (1692), were equally remarkable for sound argument and good temper. His most important other works are *Vetera Analecta* (1675–1685); *De Re Diplomatica* (1681; supplementary vol., 1704), a milestone in historiography, since it laid down scientific principles for determining the authenticity of medieval documents; and *De Liturgia Gallicana* (1685). He edited and published with Thierry Ruinart *Acta Sanctorum Ordinis Sancti Benedicti* (1668–1702) and prepared the first four volumes of the *Annales Ordinis Sancti Benedicti* (1703–1739). A collection of his works, *Ouvrages posthumes,* appeared in 1724, and his *Inedited Correspondence with Montfaucon, Magliabecchi, etc.,* was edited by Valéry (1847).

Consult Baackner, A., *Mabillons Reise durch Bayern im Jahre 1683* (Munich 1910); Denis, P., *Dom Mabillon en sa méthode historique* (Paris 1910).

MABINI, mä-bē'nē, **Apolinario,** Filipino insurgent: d. Philippine Islands, 1903. He was educated in the Catholic College of Manila, entered the public service under Spanish rule, became advocate of the treasury, resigned in 1896, and entered the insurrection. He was imprisoned for nine months by the Spaniards and then associated himself with Emilio Aguinaldo and José Rizal. Although a sufferer from paralysis, he was the soul of the revolutionary movement and by many is considered the ablest man produced in the revolution. He became privy councillor of Aguinaldo and for a time was minister of foreign affairs and chief of the Supreme Court in the latter's government. In 1899 he surrendered to the United States, was sent into exile, but allowed to return in 1903 when he took the oath of allegiance. He was the brains of the Aguinaldo government formed at Malolos, but opposed the Malolos constitution because he believed that the Philippines needed a strong, centralized government and also because it did not provide for a separation of church and state. He was a Tagalog.

Consult Worcester, Dean C., *The Philippines, Past and Present,* 2 vols. (New York 1914).

MABINOGION, măb-ĭ-nō'gĭ-ŏn, **The,** the name generally but incorrectly applied to all medieval Welsh stories. Of the general title *Mabinogian,* which Lady Charlotte Guest's English version (1838–1849) has made familiar, John Rhys gives an explanation. "An idea prevails," says Principal Rhys, "that any Welsh tale of respectable antiquity may be called a mabinogi; but there is no warrant for extending the use of the term . . . For, strictly speaking, the word mabinog is a technical term belonging to the bardic system, and it means a literary apprentice. In other words, a mabinog was a young man who had not yet acquired the art of

making verse, but who received instruction from a qualified bard. The inference is that the 'Mabinogion' meant the collection of things which formed the mabinog's literary training — his stock in trade, so to speak; for he was probably allowed to relate the tales forming the 'four branches of the Mabinogion' at a fixed price established by law or custom. If he aspired to a place in the hierarchy of letters, he must acquire the poetic art." In Lady Charlotte Guest's later edition in one volume (1877),— the most convenient edition for reference,— 12 tales in all will be found. Of these, the most natively and characteristically Welsh in character are such tales as the vivid, thrice romantic 'Dream of Rhonabwy,' which owes little to outside sources. 'The Lady of the Fountain,' on the other hand, shows in a very striking way the influence of the French chivalric romances that Sir Thomas Malory drew upon so freely in l is 'Morte d'Arthur.' In the admirably edited Oxford text of the Welsh originals by Rhys and Evans (1887–90), 'The Lady of the Fountain' appears under the title of 'Owain and Lunet'; and Lunet's name at once recalls Tennyson's 'Idylls of the King.' The old manuscript volume of the 'Mabinogion,' known as the 'Llyfr Coch o Hergest,'— the 'Red Book of Hergest,'— written in the dialect of South Wales, is in the famous library of Jesus College, Oxford, the one college in the older English universities which has a time-honored connection with Welsh scholarship and Welsh literature. The tales, though in their present form not older than the 12th century, embody traditions that were afloat prior to that date. Consult John, I. B., 'The Mabinogion' (London 1901); and Lloyd, E. J., 'The Mabinogion as Literature' (in the *Celtic Review,* Edinburgh 1911).

MABLY, Gabriel Bonnot de, gä-brē-ĕl bŏn-ō dē mä-blē, French ecclesiastic and publicist: b. Grenoble, 14 March 1709; d. Paris, 23 April 1785. His family name was Bonnot. Like his younger brother, the philosopher Condillac (q.v.), he was destined for the Church, and after studying at the seminary of Saint Sulpice in Paris was ordained subdeacon. He showed little liking for theology, and for some time was secretly employed in affairs of state by his relative Cardinal de Tencin, minister of Louis XV, conducting the most difficult negotiations and writing elaborate reports with an ability for which the minister received all the credit. Later he applied himself to literature, and in 1748 published his 'Droit publique de l'Europe,' which achieved a remarkable success. It was followed by 'Observations sur les Grecs' (1749); 'Observations sur les Romains' (1751); 'Entretiens de Phocion' (1753); 'Observations sur l'histoire de France' (1755); 'Principes des négociations' (1757); 'De la manière d'écrire l'histoire' (1773); 'De la législation' (1776); 'De l'Idée de l'histoire' (1778); and 'Principes de morale' (1784). Having been requested by the government of Poland to prepare for them a code of laws, he visited that country in 1771, and published in 1781 a work 'Du Gouvernement de la Pologne.' He was also consulted by the American Congress in 1783 on the preparation of the Constitution, and embodied his views in his 'Observations sur le gouvernement et les Lois des Etats-Unis d'Amérique' (1784). In this work he foretold the speedy downfall of the United States. He was an idealiser of ancient Rome and was enamored of the socialistic state and the communism of wealth, and from his pessimistic views on modern social organization was known as the "prophet of woe." Consult Guervier, 'L'Abbé Mably, moraliste et politique' (1886); de la Serae, 'Mabylet les physiocrates' (1911).

MABUCHI, mä-boo'chē, Japanese writer and religious teacher: b. 1693; d. 1769. He was distinguished as a scholar, and utilized his great learning in the endeavor to purify the native religion, Shinto, from the accretions of Chinese and Buddhist philosophy, etc., whereby he regarded it as having been corrupted. His love and knowledge of antiquity enabled him to present the native faith in its original simplicity, and his teachings were exemplified in his own life. To him modern students are largely indebted for direct access to ancient Japanese poetry. He added greatly to the knowledge of the past. He was the first of the three great scholars (Motoöri and Hirata being the others) who dedicated themselves to this work of simplifying the ancient faith of the country.

MABUSE, mą'bûz', **Jan,** Flemish painter: b. Mauberge, Hainault, in 1472; d. Antwerp, 1 Oct. 1552. His real name was Jean Gossart (or Gossaert). When he became a member of the Guild of Saint Luke at Antwerp in 1503, he signed the register as Jennyn van Henegouwe (John of Hainault). He signed his early pictures Jennyn Gossart and those of his middle and last period Joannes Malbodius (John of Mauberge). In the register of the Guild of Our Lady at Middleburg he is entered as Jan de Waele (John the Walloon). It is not known from whom he learned his art, but at Antwerp he fell under the influence of Quentin Matoys (15th century). In 1508 Mabuse, as he is familiarly known, went to Rome with his patron, the magnificent Philip of Burgundy, visiting Verona and Florence on the way. He stayed in Rome a year and returned to the court of Burgundy in November 1509. He then was employed at the Duke of Burgundy's castle of Zuytburg, painting for Philip. After Philip's death in 1524, he entered the service of Adolphus of Burgundy. When Christian II of Denmark visited the Low Countries he asked Mabuse to paint his dwarfs and in 1528 he requested the artist to design the tomb for his queen, Isabella, in the abbey of Saint Pierre, near Ghent. Mabuse also painted the children of Christian II — John, Dorothy and Christine, which came into the collection of Henry VIII of England. Mabuse also designed and erected the tomb of Philip of Burgundy in the church of Wyck. Van Mander's biography accuses him of habitual drunkenness, but the great works produced by him, as well as their number, prove that he was a hard-working and painstaking artist, perfectly in command of his powers. In 1527 he accompanied Lucas of Leyden on a pleasure trip to Ghent, Mechlin and Antwerp. Mabuse seems to have been the first of the Netherland painters to go to Italy. He brought back a new style; and from his time to that of Rubens and Van Dyck it was considered the proper thing for all Flemish painters to go to Italy.

The best specimen of his early and purely Netherland is the famous 'Adoration of the Magi,' long at Castle Howard, England, and purchased by the National Gallery, London, in 1911 for the extraordinary sum of $192,000. This great picture was painted in 1500 for the abbey of Grammont in eastern Flanders and was sold by the monks in 1605 to the Archduke Ferdinand, who placed it in a private chapel in Brussels. In the 18th century Charles of Lorraine acquired it and at his death in 1775 the picture passed to England. The signature of Jan Gossart appears in golden letters on the band of the crown on the negro king. In this great work there are 30 figures with an architectural background, much in the style of Memling and Roger van der Weyden.

The National Gallery (London) contains five other precious works by Mabuse, including the portrait of Jacqueline of Burgundy; portrait of a man holding his gloves: and the portrait of a man with a rosary. Hampton Court has the 'Three Children of Christian II, King of Denmark'; 'Adam and Eve in Paradise'; a portrait of 'Holbein'; 'Eleanor of Austria'; and a 'Holy Family.' The Louvre has a magnificent portrait of Jean Carondelet, chancellor of Flanders; a 'Virgin and Child'; a portrait of 'Bénédictin'; and 'a man and his wife.' 'Saint Luke painting the Blessed Virgin and Child' formerly in the cathedral of Mechlin but now in that of Prague, painted in 1515, is a fine example of Italianized Netherland art. Another celebrated picture was a large triptych, 'The Descent of the Cross,' painted for Maximilian of Burgundy for the monastery of Our Lady and Saint Nicholas at Middleburg, which perished when that building was burned in 1568. Dürer saw it in 1520 and admired it extremely, although he said "the composition was not as good as the execution." Mabuse excelled in portraiture. Occasionally Mabuse turned to mythological subjects, such as 'Neptune and Amphitrite' (1516) in the Berlin Museum. His architecture is beautifully drawn and his painting of rich materials — damasks, embroideries and tapestries — is superb. Consult Segard, Achille, 'Mabuse, Jan' (in *Les Arts,* No. 123, p. 1, with illustrations including 'Adoration of the Magi,' Paris 1912); Weisz, Ernst, 'Jan Gossart' (Freis 1913).

MAC, or **MC,** a Gaelic prefix, as MacGregor, MacDonald, McKinley, etc. It corresponds with von in surnames of Teutonic origin, Fitz in those of Romance origin, or Ap or Ab in Welsh surnames.

MACA, a tribe of people living in the forests of the eastern slope of the Andes in central Ecuador. They live in huts of palm leaves, make pottery, hunt and cultivate yucca, corn and tobacco. The various tribes, not yet classified as to language, frequently war with one another. Their weapons are spears, blowguns and poisoned arrows. They dry the heads of slain enemies.

MACABEBE, mä-kä bā'bā, Philippines, a pueblo of the province of Pampanga, Luzon, situated at the head of the Pampanga River delta, nine miles from Manila Bay and seven miles southeast of Bacolor. Pop. 16,000.

MACABER (mą-kä'bėr) **DANCE.** See DANCE OF DEATH.

MACADAM, măk-ăd'ąm, **John Loudon,** Scottish engineer: b. Ayr, 21 Sept. 1756; d. Moffat, Dumfriesshire, 26 Nov. 1836. In 1770 he was sent to an uncle at New York, where he remained during the War of Independence, and realized a considerable fortune as agent for the sale of prizes. At the close of the war he returned to Scotland, and in 1798 was appointed agent for revictualing the navy in the western ports of Great Britain, and took up his residence at Falmouth. He afterward resided for many years at Bristol. It was here, in 1815, on being appointed surveyor-general of the Bristol roads, that he resumed experiments he had made in Scotland, and first had full scope for putting in practice the important improvements in road-making which had long before occupied his thoughts. By 1823 his general success was admitted; and in 1827 he was made general surveyor of roads. In carrying out his improvement he had expended several thousand pounds from his private resources; and the House of Commons, having been satisfied of the fact by the investigation of a committee, both reimbursed the actual outlay and presented him with an honorary tribute of £2,000, presenting to him a total of £10,000. His invention was rapidly introduced throughout the civilized world, and his own name was made synonymous with it.

MACADAM, a modern system of road-making invented by J. L. Macadam (q.v.), which consists in forming the roads out of hard materials such as granite, or basalt broken into pieces, none of which are too large to pass through an iron ring 2½ inches in diameter, and then deposited evenly in a bed of from 6 to 12 inches in thickness. The bed thus laid becomes perfectly compact and smooth, and in proportion as it is worn away or cut into ruts by traffic can easily be restored by a new coating of materials. See ROADS AND ROAD-MAKING.

McADOO, măk'ą-doo', **William Gibbs,** American jurist: b. near Knoxville, Tenn., 4 April 1820; d. 1894. He was graduated in 1845 from the East Tennessee University at Knoxville, sat in the Tennessee legislature 1845–46 and served in the Mexican War in 1847. He was afterward admitted to the bar and was attorney-general of the Knoxville judicial district, 1851–60. He removed to Georgia in 1862, served in the Confederate army during the Civil War and in 1871 became judge of the 20th judicial district of Georgia. He published a volume of poems and, with H. C. White, 'Elementary Geology of Tennessee.'

McADOO, William Gibbs, American cabinet officer: b. near Marietta, Ga., 31 Oct. 1863; d. Washington, D. C., 1 Feb. 1941. Descended from a distinguished Southern family, his father, Judge William Gibbs McAdoo, a jurist and a soldier of the Mexican and Civil wars, became attorney-general of Tennessee some years after losing his wealth in the general devastation in the South caused by the Civil War. The subject of this sketch was educated at the University of Tennessee and admitted to the bar in 1885, notwithstanding that circumstances obliged him to leave the university in his junior year and earn his living as a clerk of the United States Circuit Court. He practised law in Chattanooga till 1892, when he came to New York and opened a law office. In 1898 he

formed a law partnership with Mr. William McAdoo (a native of Ireland and no relation whatever), who in 1910–1930 was chief city magistrate, and had been assistant secretary of the Treasury under President Cleveland. The partnership was dissolved in 1903.

McAdoo had gained some experience in railroad work by running a street railway in Knoxville, an undertaking which proved a failure. In 1902 he organized the Hudson and Manhattan Railroad Company and raised 4 million dollars to connect New York City with New Jersey by tunneling under the Hudson River. Work on this project had been begun in 1878, but was abandoned. McAdoo's company completed the project; the first tunnel being completed on March 8, 1904, and three more being finished in the next five years.

McAdoo also began participating in activities of the Democratic Party, and supported Woodrow Wilson in the 1910 gubernatorial campaign in New Jersey. He became vice chairman of the Democratic National Committee in 1912 and following Wilson's election to the presidency became secretary of the Treasury, March 6, 1913. McAdoo then devoted himself to the enormous financial transactions in which the government was involved during World War I. The floating of the four Liberty Loans, which brought in some 43 billion dollars in 1913–1919, and the financing of allied belligerents were among his accomplishments as secretary of the Treasury, but he was also chairman of the Federal Reserve Board, the Federal Farm Loan Board, the War Finance Corporation, and the United States section of the International High Commission. When the government took over the nation's railroads on Jan. 1, 1918, McAdoo was appointed director general of railways. He resigned from the Treasury on Dec. 16, 1918, and as director of railways, Jan. 10, 1919. On May 7, 1914 McAdoo married Eleanor Randolph Wilson, the president's daughter. They were divorced in 1934.

The former secretary was twice a candidate for the Democratic nomination for the presidency: in 1920, when he led with 266 votes on the first ballot, but lost to James Middleton Cox after Alexander Mitchell Palmer had released his delegates to the latter; and in 1924, when he led with 431½ votes on the first ballot, but was overtaken and deadlocked by Alfred E. Smith; both being defeated by John W. Davis. McAdoo then moved to Los Angeles, where he practiced law. In 1933 he was elected to the United States Senate from California, supporting the New Deal policies of President Roosevelt and specializing in legislation concerning banking and finance. He was defeated for renomination to the Senate in 1938 and retired from political life at the end of his term (1939). He wrote *The Challenge; Liquor and Lawlessness Versus Constitutional Government* (1928), and *Crowded Years* (1931), an autobiography ending with his resignation from the cabinet.

McADOO, măk'ădōō, borough, Pennsylvania; in Schuylkill County; altitude 1,800 feet. It is situated 41 miles northwest of Allentown, and is served by the Lehigh Valley and the Pennsylvania railroads. There are rich deposits of anthracite in the area, and coal mining is the principal industry. Other industries of the borough are the manufactures of paper boxes and textiles. There are waterfalls nearby, and much picturesque scenery. The borough was founded in 1880; incorporated in 1896. Pop. (1950) 4,260.

McAFEE, măk'ă-fē, **Mildred Helen** (married name, HORTON), American educator: b. Parkville, Mo., May 12, 1900. She was educated at Vassar and the University of Chicago. She was dean of women and professor of sociology, Centre College, Danville, Ky., 1927–1932; dean of women, Oberlin College, 1934–1936; and president of Wellesley College, 1936–1949. In 1942 she became the first director of the women's naval reserve (WAVES) with the rank of lieutenant commander, 1942–1943; with rank of captain, 1943–1946. In 1945 she married Rev. Douglas Horton.

MACAIRE, mă-kâr', a French *chanson de geste* of the 12th century, and one of the great poems of the Middle Ages. One of its themes—a favorite of the Middle Ages—is that of the wife unjustly accused of infidelity; in *Macaire* it is the queen of Charlemagne, here called Blanchefleur. The same story is told in another *chanson de geste,* of the 14th century, *La reine Sibille,* in which Charlemagne's queen appears under the name of Sibille.

Macaire, however, is a fusion of two tales, the second being that of the dog that brings the murderer of his master to justice. This tale may be found in Plutarch's *Moralia,* in which a dog remains by the body of his slain master for three days and reveals the identity of the murderers by attacking them. In *Macaire,* Aubry de Montdidier is murdered in the Forest of Bondy by Macaire, a French knight. Aubry's dog, named Dragon, shows such hatred of Macaire that suspicion is aroused and Macaire and the dog are summoned to single combat. Although Macaire is armed with a heavy stick, the dog overcomes him and he confesses his guilt.

Dragon was also called the *chien de* (dog of) *Montargis,* either because the murder was committed near the castle of Montargis, or because the story was depicted on the chimney of the great hall in the castle in the 15th century. Jean de la Taille in his *Discours notable des duels* (1607) says the encounter with the dog took place under Charles V in 1371.

La reine Sibille exists only in fragments, although there is a prose version extant. *Macaire* is preserved only in the Franco-Venetian *geste* of Charlemagne (Manuscript 13, Library of St. Mark), in a mixed form of French and Venetian dialects. It was reprinted by François Guessard, *Anciens poètes de la France* (1866); Gaston Paris, *Histoire poétique de Charlemagne* (1865); Léon Gautier, *Les epopées françaises* (1865–1868); and Paulin Paris, *Histoire littéraire de la France* (1873).

Dramas.—A melodrama on this subject, *Le chien de Montargis,* was written by R. C. Guilbert de Pixérécourt, and was translated and played at Covent Garden, London, in 1814. A later melodrama, *L'auberge des Adrets* (1823) by Benjamin Antier, seems to owe little to the *chanson de geste* except perhaps the name of the murderer and bandit, Robert Macaire. In the creation of this role, the French actor Frédérick Lemaître made his reputation. In a sequel, the comedy *Robert Macaire* (1834), written by Antier and Lemaître in collaboration, the hero is a reformed murderer and now a swindler. In this work, which followed the Revolution of

July 1830 in Paris, Théophile Gautier saw "the great triumph of revolutionary art." "Frédérick Lemaître," says Gautier, "created in the character of Robert Macaire a kind of humor that is almost Shakespearean. In it we find terrible gaiety, sinister laughter, bitter derision, pitiless raillery and a biting sarcasm, mingled with elegance, suppleness and astonishing grace. Robert Macaire and Bertrand [his accomplice] are Don Quixote and Sancho Panza in crime." Such was its popularity that Honoré Daumier executed a series of about 100 drawings depicting Robert Macaire as banker, lawyer, journalist, and so forth.

McALESTER, măk-ăl'ĕs-tĕr, city, Oklahoma; seat of Pittsburg County; altitude 750 feet. It is situated 83 miles south-southeast of Tulsa and is served by the Chicago, Rock Island and Pacific and the Missouri-Kansas-Texas railroads. There is a municipal airport. The surrounding area includes much fertile farmland, producing cotton, corn, livestock, dairy products, and peanuts. There is also timber-producing forest land. Coal is mined, and oil and natural gas wells are important. The city processes cotton, cottonseed, soybeans, peanuts, and petroleum, and there are meat-packing establishments, and manufactures of aluminum products and concrete.

J. J. McAlester, pioneer settler for whom the city is named, founded a store at a crossroads in what is now North McAlester in 1870, and with the aid of Chickasaw and Choctaw Indians developed the coal deposits. North McAlester was incorporated in 1899. South McAlester was organized civically in 1900, and they were consolidated, as McAlester, under a city charter in 1906. Government is by mayor, commissioners, and city manager. Pop. (1950) 17,878.

MACALESTER COLLEGE, a liberal arts, coeducational institution in St. Paul, Minn., founded in 1885 under the auspices of the Presbyterian Church. It grants the degree of A.B. in liberal arts and business administration. The average enrollment of students is about 1,500.

MACALISTER, măk-ăl'ĭs-tĕr, Sir **Donald,** Scottish physician and anatomist: b. Perth, May 17, 1854; d. Cambridge, Eng., Jan. 15, 1934. He was educated at Liverpool Institute and St. John's College, Cambridge, and was a fellow of St. John's from 1877 until his death. Macalister studied medicine at Cambridge, at St. Bartholomew's Hospital, London, and in Leipzig. He practiced and lectured at Cambridge, and in 1907 was appointed principal of Glasgow University. He held this office until 1929, when he resigned, becoming chancellor of the institution. He was created a baronet in 1924.

Macalister was chairman of the committee which prepared the *British Pharmacopoeia* (1898) and its revision (1914). He was the author of the medical works, *Nature of Fever* (1887) and *Antipyretics* (1888). Macalister was also an accomplished linguist and published *Echoes* (1907), a volume of verse translations. His interest in gypsy lore resulted in *Romani Versions* (1928).

MACALISTER, Robert Alexander Stewart, Irish archaeologist and historian: b. Dublin, July 8, 1870; d. Cambridge, Eng., April 26, 1950. He was educated in Dublin, in Germany, and at Cambridge University. He was director of excavations of the Palestine Exploration Fund, 1900–1909 and 1923–1924, and professor of Celtic archaeology at University College, Dublin, 1909–1943. From 1926 to 1931 he was president of the Royal Irish Academy.

Among Macalister's publications are *Studies in Irish Epigraphy* (3 vols., 1897–1907); *A History of Civilization in Palestine* (1912; 2d ed., 1921); *Muiredach, Abbot of Monasterboice, His Life and Surroundings* (1914); *The Life of Ciaran of Clonmacnois* (1921); *A Text-Book of European Archaeology* (1921); *Ireland in Pre-Celtic Times* (1921); *The Secret Languages of Ireland* (1936); *The Book of the Taking of Ireland* (4 vols., 1938–1941); and *Monasterboice, Its History and Monuments* (1946).

McALLEN, măk-ăl'ĕn, city, Texas; in Hidalgo County; altitude 122 feet. It is situated in the lower Rio Grande Valley, 50 miles west-northwest of Brownsville, and is served by the Missouri Pacific and the Southern Pacific railroads. McAllen is a port of entry from Mexico; being connected by road—by way of Hidalgo, Texas, and Reynosa, Tamaulipas—with Monterrey, Mexico. Citrus fruits, cotton, and truck garden crops are grown on irrigated land around the city, and there are oilfields. McAllen's chief industry is the canning, freezing, and dehydrating of foodstuffs; petroleum is refined, and chemicals and canvas products are manufactured. The city was settled in 1904, incorporated as a town in 1910; as a city in 1927. Government is by mayor and council. Pop. (1950) 20,067.

McALLISTER, măk-ăl'ĭs-tĕr, **Addams Stratton,** American electrical engineer: b. Covington, Va., Feb. 24, 1875; d. Clifton Forge, Va., Nov. 26, 1946. He was educated at Pennsylvania State College and Cornell University. After serving with private concerns, he taught electrical engineering at Cornell, 1901–1904, and in 1905 became associate editor of the *Electrical World.* He was editor of that publication, 1912–1915. During this period he was also lecturer on engineering at Pennsylvania State College, 1909–1914. In 1917 he became an adviser to the Council of National Defense, and after World War I became connected with the Bureau of Standards as electrical engineer, 1921–1923; engineer-physicist after 1923; assistant director of the bureau, 1930–1945.

McAllister was the inventor of alternating-current electrical machinery, and formulated the law of conservation as applied to illumination engineering calculations. He contributed many papers to technical journals and was the author of *Alternating Current Motors* (1906) and *Standard Handbook for Electrical Engineers* (1907).

McALLISTER, Samuel Ward (called Ward), American social leader: b. Savannah, Ga., December 1827; d. New York, N. Y., Jan. 31, 1895. He came of a family several of whose members were prominent at the bar. With his father, in 1850, he went to California to establish a law firm, remaining until 1852, when he had made a comfortable fortune. Moving to New York, he married Sarah Gibbons, the daughter of a wealthy Georgian. He lived in Europe for several years, and when he returned lived most of the time at Newport, R. I. He entered social life in New York with the advan-

tages of personal qualifications and family prestige. As a raconteur as well as an accomplished gourmet he had already attained prominence within a select circle when, by a well-turned remark, he became the leader of leaders in New York society, which, according to his strict limitation, included but 400 persons. The popular expression «The Four Hundred» originated from this assertion of McAllister's. He made contributions to the press, which, however, impaired rather than strengthened his unique position, as did also his volume 'Society as I Have Found It' (1890).

McALLISTER, Fort. See FORT McALLISTER.

MACALLUM, Archibald Byron, Canadian educator: b. Belmont, Ontario, in 1859. After receiving his education in the Toronto and Johns Hopkins universities he became lecturer on physiology (1887) and professor in the medical faculty of Toronto University (1891–92). From 1892 to 1901 he was associate professor in the arts faculty there and full professor after 1901. In 1895–97 he was president of the Canadian Institute. In 1901 he was made a Fellow of the Royal Society, Canada, and in 1906 of the Royal Society of London. In 1911 he was elected president of the American Society of Biochemists. He published scientific articles in the *Journal of Physiology, Proceedings of the Royal Society Quarterly Journal of Microscopical Science, American Journal of Morphology* and *Journal of Anatomy and Physiology.* D. 5 April 1934.

McALPINE, William Jarvis, American civil engineer: b: New York City, 30 April 1812; d. Staten Island, N. Y., 16 Feb. 1890. Completing his elementary education at schools in Newburgh and Rome N. Y., young McAlpine was apprenticed at the age of 15 to John B. Jervis, civil engineer. He remained with Jervis for eight years as apprentice, assistant and resident engineer, and, in 1836, succeeded Jervis as chief engineer of the eastern division of the Erie Canal. Several years later, he became chief engineer of the government dry dock in Brooklyn, N. Y., and with the completion of that difficult project, found himself well established in his profession. From 1852–57 he served as state engineer and railway commissioner of New York, and, during his tenure of office, made a number of important studies on comparative costs of rail and water transportation. As chief engineer of the Third Avenue drawbridge over the Harlem River, New York (1860–61), Mr. McAlpine pioneered in the design and sinking of the caissons for the piers. He later acted as chief or consulting engineer in the building of a number of the nation's largest bridges, among them the Eads Bridge, over the Mississippi at St. Louis; the Clifton suspension bridge at Niagara; and the Washington Bridge spanning the Harlem in New York City. He also directed the construction of the New York State Capitol at Albany in 1873, and later, as engineer of parks for New York City, built the famous Riverside Drive. At the time of his death, he was planning an «arcade railway» which was to provide an underground transit system for New York City, as well as second level streets beneath the more congested thoroughfares. Although remarkable in its conception and in many respects practicable, McAlpine's plan met with much opposition from property owners and was later abandoned. He was well known in professional circles in Europe and in England, and was consulted on a number of major projects, among them the Manchester Ship Canal, a proposed railroad to India, and improvement of navigation of the Danube River near the «Iron Gate.» For many years he was the only American who could claim membership in the British Institution of Civil Engineers. He was elected president of the American Society of Civil Engineers in 1870, and honorary member in 1889. Mr. McAlpine was a frequent contributor to technical publications, and in addition to reports and a number of original papers, he wrote a textbook, 'Modern Engineering' (1874). At the time of his death he was the acknowledged dean of his profession, and one of the last of the «general practitioners» of civil engineering.

McANENY, George, American civic administrator: b. Greenville, N. J., 24 Dec. 1869. He was graduated at the Jersey City High School in 1885 and entered journalism, serving on the staff of several New York newspapers from 1885 to 1892. From 1892 to 1894 he was assistant secretary of the Civil Service Reform League, of which he became secretary in 1894. He held this position until 1903, serving on committees that drafted the municipal home-rule section of the state constitution in 1894 and the state Civil Service Law in 1899. In 1902 he was a member of the New York Civil Service Commission and also of the commission to revise the city charter in 1908. In 1903–06 he read law with Edward M. Shepard. In 1906–09 he was president of the City Club of New York; in 1910–13 he was president of the borough of Manhattan, and in 1914–16 president of the board of aldermen (fusion ticket), and was active in obtaining municipal markets for New York City. In 1902 he drafted the civil service rules now in force in New York City; was a member of the commission appointed by the governor to revise the New York City charter (1908); chairman of the transit committee of the New York board of estimate and apportionment, which, with the Public Service Commission, developed New York's subway system, and chairman of committee on city plan 1914–16. From 1916 to 1921 he was executive manager of the New York *Times,* resigning in the latter year to become a member and chairman of the New York Transit Commission. Following the abolition of this body in 1926 he resumed his position with the New York *Times.* In 1913 Paris gave him the medal of the Société des Architectes Diplômes par le Gouvernment Français for services to city planning and architecture in the United States. Vice-president, Hampton Association National Municipal League, and president of the New York Kindergarten Association. In 1914 he was Dodge lecturer at Yale. The lectures were published under the title of 'Municipal Citizenship' (New York 1915). In 1924 he was Day Foundation lecturer at Union College.

MACAO, mä-kow' or mä-kä'ō, China, a Portuguese settlement and seaport on the west shore of the mouth of the Canton River, 40 miles west of Hongkong. It occupies a high peninsula, formerly the island of Macao, but now united by a narrow isthmus north of the town with the island of Hiang-shan, and, with

the small islands of Taipa and Colôane, forms a province. The settlement is about eight miles in circuit, and its limits landward are defined by a barrier wall stretching across the isthmus, where a guard of Chinese troops is stationed to prevent foreigners from trespassing on the Inner Land. The town occupies a slope gradually descending to the sea, backed by a range of lofty hills, and having an extensive plain stretching east. It is nearly surrounded with water, and is open to the sea-breezes on every side. The houses occupied by the foreign population are large, roomy and open, and the shops are numerous. The city is divided into two wards, one inhabited by Chinese and the other by non-Chinese, each with its own administrator. The quay or «Praya Grande» is commodious, forms a pleasant drive and is protected by a battery. The harbor is formed between the peninsula on which the town stands and the large island of Twee-lien-shan, to the west. Macao is considered the healthiest residence in southeast Asia with a mean annual temperature of 74°. Near it, in a beautiful garden, is the grotto in which the poet Camoens is said to have finished the 'Lusiad.' The principal exports are tea, cassia and cassia oil, anise and anise oil, fish, and opium. The commerce (mainly in the hands of the Chinese), which is chiefly carried on with Hongkong, Canton, Batavia and Goa, has greatly declined since the opening of the rival free ports, and a considerable part of the colonial revenue is drawn from a tax on the gambling tables for which Macao is notorious. Imports in 1936 were valued at 15,723,585 patacas; exports at 9,143,627 patacas. (Pataca = 34 cents.) Trade is controlled by Chinese. The Portuguese first obtained permission to form a settlement and to trade at Macao in 1557. From 1563 they were required to pay a yearly tribute to the Chinese government, and their trading privileges were much restricted till 1844, when they were allowed to carry on commerce with the five ports then open to foreigners. Macao was then declared a free port, but the Chinese continued to ignore the territorial claims of the Portuguese until 1887 when a treaty was concluded. Macao from its convenient situation was the place of retreat for European merchants and missionaries when threatened by uprisings of race or religious feelings in China. Robert Morrison, the first Protestant missionary in China, was buried here. Pop. about 200,000 (4,000 Portuguese).

MACAPA, mä-ka-pä, Brazil, town on the delta of the Amazon, 110 miles from the mouth of that river. It has a fine harbor with fortifications. The exports are chiefly timber and fine woods for the furniture trade. Pop. 4,000.

MACAQUE, ma-kăk', one of the small, short-tailed Asiatic monkeys of the genus *Macacus* and family *Cercopithecidæ,* which are so docile, intelligent and interesting as a rule that they are common in menageries and frequently kept as pets; their gentleness and playfulness disappears as they grow old, however, and they are then likely to become morose and savage. They go about in troops, keeping by themselves, and differing from other monkeys in most of their actions and cries. Some of the best known are the quaintly crested capuchin or bonnet-monkey (*M. sinicus*), excessively common and pestiferous in southern India; the entellus monkey (q.v.) of northern India; the large pigtailed (*M. leoninus*) of Japan, whose likeness is seen in numberless Japanese drawings and carvings. Ranging over so wide a variety of countries, their habits and food differ greatly. Besides the fruit, juicy leaves and insects eaten by most monkeys they devour small reptiles, young birds, frogs and crabs, the last-named forming the principal diet of a Malayan species (*M. cynomolgus*). One species is isolated in the mountains of Algeria and Morocco, whence they were long ago carried, probably first to Gibraltar, where they are known to the English of the garrison as «Barbary apes» (*M. inuus*), and the small band upon the Rock are carefully protected from harm.

MACARIANS, name given to the followers of the monastic customs of the elder Macarius of Egypt, or of the younger Macarius of Alexandria, contemporary monks of the 4th century who were noted for their austere rule. The name was also given to the followers of the Monothelite Macarius, patriarch of Antioch in the 7th century.

MACARONI (Ital. *maccheroni*), a peculiar paste or dough prepared from wheat flour and manufactured into tubes or ribbons. It is an Italian invention, and, though made by a simple process, has never been produced with so great success in any other country. The grain grown in the more southern countries of Europe is said to possess a greater amount of gluten, and is therefore better adapted to this manufacture. The wheat, after being washed, is freed from the husks and ground in water mills, when hot water is added till it is of the consistency of stiff dough. Five different qualities of flour are obtained by an equal number of siftings, the last giving the finest and most delicate that can be made. To reduce the dough to tubes or ribbons a hollow cylindrical cast iron vessel is used, having the bottom perforated with holes or slits. When this is filled with the paste a heavy iron plate is driven in by a powerful press, which forces the paste through the holes and gives it the shape of the perforations, the workman cutting off the pieces of the desired length as they come through. During this process it is partially baked by a fire made under the cylinder. Sometimes the flat pieces are formed into tubes by uniting the edges before they are thoroughly dry. After being hung up for a few days they are ready for use. The largest tubes are called *maccheroni,* the smaller *vermicelli* and the smallest *fedelini.* Macaroni is prepared for the table by boiling and baking with grated cheese, and is in common with vermicelli and the other varieties much used in the preparation of soups. Since about 1880 the use of macaroni in the United States has largely increased, and where it was once only consumed by Italians in this country, it is now eaten by all classes. Numerous macaroni factories have been established in New York and elsewhere. The United States imports annually from Italy over 5,000,000 pounds of macaroni.

MACARONIC VERSE (It. *maccheronico,* relating to macaroni, from *maccheroni,* macaroni), a type of humorous poetry in which modern words, given Latin endings, are introduced into Latin verse. The name is also given

to poetry which is merely a mixture of Latin (in some cases Greek) and the vernacular of the author. Macaronic verse is said to have originated with Teofilo Folengo (1491–1544), a learned Benedictine monk, who left his monastery and lived a worldly life, supporting himself by writing ridiculous poetry under the pseudonym of Merlin Coccai. His *Liber Macaronicus* appeared in 1517 and was highly successful. One authority states, however, that Folengo was only the popularizer of this verse form, which was originally invented by his teacher, Odaxius of Padua (born c. 1450). The term macaronic was chosen with reference to the mixture of ingredients which go into the making of the food macaroni. Folengo's *Liber Macaronicus* greatly influenced Rabelais' work, *The Voyage of Pantagruel*, and was imitated by a number of minor Italian poets. In France in 1573, Antonius de Arena (Antoine de la Sable) published a mock epic on Charles V's campaign in Provence, after the style of Folengo's poem. Molière made use of macaronic verse in *Le Malade imaginaire*. Macaronic prose, however, is very rare. It is thought that this form of poetry might have been suggested by the barbarous Latin used by the monks.

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MACAROON, a small, rich, usually glazed cooky, formerly a French delicacy, now frequently baked from simple recipes. Principal types of macaroons are made from combinations of such ingredients as almond paste or extract, coconut, flaked cereal, flour, egg whites, sugar, and salt.

MacARTHUR, Arthur, United States Army officer: b. Springfield, Mass., June 2, 1845; d. Milwaukee, Wis., Sept. 5, 1912. He entered the service during the Civil War as a first lieutenant in the 24th Wisconsin Infantry, in August 1862, and thereafter saw action in the battles of Perryville, Stone River, Dandridge, Franklin, and in the Atlanta campaign. He was mentioned in dispatches for gallant and meritorious service, and in 1890, was awarded the Congressional Medal of Honor for bravery in the battle of Missionary Ridge (1863). By the end of the war, he had been brevetted a colonel of the regiment. In February 1866, he entered the regular army, and from then until 1886, was stationed in the West and Southwest, where he took part in several Indian campaigns. In May 1898, shortly after the beginning of the Spanish-American War, he was appointed brigadier general of volunteers, and assigned to the Philippines. In August of that year, he was commissioned major general of volunteers. In 1899, under Gen. Elwell Otis, he led a division against Aguinaldo, and in 1900, was appointed commander of the Division of the Philippines, and succeeded General Otis as military governor of the islands. He was promoted to brigadier general in the regular army in January 1900, and in 1906 was made assistant chief of staff of the United States Army, with the rank of lieutenant general. During the Russo-Japanese War, he was detailed as a special observer with the Japanese Army (1905). He was retired from active service in June 1909. Lieutenant General MacArthur was the father of General Douglas MacArthur (q.v.).

MacARTHUR, Douglas, American general: b. Little Rock, Ark., Jan. 26, 1880. It is generally agreed that General MacArthur possesses one of the outstanding military records in modern history. Son of the late Lieut. Gen. Arthur MacArthur (q.v.), a distinguished army officer, Douglas MacArthur began his military career in 1899 when he was admitted as a student to West Point. He graduated in 1903, having attained the highest scholastic average of any student in 25 years. Commissioned second lieutenant in the Corps of Engineers, he served in various capacities in the Philippines, Japan, Mexico, and army schools until 1913–1915 and 1916–1917, at which times he served on the general staff. In August 1917, with the rank of colonel, he became chief of staff of the 42d (Rainbow) Division, which he had helped to form. During World War I he served in the Champagne-Marne and Aisne-Marne defensives, and in June 1918, after being made brigadier general, he commanded the 84th Infantry Brigade in five offensives. From November 1918 to April 1919 he was with the Army of Occupation in Germany and then returned to the United States Military Academy where he held the post of superintendent until 1922. Here he modernized the academy's military training and broadened the curriculum to include a full collegiate education. From 1922 to 1925 he served in various Philippine commands, returned to the United States for three years as major general in command of corps areas with headquarters at Baltimore and Atlanta, and in November 1930, he was named by President Hoover as chief of the general staff of the United States Army, with rank of general, the youngest officer to hold that rank since Grant. During his term of office, he was responsible for reorganizing the defense program, increasing the size of the air corps and the number of enlisted personnel, and speeding up the army's mechanization. He also favored coordination of air and ground forces. In 1935, at the request of the Philippine president, he was appointed military adviser to the Philippine Commonwealth government, for which he organized the islands' defenses and built up a native army. From June 1936 to Dec. 31, 1937, when at his own request he was placed on the army's retired list, he served as field marshal of the Philippine Army. He was recalled to active service on July 26, 1941, commissioned lieutenant general, and appointed commanding general of the Far East Command. On Dec. 8, 1941, he was named commander in chief of United States armed forces in the Far East, with the rank of full general. He led American and Filipino troops against the Japanese, but was forced to abandon Manila on Dec. 26, 1941, retreating to Bataan Peninsula. Here he made the two-months defense which won for him the respect of military experts and the affection of the American people. In March 1942, under orders from President Roosevelt, he surrendered his command to Maj. Gen. Jonathan M. Wainwright, and was evacuated to Australia, where he was appointed commander in chief of Allied forces in the Southwest Pacific area. During 1942 the forces under his command defeated the Japanese in the Coral Sea, waged the Battle of Midway, began the

Solomon Islands campaign, and dislodged the Japanese from Buna and Gona. In March 1943 General MacArthur announced the destruction of a 22-ship Japanese convoy advancing on New Guinea, and in July, with Admiral William F. Halsey, he launched a joint offensive in the Southwest Pacific. Under MacArthur's personal leadership, his forces invaded the Philippine island of Leyte on Oct. 20, 1944; three months later they invaded Luzon, and by July 5, 1945, the liberation of the Philippines was completed. Previously, in December 1944 he had been given the five-star rank of general of the army and in April 1945, he had been given command of all United States Army forces in the Pacific. In August 1945, on President Truman's orders, he arranged the terms of Japanese capitulation and on Sept. 2, aboard the U.S.S. *Missouri* in Tokyo Bay, accepted Japan's formal surrender to the Allies. He was then designated Supreme Commander of the Allied Powers in Japan. After five years of Allied occupation of Japan, General MacArthur stated that he believed Japan had achieved a new "political reorientation" and that the country was ready for membership in the "family of free nations." On June 25, 1950, his program in the Pacific was expanded when the South Korean Republic was invaded by forces from North Korea. On that day the United Nations Security Council issued cease-fire orders and asked United Nations countries to enforce the order. Two days later President Truman ordered the United States air and naval forces under General MacArthur's command to help repel the North Korean invaders, and on June 29 General MacArthur reached South Korea to organize its defense. He requested and received authorization to send "supporting ground units" from Japan to Korea, to permit the Air Force to lift its bomber line above the 38th parallel, and to order the Navy to blockade the entire Korean coast. On July 8, 1950, after a majority of the U.N. Security Council had agreed, President Truman appointed General MacArthur commander of U.N. forces fighting in Korea under the United Nations flag.

On April 11, 1951, General MacArthur was dismissed by President Truman from his United Nations, Allied, and American commands in the Far East. The president charged MacArthur, who had made public demands for a more extensive war against the Chinese Communists, with being "unable to give his wholehearted support to the policies of the United States Government and of the United Nations." The general's ouster, the most sensational in American military history, set off a vigorous internal controversy in the United States. MacArthur highlighted a history-making return to the United States by addressing a joint session of Congress on April 19, 1951. Having accepted an offer to join the Remington-Rand Company, he delayed assuming his business post until July 31, 1952 when he was installed as chairman. Meanwhile he made the Republican National Convention keynote address, castigating the Truman administration. Though supporting the Taft candidacy, he received 10 votes in the first roll call.

MacARTHUR, Duncan, American soldier and political figure: b. Dutchess County, N. Y., Jan. 14, 1772; d. near Chillicothe, Ohio, 1839. His family removed in 1780 to the western frontier of Pennsylvania, and at 18 years of age he went to seek his fortune in the wilderness, and participated as a ranger or scout in the warfare with the Indians in Kentucky and Ohio, until the victory of General Anthony Wayne in 1794 gave peace to the Western country. In 1796 he was married, and settled near Chillicothe, Ohio, as a surveyor and land speculator. In 1805 he became a member of the Ohio legislature, and in 1808 was appointed major general of the state militia. In the War of 1812 he received the commission of brigadier general in the army, and in 1814 succeeded General William Henry Harrison in command of the army of the West. After the war, as a joint commissioner with General Lewis Cass, he negotiated the treaty with the Indians of Ohio for the sale of their lands in that state, which was ratified in 1818. He served intermittently in the Ohio legislature (1815–30), and in 1823–25 was a representative in Congress from that state. In 1830 he was elected governor of Ohio.

McARTHUR, John, Jr., American architect: b. Bladenock, Wigtownshire, Scotland, May 13, 1823; d. Philadelphia, Pa., Jan. 8, 1890. He came to the United States as a child and was apprenticed to his uncle, a Philadelphia carpenter. He later studied drawing and design at the Franklin Institute under Thomas U. Walter, architect and teacher. Thereafter, young McArthur had much practical experience in his chosen field as apprentice and later as foreman and superintendent. At the age of 26, he won first prize for a design of a building for the House of Refuge at Philadelphia. He soon became well established as an architect, and designed many important buildings, both public and private. Among them were the Public Ledger Building, the George W. Child's mansion, both in Philadelphia; buildings at Lafayette College in Easton, Pa.; and the State Asylum for the Insane at Danville, Pa. During the Civil War, he worked for the United States government, and was architect of the naval hospitals at Mare Island, Annapolis, and Philadelphia. Some of his finest work was done in the construction of the Philadelphia City Hall or Public Buildings, at one time one of the two largest public buildings in the United States.

MacARTHUR, Robert Stuart, American Baptist clergyman: b. Dalesville, Quebec, July 31, 1841; d. Daytona Beach, Fla., Feb. 23, 1923. Graduated from the University of Rochester (1867) and from Rochester Theological Seminary (1870) he served from May 1870 to September 1911 as pastor of Calvary Baptist Church, New York, when he resigned to assume the presidency of the Baptist World Alliance. He went to Russia to secure from the czar's government permission to buy land at St. Petersburg on which to erect a Baptist Bible college, a project which the outbreak of World War I made impossible. He later went to Burma as president of the alliance to assist in celebrating the centennial anniversary of Adoniram Judson's mission work. He was connected editorially with the *Christian Inquirer* and *Baptist Review.* His publications include *Current Questions for Thinking Men* (1898); *Divine Balustrades* (1898); *Quick Truths and Quaint Texts* (1898); *Lectures on the Land and the Book* (1899); *The Celestial Lamp* (1899); *Old Testament Difficulties* (1905); *The Baptists* (1911); *and The Question of the Centuries* (1921).

McARTHUR, William Pope, American naval officer and hydrographer: b. Ste. Genevieve, Mo., April 2, 1814; d. aboard ship Dec. 23, 1850. In February 1832 he was appointed midshipman in the United States Navy, spent several years in the South Pacific station, and later attended the naval school at Norfolk, Va. During the second Seminole War (1837–1838) he commanded one of the vessels in the expedition to the Everglades. He was assigned to duty with the United States Coast Survey in 1840, and in the following year, took part in the survey of the Gulf coast. Promoted lieutenant in 1841, in 1848 he commanded the hydrographic party that made the first preliminary survey and reconnaissance of the Pacific coastline from Monterey to the Columbia River. He died of acute dysentery as his ship entered Panama Harbor on the return voyage.

McARTHUR, town of southern Ohio, the seat of Vinton County, 75 miles southeast of Columbus, on the Chesapeake and Ohio Railway. Local clays provide raw materials for brick-making, the town's chief industry. Fruit and vegetables are grown and stocks raised in the surrounding area; there also are a coal mine and oil and gas wells in the vicinity. McArthur was platted in 1815 and incorporated in 1851. Pop. (1950) 1,466.

MacARTHUR, P. I. See ORMOC.

MACASSAR or **MAKASSAR,** mȧ-kăs'ẽr, seaport and capital of the province of Sulawesi (Celebes), United States of Indonesia. It lies on the west coast of the southern peninsula of the island of Celebes, at the southeast end of Macassar Strait separating Celebes from Borneo. It is served by the coastal railroad and is the site of an airport. Its natural harbor has been improved in 1925 and is the port of call of cargo ships from Europe and other parts of Asia; here imported goods are transshipped to smaller boats serving the other ports of Celebes, New Guinea, and the Molucca Islands. Teakwood, vegetable oils, coffee, spices, gums and resins, and rattan are exported. There are few Europeans, but a large Chinese group. The climate is very hot and humid and the vegetation of the surrounding area is of the tropical rain-forest type. Macassar consists of the Dutch town and port, Vlaardingen, the center of the European and Chinese trade, and of the Malay town, which lies inland. Vlaardingen dates in part back to the times of the East India Company, but contains also broad avenues and modern constructions. The port is dominated by old Fort Rotterdam, originally built by the Portuguese; in front of it is a wide square surrounded by government buildings.

The new museum contains a valuable collection of objects illustrative of the native arts and industries, arms, costumes, and jewelry. The native Macassarese and Bugi are branches of the Malay people, and the Makassar language is one of the most important of the Malay group. The Portuguese claim to have visited Macassar as early as 1512, but their first permanent settlement is probably of much later date. During the 17th century the Dutch came often in conflict with the sultan of Macassar and with the Portuguese; in 1667 the sultan submitted, then the Portuguese were driven out and the Dutch East India Company won complete control. All attempts by the British to supplant the Dutch were unsuccessful and the Dutch have remained masters until the end of World War II. In 1946–1950 Macassar was the capital of the state of East Indonesia and parliament convened here in 1947. Pop. (1930) 84,855.

MACASSAR OIL, the trade name for an unguent that made its appearance in England early in the 19th century. It took its name from the district of Macassar, where it was first produced, being pressed from the fruit, or seed, of the *Schleichera trijuga,* the East Indian kusum tree. This fixed vegetable oil is used by the natives for cooking, illuminating and for medicinal purposes. The name is now given to a pomade made of almond, olive or peanut oil, to which other substances are added to give color and perfume. The original Macassar oil became so well known that Byron spoke of it as "Thine incomparable oil, Macassar," and Lewis Carroll alludes to it in the "Song of the Man Sitting on the Gate" in *Through the Looking-glass.* So general was its use that in England a covering was specially made to throw over the back of a chair or sofa as a protection from the grease in the hair; and to these coverings the name antimacassar was given. Antimacassars were at first made of white cotton in crochetwork, and were stiff, hard, and uncomfortable; but in the third quarter of the 19th century they were simpler and more artistically worked in colored wools or crewels, or colored silks in pretty patterns. In the United States the word "tidy" was used to describe the article.

MACASSAR STRAIT, arm of sea between Celebes and Borneo islands, United States of Indonesia, connecting the Sea of Celebes with the seas of Java and Flores; through it is the most direct route from Java to the Philippine Islands. It reaches a width of almost 250 miles in the south, while in the north it is only 80 miles wide; the depth is mostly 3,000 feet, except an area in the north where it reaches almost 10,000 feet. Macassar is the most important harbor. Here on Jan. 23, 1942, took place the naval engagement in which American and Dutch warships and planes opposed a Japanese armada of some 100 ships in the Strait of Macassar between Borneo and Celebes. In the battle, which raged for five days and nights, the Japanese lost over 30 ships sunk or damaged, including one battleship and an aircraft carrier, and between 25,000 and 30,000 men drowned. Although Japanese losses were high, the battle proved to be principally an Allied delaying action, and in February of that year Japanese forces again advanced on Java, established bases on both sides of Celebes, and occupied Amboina Island, second most important naval base in the Dutch East Indies, and Timor, north of Australia.

MACAULAY, mȧ-kâ'lĭ, **Catharine Sawbridge,** English historian: b. Wye, Kent, April 2, 1731; d. Binfield, Berkshire, June 22, 1791. In 1760 she was married to George Macaulay, a London physician. She was an ardent Republican and a great admirer of Washington, with whom she corresponded, and whom she visited in 1785. She published a *History of England from the Accession of James I to that of the Brunswick Line* (8 vols., 1763–1783), once very popular and eulogized by Pitt in the House of Commons, but now neglected.

MACAULAY, James, Scottish novelist: b. Edinburgh, 22 May 1817; d. there, 20 June 1902. He was educated at the University of Edinburgh and for 35 years was in the service of the Religious Tract Society as editor-in-chief. In 1851–57 he was joint editor of the *Literary Gazette* and in 1858 became editor of the *Leisure Hour Sunday at Home. The Boy's Own Paper* and *The Girl's Own Paper* were founded by him. He was a voluminous writer, and among his published works the following may be mentioned: 'Across the Ferry; First Impressions of America and its People' (1871); 'Memory Helps in British History' (1873); 'All True: Records of Adventure' (1879); 'Luther Anecdotes' (1883); 'Gordon Anecdotes' (1885); 'Livingstone Anecdotes' (1886); 'Wonderful Stories of Daring, Peril and Adventure' (1887); and 'Victoria, Her Life and Reign' (1887).

MACAULAY, Sir James Buchanan, Canadian jurist: b. Niagara, Ontario, 3 Dec. 1793; d. Toronto, 26 Nov. 1859. He was an ensign in the British army during the War of 1812, and subsequently studying law was admitted to the bar in 1822. In 1829 he was appointed a judge of the King's Bench, from 1849 to 1856 he was chief justice of the Court of Common Pleas, and just prior to his death became judge of the Court of Error and Appeal. He was knighted in 1859.

MACAULAY, Thomas Babington, English essayist, historian and statesman: b. Rothley Temple, Leicestershire, 25 Oct. 1800; d. Holly Lodge, Kensington, 28 Dec. 1859.

Macaulay was the son of Zachary Macaulay, a Scotchman of remarkable character, who achieved distinction by his life-long advocacy of the abolition of slavery and by his efficiency, as a young man, in the governorship of Sierra Leone, the colony of African freedmen. The family removed to Clapham, then a suburb of London, where much of Macaulay's youth was spent. Hannah More was a friend of the family and she encouraged the lad as a writer and presented him with books to start his library. Young Macaulay was regarded as a prodigy, and his memory was something startling. He attended school near Cambridge under a Mr. Preston; his range of reading, particularly in poetry and fiction, was immense, but his taste for mathematics and the exact sciences steadily declined. In October 1818 he entered Trinity College, Cambridge, and in the citadel of mathematics his aversion for this study became pronounced. Twice he gained the Chancellor's medal for poetry, and he displayed classical attainments, but was «gulphed» in mathematics. However, after a third trial, he won a Fellowship in 1824. His mental training was thus one-sided; and a certain lack of philosophical grasp and a dislike of facing abstruse intellectual problems became thus characteristic.

The association with his college mates, rather than his studies, left the deepest impression upon Macaulay. His great friend was Charles Austin, whose influence converted the young Tory into an uncompromising Whig. He shone in the Union Debating Society, developing powers that afterward became conspicuous in the House of Commons. Politics he had heard discussed from early childhood in the circles which gathered round his father's table, and along with literature politics was his abiding passion. At college he had competed for a prize in history on the subject which he developed fuller in later years: «The Conduct and Character of William III.»

Before leaving the university he began writing for publication in *Knight's Quarterly Magazine* (1823). Two lyrics, 'Ivry' and 'Naseby' still live; but the most important contribution was the ingenious 'Conversation between Mr. Abraham Cowley and Mr. John Milton, touching the great Civil War.' It seems likely enough that the freshness and delicacy revealed in this early work became injured by the author's entrance into the rougher world of political strife. On the other hand, it may be maintained that Macaulay's gifts were preeminently those of the man in public life, and to him literature, always a delight, was nevertheless really but an avocation.

Macaulay's father unexpectedly became financially involved. Full of courage, the son began tutoring while still at Cambridge, and cheerfully assisted in supporting his sisters. Ultimately, together with his brother, he paid off all his father's obligations.

Macaulay was called to the bar in 1826 and joined the Northern circuit; but soon gave up the law for politics. Interestingly enough, his entrance into politics came by way of literature. In August 1825 appeared the essay on 'Milton,' the first of the series that Macaulay contributed to the *Edinburgh Review,* which, for the next 20 years, made both him and the *Review* famous. Jeffrey, the editor, expressed his frank wonder as to where Macaulay «picked up that style.» Upon Jeffrey's resignation Macaulay was offered the editorship, but he was not willing to leave London. Papers on 'Machiavelli' (1827), 'Dryden,' 'History' and 'Hallam's Constitutional History' (1828), followed, and soon after controversial articles on James Mill, Sadler and Southey, which revealed the declared Whig. Their reputation introduced him into both social and political life. He was made commissioner of bankruptcy in 1828 and in 1830, Lord Lansdowne, who had been favorably impressed by the attack on Mill, offered Macaulay a seat in Parliament for Calne in Wiltshire which he held until in 1832 he was elected for Leeds.

His time of entrance into the House of Commons was propitious. It was just before the death of George IV and the accession of William IV, and consequently on the eve of the battle for the reforms of 1832. Macaulay was 30 years of age, was widely read in history and literature and was a ready and fluent speaker aflame with interest in public questions. In 1824 he had made a notable speech at a meeting of the Anti-Slavery Society; later, in the discussion for Catholic emancipation, he headed a coachload of M.A.'s from London to Cambridge, arriving in time to vote down a petition in the university senate against the act. He now threw himself ardently into the struggle for reform and took an honorable part in the fight from beginning to end. His Parliamentary success was immediate. «Whenever he rose to speak,» Mr. Gladstone testified, «it was a summons like a trumpet-call to fill the benches.» His earliest effort was on the removal of the civil disabilities of the Jews, which he followed by an essay on the subject in the

Edinburgh Review (January 1831). On the emancipation of slaves in the colonies he never wavered, but stood unflinchingly true to his father's principles. He offered to resign his position with the ministry rather than yield his views on this subject; but the question was satisfactorily settled and his resignation not accepted.

Meanwhile he found time to write. The essays on 'Byron, 'Johnson' and 'Hampden' appeared in 1831; 'Burleigh' and 'Mirabeau,' in 1832; 'War of the Succession in Spain' and 'Horace Walpole,' in 1833, and the first essay on 'Chatham,' January 1834.

His appointment in 1832 as a commissioner of the Board of Control was followed by absorption in East Indian affairs, and in 1833, when the charter of the East India Company was renewed, he was offered a position on the East Indian Council with a salary of £10,000 per annum for five years. His brilliant career in Parliament was seemingly permanently endangered; but Macaulay did not hesitate. He estimated that he could save half his salary and in five years have a competence. He needed money on account of his father's poverty, for the sake of his two sisters, as well as for his own career; and he accepted, going out in 1834 and returning in 1838. The genius for government which the father had displayed at Sierre Leone, the son now manifested at Calcutta. His important permanent reforms were the creation of the Indian Penal Code and the Code for Criminal Procedure, achieved in the face of bitter local opposition, and the organization of a sound educational system.

Macaulay's family ties were very strong and there is no record of any love affair in his life. A sister, Jane, had died in 1830, and his mother in 1831. One of his favorite sisters, Margaret, was married in 1832, an occurrence which he accepted as a source of personal distress. The other, Hannah, accompanied him to India, and there she met and was shortly married to Charles Trevelyan, an officer in the government service. Macaulay was much pleased with the match, and the two households lived together under the same roof. Ever afterward, as the young Trevelyans, his nieces and nephews, grew up, they became a very real part of Macaulay's life. His love for children, and particularly for these, was a marked trait, and one of them afterward filially wrote his uncle's biography. Meanwhile his sister Margaret had died in England, and likewise his father died while Macaulay and the Trevelyans were on their homeward voyage. These deaths affected him deeply, and the home-coming was a sad one.

While in India he made opportunity for an immense amount of reading, particularly of the Latin and Greek classics, to which he returned with increasing delight. He also read widely in Italian and French, and did some German on the return voyage. His love for the great poets, dramatists, orators and historians affected his culture, his style and his ideals. The lists of his reading from now to the end of his life became a part of his biography and would stock a good library. His long walks with a copy of Homer or Virgil, from which he was reading or spouting, became an accustomed sight. Thenceforward he determined that he would write a history in emulation of Thucydides and Tacitus and Livy, and his set speeches caught something of the spirit of Lysias and Cicero.

Upon his return to England he left for a tour in Italy, revelling in its beauties and associations with the enthusiasm of a first visit and the eye of an historian and student of Latin and Italian literatures. The literary fruits were the 'Lays of Ancient Rome.'

Returned home, he sincerely hoped to begin his 'History of England,' which he had planned to write from the Revolution of 1688 to the death of George III. Had he begun it then, with 20 years of life to devote to it, he might easily have left 10 or more volumes covering the century instead of the first five extending through but 15 years — a brilliant fragment. But he was again dragged into politics and Macvey Napier, editor of the *Edinburgh Review*, made heavy draughts upon his time.

In India he had contributed but two essays to the *Review*, that on 'Mackintosh's History' and the very long one on 'Bacon.' However, his experience furnished him the material for the brilliant narratives on 'Clive' (1840) and 'Warren Hastings' (1841). Besides these in the six years after his return he contributed 'Sir William Temple' (1838) — written in an entirely fresh spirit; 'Gladstone on Church and State' (1839); 'Von Ranke's History of the Popes' (1840); the 'Comic Dramatists of the Restoration' and 'Lord Holland' (1841); 'Frederick the Great' (1842); 'Mme. d'Arblay' and 'Addison' (1843); 'Barère' and the second essay on the 'Earl of Chatham' (1844). This, perhaps his noblest essay, proved to be his last. He was forced to give up writing in order to find time for his 'History.' His complaisance in continuing to write for the *Review* had undoubtedly worked to his detriment. But the entrance into politics was only in part due to the exigencies of his friends; for public life exercised a subtle fascination over him.

In 1839 he was elected member of Parliament for Edinburgh and was made Secretary at War with a seat in the Cabinet. Fortunately the ministry soon expired, and his freedom from official duties gave him some leisure. He retained, however, his seat for Edinburgh, and his most important work was the Copyright Bill, which, after many radical suggestions, passed in almost the exact terms in which he advocated it.

In 1842 the 'Lays' appeared and achieved a great success despite the natural fears of friends. «Christopher North» of *Blackwood's*, who had attacked Macaulay on account of the Southey reviews, made up — on poetry they could agree. In 1843 the 'Essays' were collected and published. There had been a constantly growing demand for them in a permanent form, which their author at first resisted. They had been written at odd moments of leisure, and he regarded them as ephemeral, but copies were being introduced from America, and Macaulay had to consent. The sale proved their popularity to be a permanent one. Macaulay's Essays still are unapproached of their kind, as condensed booklets of knowledge. An analysis of their contents shows how their author's mind was revolving constantly upon a definite period of English history — the Revolution and the consequent development under constitutional government, the subject he set

for himself in writing his 'History'— and these are uniformly among his best. Those on foreign subjects and the controversial ones are less satisfying.

The 'History' had been delayed year after year for lack of leisure to begin actual work. At length the first two volumes appeared in 1849. They comprised the reign of James II and the Revolution, but reproduced the setting as a whole and included details at once picturesque and dramatic such as could only be drawn by a supreme master of narrative. Macaulay had set for himself high ideals; he wished to be read and to be understood; he sought to give a series of brilliant mental pictures; and he achieved what he set out to do. He is weakest, perhaps, on the side of ethical interpretation, in searching out the causes and setting forth the nexus of events; his narrative is brilliant and effective, but it has the supreme fault in a history of being entirely lacking in detachment of view. In opinions he represented the great middle class and the world of Whiggism and its mode of thinking; in many things, Philistine; in some things, even vulgar; where mysticism and all esoteric systems of philosophy and kindred schools of poetry were accounted as foolishness.

The popularity of the 'History' was something enormous, surpassing even that of Byron's poems and of Scott's and Dickens' novels. In 1849, in consequence of this success, Macaulay was made rector of the University of Glasgow and Fellow of the Royal Society. He had been appointed trustee of the British Museum in 1847. He declined a professorship of history at Cambridge, and steadily refused positions under the government which would take up his time.

He had represented Edinburgh in Parliament for eight years, when in 1847, on account of his characteristic independence in voting for the Maynooth grant — for the maintenance of a Catholic university in Ireland — he offended many Edinburgh electors, and was not returned at the polls. He accepted his defeat with relief, and turned the more eagerly to the 'History.' In 1852, without any solicitation on his part and with a steady refusal to give pledges, he was returned voluntarily by the electors of Edinburgh to his former seat. Under such circumstances he felt he could not refuse election; but the duties it involved aided in sapping his strength, and that year he had a spell of illness from which he never wholly recovered.

In 1853 his speeches were collected and published. In 1855 the third and fourth volumes of his 'History' appeared. Macaulay feared for their success after the splendid reception accorded to the former two; but the new subject was the life and career of William of Orange, his favorite hero, he had worked hard to sustain himself and 26,500 copies were sold in 10 weeks. In 1856 he withdrew from the House of Commons; and in 1857 he was made a peer, and chose the title, Baron Macaulay of Rothley, from his birthplace. Likewise this year he was made a foreign member of the French Academy, member of the Prussian Order of Merit and high steward of Cambridge. In 1858 he wrote five short biographies for the eighth edition of the Encyclopedia Britannica — Atterbury, Bunyan, Goldsmith, Johnson and Pitt. These show greater compactness and maturity in judgment than his earlier treatment of the same themes.

In 1856 he left his bachelor quarters in town, at The Albany, and leased a pleasant villa, Holly Lodge, Campden Hill, Kensington. In 1859 his brother-in-law, now Sir Charles Trevelyan, was appointed governor of Madras, and the thought of the separation bore heavily upon him. Fortunately his sister and the children remained behind a while longer. Macaulay had not been well for some time, and he died at Holly Lodge, 28 December. On 9 Jan. 1860, he was buried in Westminster Abbey in the Poets' Corner at the foot of Addison's statue.

A fifth volume of the 'History,' concluding the reign of William III, had been completed, was edited posthumously by Lady Trevelyan and appeared in 1861. See MACAULAY'S ESSAYS; LAYS OF ANCIENT ROME.

Bibliography.— The official life, written by George (afterward Sir George) Otto Trevelyan (his nephew), appeared in London in 1876, and is generally conceded to be one of the best biographies in the English language. Consult also Lord Avebury, 'Essays and Addresses' (London 1903); Bagehot, Walter, 'Literary Studies' (ib. 1879); Canning, 'Lord Macaulay and his History' (ib. 1822); Hughes, D. A., 'Thomas Babington Macaulay the Rhetorician: an Examination of his Structural Devices' (Ithaca, N. Y., 1898); Macgregor, D. H., 'Lord Macaulay' (London 1901); Viscount Morley, 'Critical Miscellanies' (ib. 1877); Morrison, J. Cotter, 'Macaulay' in the 'English Men of Letters' (ib. 1882); Spedding, 'Evenings with a Reviewer' (ib. 1881).

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MACAULAY'S ESSAYS. Macaulay did not originate the essay of literary and historical criticism. But Macaulay's essays so far surpass all others in brilliancy, style and solidity of matter that his name ranks with those of Bacon and Montaigne, each a master in his own special field. Macaulay's first published articles, written while he was still in residence at Cambridge University, appeared in Knight's *Quarterly Magazine* in 1823 and 1824, and from that time until his death in 1859 he wrote two score essays for the *Edinburgh Review* and many articles for the 'Encyclopædia Britannica.' The subjects he wrote upon were many — Dante, Dryden, Mill on Government, Mr. Robert Montgomery's poems, Moore's Life of Byron, Lord Bacon, Von Ranke, Leigh Hunt, Frederick the Great, Madame d'Arblay, Barère, etc., but by far the greater number deal with poets and men of letters or political personages in English history. Perhaps his most famous essays are those on Lord Clive, Warren Hastings and William Pitt, but others that deal with men of letters, Addison, for instance, or Samuel Johnson, are just as brilliant.

Macaulay's essays are set off by all the arts of rhetoric; they are ornamented by all the resources of omnivorous reading and a marvelous memory; they sparkle with a youthful enthusiasm, and are compact of sound information. In their own class they have no rivals. They are books to be taken on a long sea voyage, to be put on the shelf of a lonely ranchman, to be read and reread by all who have any taste for

literature. Pick up the essay on Addison and you are delighted with the tender sympathy of the critic who can set forth a good man's character in so generous and beautiful a manner. Read that on Croker's edition of 'Boswell's Johnson,' and you not only derive pleasure from Macaulay's admiration for Johnson, but you also get a lively idea of what the editor of a biography should not do. Take up any essay you please and you find knowledge, wit, sympathy, admiration; you are delighted to find with what extraordinary ease you acquire information, and how your horizon rapidly reaches out as if you were going up in a balloon, how places and things once so dark become enveloped in light as if the sun were rising, how great historical events seem to have been familiar to you from boyhood and how eminent personages, hitherto unknown, leap into your sudden intimacy.

Thus to delight, in form, and exhilarate the reader is a wonderful feat, and for nine men out of 10 Macaulay's essays are wholly satisfactory. They give a busy man what he wants to get from history and literature; but the 10th man finds himself not wholly satisfied. He feels oppressed by the arts of rhetoric. These animated pages, paragraphs, sentences that advance upon him, rank by rank, marshaled according to the most brilliant rules of tactics and strategy, trouble his spirit. Not a single sentence, here or there, appears in undress uniform. Such prose affords no room for subtleties. And the author's dogmatism rings in our ears like a trumpet in a room; this world of ours so full of perplexities, uncertainties, obscurities, cannot be truly expressed in opinions of absolute definiteness. History, literature, art, are not mathematics; a column of figures adds up the same for all; but William of Orange, James the Second, Archbishop Laud, Alexander Pope, Francis Bacon, must seem different to different people. We need, in literature, in history, light and shade, we need twilight and even night; high noon all the time is intolerable. It seems unlikely that all right views on English politics, during the 17th, 18th and 19th centuries, were embodied in the Whig creed, that all the good in religion is with the Protestants and none with Roman Catholics, that a comparative estimate of national characters summed up in the phrase "as the Italian is to the Englishman, as the Hindoo is to the Italian, as the Bengal is to other Hindoos," etc., should not need explanations and qualifications. And why should a historical writer, all the time, be giving his personages good or bad marks for conduct, like a village schoolmaster?

Such faults certainly exist. Macaulay had the temperament and the manner of an orator. He took, or rather he inherited, a view, he accepted it unquestioningly with enthusiasm, even with passion, he expressed that view in as absolute and as lucid a manner as possible. He had the method of an orator whose oration will be heard but once, and who must be positive in order to convince. This may be a merit in an advocate but it is a grave fault in a writer; and one would say that with such a fault it would be impossible for a man to be a great writer. But this very fault is proof of Macaulay's extraordinary talents; with his eloquence, with his immense fund of information, with his obvious honesty and his contagious enthusiasm, he is able to cover up and conceal what in any other writer would be fatal defects.

A man without doubts, without metaphysics, without high imagination, without dreams, cannot be one of the world's greatest writers; but Macaulay was a great English writer and occupies a place in which he not only has no rival, but no competitor who can be compared with him.

CARL E. EGGERT.

MACAULAY, Trevelyan's Life of. The authoritative biography of Thomas Babington Macaulay is the 'Life and Letters' by Sir George Otto Trevelyan. It is likely always to remain the chief source of information on account of the opportunity open to the biographer of knowing the subject thoroughly and of having free access to all available material. The writer is a nephew of Lord Macaulay, the son of Hannah More Macaulay, one of the historian's favorite sisters; from his earliest boyhood he knew his uncle intimately, and was 21 years old when Macaulay died in December 1859. Lady Trevelyan bequeathed to her son the task of writing his uncle's biography, a task that occupied many years, the completed work appearing in 1876.

The excellence of the work was recognized from the first. John Morley and William Ewart Gladstone approved it at once in extensive reviews, and succeeding years have detracted not at all from their judgments. Mr. Morley commended "the skill and candor with which Mr. Trevelyan has executed a very delicate and difficult task." Excellent and abundant materials and extensive knowledge do not necessarily ensure the production of a great biography. Nor do intimacy and strong affection; close relationship, indeed, is frequently the snare that prevents success. It is a tribute to Trevelyan's genius that he was not blinded by relationship or affection, nor overcome by the excess of material with which he had to deal. The biography exhibits careful selection. If now and then the loyal nephew is unable to see anything but good in the famous uncle, he nevertheless does not represent him as faultless; he admits that Macaulay had both limitations and prejudices. Trevelyan does not intrude himself unduly upon the narrative: he keeps our attention at all times chiefly upon Macaulay. Gladstone said that one of the greatest merits of Trevelyan's work is the fact that it has movement — life. And Gladstone was right. The biography is no lifeless transcript of facts; it is a characterization and an interpretation, possessing all the qualities of the best artistic work — proper perspective, proportion, gradation. The style is attractive and contributes much to the delight of reading.

Trevelyan adopted the method employed and established by Boswell, that of allowing the subject to tell, "as far as possible," his own story. The 'Life of Macaulay' is sometimes, to be sure, mentioned along with the 'Life of Johnson,' and there is no doubt that it has taken its place as one of the greatest English biographies. It is true, however, that with all of the advantages open to Trevelyan, he yet falls short of the success attained by Boswell. The 'Macaulay' contains no such record of conversation, no such variety of "exquisite personal touches," no such dramatic quality as the 'Johnson.' Neither does it so freely portray faults and foibles. Falling somewhat short of the 'Life of Johnson' in sheer artistry, it surpasses Lockhart's 'Life of Scott' in movement and concen-

tration. Morley was giving high yet just praise when he expressed the belief that this 'Life of Macaulay' would be read throughout the world with a curiosity and an interest only to be surpassed by the success of Lord Macaulay's own writings. Consult the review of the 'Life' by John Morley (in the *Edinburgh Review,* Vol. 143); and that by Gladstone (in the *Quarterly Review,* Vol. 142). WALDO H. DUNN.

McAULEY, Catherine, Irish founder and first superior of the Sisters of Mercy: b. Stormont House, County Dublin, Ireland, 29 Sept. 1787; d. Dublin, 11 Nov. 1841. In childhood she was adopted by a wealthy Protestant family who allowed her to remain in the church of her father, the Roman Catholic, and left her a large fortune which she wished to use for the benefit of the poor. She first erected a commodious house wherein might be taught a number of poor children, and where homeless young women might find lodging and board. This institution was opened in Dublin, 24 Sept. 1827, but the religious order was not established until 12 Dec. 1831. The members of the order take the vows of poverty, chastity and obedience; and the works which they perform are visiting the poor, sick and imprisoned, teaching, establishing hospitals, orphanages, homes for the friendless and other works of mercy. There are houses of her order in nearly all parts of the world. In the United States it comprises over 4,700 members. The order includes a college for young women, at Mount Washington, Md., a large number of academies, high and elementary schools and hospitals and orphanages in nearly every State in the Union. Consult Hartnett, 'Memoir of Mother McAuley'; Murphy, 'Sketches of Irish Nunneries'; Member of Order of Mercy, 'Life of Catherine McAuley.' See MERCY, SISTERS OF.

McAULEY, m'kä'lĭ, **"Jerry,"** New York City missionary: b. Ireland, in 1839; d. New York City, 18 Sept. 1884. He came to New York in 1852 and became a thief and prize-fighter. In 1857 he was sent to Sing Sing prison on a false charge of highway robbery, but was pardoned in 1864. He returned to his evil life. In 1872, having reformed, he opened a mission, "The Helping Hand," in Water street, a criminal neighborhood in New York. In 1882 he opened another mission, "The Jerry McAuley Cremorne Mission" and in 1883 began the publication of *Jerry McAuley's Newspaper.* He appealed with the greatest success to outcasts considered beyond redemption. After his death the work was continued by Samuel H. Hadley and John H. Wyburn. In 1912 a modern sanitary building was erected on the site of the first mission in Water street. Consult 'Jerry McAuley: his Life and Work,' autobiography edited by the Rev. Robert M. Offord (New York 1885).

MACAW, mă'kä', name given to 15 or more species of large, long-tailed and strong-flying parrots of gaudy coloring. They belong to the genus *Ara,* and are natives of the Western Hemisphere. They live on the mainland of America from Mexico to Paraguay, being especially abundant in Bolivia, where no fewer than seven (or nearly one-half) are found. They are also in Colombia and in Cuba. In the true macaws (*Ara*) the bony orbitical ring is complete and the lores (space between the eye and the upper mandible) and, to a greater or less extent, the cheeks are naked. One of the handsomest and best known is the Blue and Yellow Macaw (*Ara ararauna*), which enjoys an extensive range in South America from Guiana in the east to Colombia in the west and from Panama to Bolivia. A little over 30 inches long it has the upper parts blue, the forehead olive-green and the ear-coverts, sides of neck, breast and abdomen yellow-orange, while the wings and long tail are blue above and golden olive-yellow below. This bird is seen in almost every zoological garden and is often kept in private houses. It possesses a fairly good temper and grows much attached to those who tend it; but, like all other macaws, it persists in violent screaming. Salmon-fishers use its feathers for the making of artificial flies. Larger and even more gorgeously plumaged is the great Red and Blue Macaw (*Ara macao*), which is mainly scarlet-red both above and below, but with the back and upper and lower tail coverts pale blue, as are the wing-quills, while the shoulders and greater coverts are chrome yellow. The tail feathers are scarlet, the two central ones scarcely tipped with blue, the blue tips increasing in extent on the outer feathers, the three outermost being almost exclusively blue. The home of the Red and Blue Macaw extends from Mexico, through Central America, to Bolivia, Guiana and the Amazon Valley. It is usually seen in pairs, or in companies of pairs. It is also a common bird in captivity. The Red and Green Macaw (*Ara chloeoptera*), ranging from Panama to Brazil, has a shorter tail than the other two and is not so frequently met with in zoological gardens. It does not extend north of Panama. It differs from the Red and Blue in being of a darker red, or crimson, and having the middle wing coverts olive-green instead of yellow. The Green Macaw (*Ara milateris*) is green throughout, except for the presence of a scarlet patch on the forehead and blue on back, rump, wings and tail. It is 27 inches long and ranges from Mexico to Peru and Bolivia,—the most northern of all in distribution. It is well known in captivity. Colonel Grayson and other writers explain that this macaw is called "guacamayo" by the natives of Mexico and Central America, because they believe that it descends to the ground only once a year, and this in the month of May, when it searches the ground for a very hard-shelled palm-nut of which it is fond. This rather surprising statement is probably substantially true, as there seems no other reason why it should ever alight on the ground, where it would be exposed to much more danger than in the tree-tops, where it finds abundant food the year round. The tree of this nut the Mexicans call Ava, a species of *Nux vomica.* Both the milky sap of the tree, as well as the fruit, are deadly poison to any other creature but this parrot. The shell is exceedingly hard, but the enormous bill and powerful jaws of the Guacamayo enables it to split the nut with ease. When migrating to some distance these birds pass at a great height, flying in pairs and uttering harsh and discordant cries.

The Hyacinthine Macaw (*Ara hyacinthus*) of the central provinces of Brazil is a splendid bird. It is about three feet long, the plumage being nearly uniform cobalt blue, relieved by

bright yellow skin about the eyes and at the base of the lower mandible and a black bill which is of enormous size. This appears to be a rare species, occurring, according to Riker, about the inland ponds in the dense forests of the interior, where it feeds chiefly upon the fruit of a palm peculiar to these localities. Some of these palm fruits are of extraordinary hardness, but these birds crush them to pulp by their bills. The nesting habits of the Hyacinthine differ from those of other macaws in that they excavate a hole in the river bank for their nest instead of placing it in a hollow tree. In Spixi Macaw (*Cynopsittacus Spixi*), of the province of Bahia, Brazil, the lores are naked and the general color also blue; but parts of the head are more or less grayish.

All macaws live well in captivity and are often kept chained to a perch. Few persons are acquainted with their strong, wonderful and graceful flight. They all scream harshly. They are gregarious and apparently monogamous, and lay two lustreless white eggs in nests in hollow trees. One of their characteristics is a long and graduated tail with the individual feathers tapering to a point and the middle pair always the longest. The bill is powerful and usually deeper than long. Consult Greene, William Thomas, 'Parrots in Captivity,' with notes (3 vols., London 1884–87); id., 'Parrots in Captivity,' colored illustration (London 1884); Lear, Edward, 'Illustrations of the Family of Psittacidae, or Parrots' (folio, London 1832); Page, Charles N., 'Parrots and Other Talking Birds: their Foods, Care and Training' (Des Moines 1906).

MACAW TREE (*Acrocomia sclerocarpa*), a palm of the same family as the cocoanut. It is a native of the West Indies and of the warm parts of America. It grows from 20 to 30 feet high with pinnated leaves from 10 to 15 feet long. The fruit yields oil of a yellowish hue, sweetish taste and with an odor like violets. This oil is about the consistency of butter. In the native regions of the tree the inhabitants use this oil as an emollient for affections of the joints. It is extensively imported and is used in the manufacture of toilet soaps as palm oil. The leaves yield a fine, soft fibre. In Guiana the tree is called *Macoya,* in Brazil it is called *Macahuba,* in Jamaica *Grugru.* In southern California this palm is cultivated as an ornamental tree.

MACAYO, mä-sī-ō, Brazil. See MACEIO.

MACBETH, or MACBETHAD, Mac-Finlegh, king of Scotland, who reigned from 1040 to 1057. The facts of his life, so far as known, are these. During the reign of Duncan he was «mormaer» of Moray by inheritance, and by his marriage with Gruoch, granddaughter of Kenneth IV. Duncan, in his attempt to subdue the independent chiefs of the north, was defeated in a battle with the Earl of Orkney and Shetland at Burghead, near Elgin in 1040; but was murdered at Pitgaveny, nine miles from the battlefield, by Macbeth, his general. By this means Macbeth became king, and, according to accounts, his reign was fairly successful. He was finally defeated in battle and slain by Malcolm Ceannmor, son of the murdered Duncan, at Lumphanan, Aberdeen (1057). The legends which gradually gathered round the name of Macbeth were collected by John of Fordun and Hector Boece, reproduced by Holinshed in his 'Chronicle' (1577) and made use of by Shakespeare for his great tragedy. These writers appear to have overlooked the excellent qualities of Macbeth as king, and regarded him with horror as a usurper. Consult Robertson, 'Scotland under her Early Kings' (1862); Skene, 'Celtic Scotland' (1876–80), and Rhys, E., 'Celtic Britain' (3d ed., London 1904).

MACBETH. This play was not published until 1623, though it was probably written several years before Shakespeare's death. A reference to it in 1610 by Dr. Simon Forman, the probable reference to the accession of James the First (1603) that brought about the union of two crowns, and the proportion of rhyme, blank verse and prose, point to 1605–06 as the probable date. Because of its late publication the text is one of the most corrupt of Shakespeare's plays. It may have been taken down from the play as acted, or it may be a transcript of the author's manuscript which was in great part not copied from the original but written to dictation. Act 1, scene 2, and part of scene 3 may be an interpolation, but the Porter Scene, which was long considered to be the work of a collaborator, is now justified by reason of its dramatic contrast with the preceding scene and by the amazing felicity of such lines as, «go the primrose way to the everlasting bonfire.» With the exception of a few lines and scenes Macbeth is an example of amazing concentration — it has neither underplot, nor, with the exception of the Porter Scene, such comic scenes as are found in nearly all of the other tragedies of Shakespeare. It is shorter by some thousand lines than any other tragedy and moves along with the swiftness of a tempest. The 20 years of history become nine days of dramatic time, and so swift is the passage of time that it seems but a few hours.

Shakespeare was indebted for the main events of the play to Holinshed's 'Chronicles of Scotland.' The character and the story of Macbeth, partly historical and partly legendary, were drawn largely from this source, but the witches were the creation of Shakespeare's genius from the shadowy creatures of a crude folklore. There is just enough of the popular conception of supernatural creatures of evil to satisfy the demands of the age in which he lived, but he informed this popular and somewhat vulgar superstition with a moral significance suited to all ages alike. These invisible, unearthly creatures do not create the evil in Macbeth's mind; they only serve to bring into life-like reality the evil that is already there. They are an embodiment of the same forces as the thunder, lightning, rain — nature «red in tooth and claw» — that constitute the background for the evil forces that are at play in this drama. While the minor characters of the play, and especially Banquo, are adequately presented, the interest centres in Macbeth and Lady Macbeth, who while engaged in the same evil deeds yet reveal differences of temperament and character that afford the most significant dramatic contrasts. Lady Macbeth before the murder of Duncan displays firm, sharp, wiry, matter-of-fact intellect and energy of will; she becomes for the time being possessed by one thought, one ambition. She has no imagination to represent

for her the inevitable consequences of the murder. As soon, however, as the deed is done, her womanly nature asserts itself; her amazing self-control gives way, and remorse wells up in her conscience-tortured heart. She had denied the quality of her sex, only to find that the woman was stronger than the queen or the wife. Macbeth, on the other hand, is possessed from the beginning by a vivid imagination that visualizes the deed itself and falters at its contemplation. Deeper and deeper he plunges into guilt until a sort of world-weariness and sick despair settle upon his brooding spirit. In words as eloquent as Shakespeare ever wrote he pronounces a requiem upon his wife and summarizes his pessimistic indictment of old age and of life; life is to him but "a tale told by an idiot, full of sound and fury, signifying nothing." He dies with the harness on his back, the intrepid soldier that he has always been, but with a sigh that pierces to the depths.

EDWIN MIMS.

McBRIDE, măk-brīd, **Sir Richard,** Canadian statesman: b. New Westminster, British Columbia, 15 Dec. 1870, where his father held office; d. England, 1917. He was educated at Dalhousie University, Halifax, Nova Scotia, graduating in 1890, called to the bar in 1892, he practised his profession in Victoria. Entering politics he was elected in 1898 a Conservative of the provincial legislature. In 1900–01 he was Minister of Mines in the Provincial Ministry; in 1902–03 a leader of the Conservative opposition; in 1903 Premier and Minister of Mines; in 1906 a delegate to the Interprovincial Conference at Ottawa; and in 1907 a delegate to the Colonial Conference at London (England). In 1912 he was knighted. Consult Gregg, T. A., 'Richard McBride,' with portrait, *Canadian Magazine* (July 1904).

MACBRIDE, Thomas Huston, American educator and botanist: b. Rogersville, Tenn., 31 July 1848. After graduation at Monmouth College in 1869 he taught mathematics and modern languages at Lenox College from 1870 till 1878, in which year he became assistant professor of natural sciences. In 1884 he was made professor of botany and held this post until 1914 when he became president. From 1916 he was president emeritus. His specialty was fungi. Dr. Macbride had many degrees: Monmouth gave him A.M. in 1873; the University of Bonn the same in 1891; Lenox gave him Ph.D. in 1895; Monmouth that of LL.D. in 1914, and Coe the same in 1915. He was a member of many scientific societies, of the American Forestry Association, Iowa Park and Forestry Association and of the Society of Botanists of the Central States. He was also a Fellow of the Botanical Society of America. He published many of his lectures and addresses, contributed to the *Popular Science Monthly, Science,* etc., and was the author of a textbook on 'Botany' (1895) and 'North American Slime Moulds' (1899). He died 27 March 1934.

McBURNEY, măk-bèr'nĭ, **Charles,** American surgeon: b. Roxbury, Mass., 17 Feb. 1845; d. 1913. He was graduated at Harvard in 1866; and from the Columbia Medical School in 1870, and thereafter practised his profession in New York. He was professor of surgery in the College of Physicians and Surgeons, New York, and was visiting and consulting surgeon at Saint Luke's, the Presbyterian, Roosevelt, New York Orthopedic and other hospitals. He became widely known as a very skilful operative surgeon, and was Fellow or member of many medical societies of this country and Europe. He discovered "McBurney's point," which is pathognomonic of appendicitis. He was a world-wide authority on appendicitis. When President McKinley was shot, Dr. McBurney was summoned to Buffalo as consulting surgeon. He was a great teacher as well as a great surgeon.

McBURNEY, Robert Raikes, American religious worker: b. Castleblaney, Ireland, 31 March 1837; d. Clifton Springs, N. Y., 27 Dec. 1898. He came to the United States in 1854, and from 1862 was the general secretary of the New York Young Men's Christian Association. He was devoted to his work, and with the progress of years came to be recognized as the leading Y. M. C. A. secretary in the world.

McCABE, ma-kāb', **Charles Cardwell,** American Methodist bishop: b. Athens, Ohio, 11 Oct. 1836; d. New York, 19 Dec. 1906. He was educated at Ohio Wesleyan University. In 1860 he entered the Methodist Episcopal ministry, and in 1862 was appointed chaplain of the 122d Ohio Infantry. At the battle of Winchester he was captured, and held in Libby prison for four months, and soon after his release entered the service of the United States Christian Commission and succeeded in raising a large amount of money for its work. Later he became financial agent for Wesleyan University; and in 1884 was made secretary of the Methodist Episcopal Missionary Society. He was remarkably successful in raising large amounts of money for missionary purposes. He became a bishop of his Church in 1896, and in December 1902 was elected chancellor of the American University at Washington, D. C.

McCABE, James Dabney, American author: b. Richmond, Va., 30 July 1842; d. Germantown, Pa., 27 Jan. 1883. He was the son of James Dabney McCabe (1808–75), a Protestant Episcopal clergyman and writer, and was educated at the Virginia Military Institute. He began to write very early. At the beginning of the Civil War he published a pamphlet entitled 'Fanaticism and its Results, by A. Southerner' (Richmond 1860) and throughout the war he employed his pen effectively in the cause of the Confederates. Three martial plays were performed in Richmond in 1862–63 and his war-story, 'The Aide-de-Camp,' was issued in 1863. In 1863 he published a Christmas compilation called 'The Bohemian' and in 1863–64 edited *The Magnolia Weekly.* His war-poems were very popular, particularly 'The Sword of Harry Lee.' He wrote several biographies, including 'Life of Gen. Thomas J. Jackson' (Richmond 1863); 'Memoir of Gen. Albert S. Johnston' (1866); and 'Life and Campaigns of Gen. Robert E. Lee' (New York 1867). His other works are 'Planting the Wilderness' (Boston 1869); 'History of the Late War between Germany and France' (1871); 'Lights and Shadows of New York Life' (New York 1872); 'History of the Grange Monument,' published under the name of Edward Winslow Martin (Chicago 1874); 'Paris by Sunlight and Gaslight' (Philadelphia 1875); 'Centennial History of the United

States' (Philadelphia 1875); 'Pathways of the Holy Land' (1877); 'History of the Turko-Russian War' (1879); 'Our Young Folks Abroad' (Philadelphia 1881), and 'Our Young Folks in Africa' (1882). Besides these he was the author of several hundreds of short stories, essays and translations, and made a compilation of the romance and humor of the war called 'The Grayjackets' (1867).

McCABE, Joseph, British rationalist: b. England, 1867. He was educated at Saint Francis's, Manchester, at Saint Anthony's, Forest Gate and at the University of Louvain. In 1883 he became a Franciscan, was ordained a priest in 1890 and in 1895 became rector of Buckingham College. In 1896 he left the Roman Catholic Church and became a lecturer and writer on rationalistic subjects. His books include 'Twelve Years in a Monastery' (London 1897); 'Modern Rationalism' (1897); 'Abelard' (1901); 'Saint Augustine and his Age' (1902); 'Talleyrand' (1906); 'The Martyrdom of Ferrer' (1909); 'The Decay of the Church of Rome' (1909); 'The Evolution of Mind' (1910); 'The Empresses of Rome' (1911); 'The Story of Evolution' (1912); 'Goethe' (1912); 'The Empresses of Constantinople' (1913); 'A Candid History of the Jesuits' (1913); 'The Sources of the Morality of the Gospels' (1914); George 'Bernard Shaw' (1914); 'The Soul of Europe' (1915); 'The Kaiser' (1915); 'Crises in the History of the Papacy' (1916); 'The Romance of the Romanoffs' (1917); 'The Popes and Their Church' (1918); 'A, B, C of Evolution' (1921); 'Ice Ages' (1922); 'A Century of Stupendous Progress' (1925); 'Lourdes' (1925); '40 Big Blue Books' (1927); 'The Story of the Catholic Church' (1929). Chesterton devotes a chapter to him in 'Heretics' (1909).

MACCABEES, a famous family which battled for liberty in the 2d century B.C., when the Jews were persecuted by the Syrians under Antiochus IV, Epiphanes. Originally applied to Judas, the third son of the aged priest Mattathias, who began the revolt, the name was widened to include the family of Judas and his followers, in due course to be applied to all wrestlers for freedom in the Greek period of Jewish history. The word's origin has received various fanciful explanations, but the most probable etymology is from the Aramaic *maqquaba* (Judges iv, 21 and elsewhere) meaning «Hammer.»

The story of the Maccabean struggle belongs to the history of heroism in all ages. When Antiochus of Syria (175–164 B.C.) strove to impose Hellenism in its crassest form upon the Jews under his sway and Jerusalem was overrun, while pagan rites were ordered to be substituted for Jewish, a sacrifice to Zeus being offered (168) on the Temple altar, an aged priest at Modin, Mattathias, spurned the mandate, killed the royal messenger, and destroyed the altar. Then escaping with his five sons to the mountains, he raised the standard of revolt. Two years later he died, and Judas, the third son, was acclaimed leader. His skill and genius, joined to a religious fervor that was the secret of his strength, cleared away every obstacle, as he defeated in rapid succession the three Syrian generals, Apollonius, Seron and Gorgias, and later the regent, Lysias. In 165 he reconsecrated the Temple amid the exultation of the people — the festival of Hannukkah, in memory of this restoration is still observed by the Jews of every land. In 162 Lysias granted religious freedom but Judas resolved to fight on until political liberty was also attained. A year later he defeated Nicanor at Adasa, but shortly afterward he fell at Elasa, while resisting Bacchides with greatly superior forces.

The command was now assumed by his brother Jonathan, who was astute enough to secure the favor of the Syrian ruler and was made high priest (153). For a time he fought for Antiochus VI, who owed his crown to Tryphon, and succeeded so well as to awaken Tryphon's jealousy. He fell into his power at Ptolemais and was finally put to death (143). Simon, the last surviving son of Mattathias, became leader of the Jewish people. By his ability and force of character, he outwitted Tryphon and secured the independence of Judæa. In 141 he was appointed by the people hereditary leader and high priest. With him began properly the Hasmonean dynasty — the name being traced to an ancestor of the house Asamonaios (Josephus, Antiq. xii, 6); according to Wellhausen (*Phar. und Sadd.* x, Note 94) he was the grandfather of Mattathias. The first year of his reign marked the beginning of a new era (Seleucid year 170 = 143–142 B.C.). The country enjoyed much prosperity, its resources were greatly developed and the outlook was distinctly more favorable than at any previous period since the Exile. With a change of rulers in Syria, Antiochus (VII) Sidetes becoming king, Simon and two of his sons were murdered by his son-in-law who wished to curry favor with the new monarch. But the third son, John Hyrcan, escaped and succeeded to the throne, reigning 30 years with much ability. Partisan strife, however, disturbed the kingdom's peace and weakened its strength, with the constant clashing of Pharisee and Sadducee.

On the death of John Hyrcan (105), his son Aristobulus reigned for a year when his brother Alexander Jannæus became ruler (104–78), a man of considerable energy, in his persistent conflicts to extend and defend his realm. His sympathies were with the Sadducees, and once when officiating as high priest, some of the Pharisees in their anger threw at him and the attending Sadducees citrons which had been supplied for the Feast of Tabernacles. As punishment, he attacked them with his troops, killing 6,000. On his death his widow, Salome Alexandra, ruled (78–69), reversing his policy and making the Pharisees her favorites, the land enjoying peace and prosperous growth. Her eldest son, Hyrcan II, who lacked capacity, was made high priest. The younger, Aristobulus, stronger and abler, coveted the succession and organized an army to conquer Jerusalem, when Alexandra died and Hyrcan was willing to retire in his brother's favor.

At this moment a new factor appeared in the person of Antipater of Idumæa who sought to further his own designs. An appeal to Rome was made. Pompey resolved to settle the matter in his own fashion, at some slight which Aristobulus offered, entered Jerusalem and made Hyrcan II high priest and ethnarch, while his brother was carried a captive to Rome. And now the Roman yoke became firmly fastened. Antipater was made procurator in 47, with his

sons Phasæl and Herod governors of Jerusalem and Galilee. In 41 they became tetrarchs of Judæa. In 40, Antigonus, the sole surviving son of Aristobulus, was appointed king by the Parthians, in the swift changes of the day. But Herod who had escaped from prison, while his brother had committed suicide, was given the throne by the Romans (37 B.C.). In the same year Antigonus was put to death by Mark Antony and the Maccabean-Hasmonean dynasty ended.

Bibliography.— Curtiss, 'The Name Maccabee' (Leipzig 1876); Henderson, F., 'The Age of the Maccabees' (1898); Morrison, 'The Jews under Roman Rule'; Streanes, 'The Age of the Maccabees'; Weiss, 'Judas Makkabeaus' (1897). Consult modern histories of the Jews, Graetz, Schürer, etc.

ABRAM S. ISAACS.

MACCABEES, Book of the, a name given to several Apocryphal books of the Old Testament. Of the four or five thus termed, two were declared canonical by the Council of Trent (1546), are contained in the Vulgate, and among the Apocrypha of the English Bible. The three other books may be summarized: Book III is found in the Septuagint but not in the Vulgate, Book IV is included in some manuscripts of the Septuagint and of Josephus. Book V is merely a Syriac reproduction of the sixth book of Josephus' 'Jewish War' and is of no historical value.

First Book was the record of 40 years from the accession of Antiochus (175 B.C.) to the death of Simon (135 B.C.), and is composed after the model of the Old Testament historical style, terse, simple, and at times poetic and impassioned. The narrative is written with due proportion and in sympathetic tone. All events are dated in terms of the Seleucid era. It is generally admitted that the original was in a Semitic language, most probably Hebrew, to which both Origen and Jerome bear testimony. However, it is not impossible that they were acquainted with an Aramaic version or paraphrase. The Greek translation of the Hebrew was made at an early date and has alone survived. It bears all the marks of a literal translation, preserving the Semitic and at times the Hebrew idiom. The author, to judge from the book itself, was a pious and patriotic Jew: a Palestinian, to infer from his evident familiarity with the Holy Land and his want of knowledge as to the foreign lands mentioned. An admirer of the Maccabees and their military skill, he shows the influences of his day by omitting the words «God» and «Lord» as in the book of Esther, substituting «He» and «Heaven.» Owing to his omission of the disloyal priests, Jason and Menalaus, in striking contrast to the attitude of the Second Book, Geiger claims a Sadducee as its author, a view held by later authorities, even if Geiger's views as to its being a partisan document are not upheld. Opinions differ as to its precise date — Schürer tracing it to the first or second decade of the 1st century B.C., while Torrey dates it early, in the reign of Simon, a little after 135 B.C. The book is one of the most vivid and valuable sources extant for Jewish history.

Second Book, has a peculiar opening — two letters written by Jews of Palestine to brethren in Egypt, held by some to be spurious. The work itself, an abridgment of five books written by Jason of Cyrene, covers Jewish history from a period a year earlier (176 B.C.) than its predecessor to the death of Nicanor (161 B.C.). It is of special interest as picturing the situations in Palestine before the revolt of Mattathias and furnishing other data that are lacking in the First Book. The author, probably a Hellenistic Jew, writes largely from the religious point of view, is a Pharisee, with a direct partisan tendency. Greek was the original language. Its exact or approximate date cannot be fixed. Among its characteristics are allusions to angels and spirits, to resurrection and immortality — that the book concludes with the victory of Judas over Nicanor, indicates its aim — to arouse the Jew to observe the two Maccabean feasts, that of Dedication and of Nicanor. The incident of the mother and her seven sons, and other stories of martyrdom have given the book a value and power of its own, which appealed with special force to the Christians of the first four centuries, as Bevan states in his 'House of Seleucus' (1902, II 175).

Third Book describes the escape of the Jews from martyrdom in Alexandria in the reign of Ptolemy IV, Philopator (222–204 B.C.). It has no relation to the Maccabees, but doubtless its title was given later when all who suffered for the olden faith were called by that name. It was written by an Alexandrian Jew to give courage and endurance to his brethren in Egypt. In view of the fact that early Jewish settlements in the Fajum have been discovered. Both I. Abrahams and A. Büchler claim the book has distinct reference to a persecution in the Fajum — a theory that is disputed.

Fourth Book has been aptly described by Freudenthal (Breslau 1869) as a homily delivered probably on the Feast of Dedication to a Greek-speaking Jewish community. It is sermon not history, to prove how the passions can be controlled by the reason, by which term he means reason enlightened by religion and the Mosaic Law. This thesis is illustrated by many examples, notably from the Maccabean struggle. A Hellenist to a certain extent, he was nevertheless an earnest, loyal Jew, eloquent and convincing. His precise date is unknown. He supplied the model for similar homilies by Christian writers in the early centuries, with their thrilling martyrdoms. In the Church the book was attributed to Josephus and added to his writings, with whose style and language it is wholly incompatible.

Without historical value is the so-called *Fifth Book* which Cotton gives in his 'Five Books of the Maccabees' (1832), and known also as the Arabic 'Book of Maccabees' which claims to be the history of the Jews from 186 B.C. to the end of Herod's reign, but which in reality is nothing but a compilation from First and Second Books of Maccabees and Josephus. The manuscript of a 'Fifth Book' which Sixtus Senensis (1566) states that he saw in Lyons and which was subsequently lost by fire, is characterized by Schürer as a «reproduction of Josephus, the style being changed for a purpose.»

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Oniaden' (Vienna 1899); Fairweather and Black, 'First Book of Macc. in Cambridge Bible Texts'; Grimm in 'Handbuch zu den Apokryphen'; Kacutzsch, 'Apokryphen'; Schürer, 'History of the Jewish People.'

ABRAM S. ISAACS.

MACCABEES, Knights of the Modern. See MACCABEES, THE.

MACCABEES, The Ladies of the, a fraternal beneficiary association, founded in 1886, formerly the Ladies of the Modern Maccabees. Until 1914 it formed a species of auxiliary organization to the Knights of the Maccabees and the latter exercised over it a kind of guardianship. It has about 50,000 members and since its institution has distributed about $7,000,000 in benefits and insurance.

MACCABEES, Ladies of the Modern. See LADIES OF THE MACCABEES.

MACCABEES, The, a fraternal beneficiary association having its general offices, at the present time, in the Maccabees Building, a 15-story structure on Woodward Avenue at the Art Center in the city of Detroit, Michigan. The former title of The Maccabees was the «Knights of the Maccabees of the World,» which was changed in 1914 to the simple title «The Maccabees.»

The society was organized in the city of London, Ontario, Canada, on 20 Aug. 1878, by W. D. McLaughlan and a few other interested men. The association grew rapidly, and its subordinate lodges sprang up all over the Canadian provinces and in the states of New York and Michigan. In 1914 it united with the Knights of the Modern Maccabees, which was the original organization. In 1926 the Ladies of the Modern Maccabees also united with the association, and in 1924 the society broadened its sphere of operation by the organization of a Ladies and Junior Department, so that it has now become a family protective institution.

The association derives its name from the ancient Maccabees, a chivalrous and religious people whose history is given in the writings of the Old Testament. The leading character in the history of the ancient Maccabees was Judas Maccabeus, considered one of the most valiant soldiers and one of the greatest military leaders of all time. During the wars in which the Maccabees were engaged and in which he was their leader, he required that a portion of the fruits of all their victories should be set aside for the benefit of the widows, the orphans, the disabled, and the dependents of those who had fallen in battle. It was this particular practice and characteristic that probably suggested to Mr. McLaughlan and his co-workers the name for the new society, for this practice characterizes The Maccabees of the present day.

The organization takes applicants from the day of birth up to their 60th anniversary, and it affords all kinds and character of legal reserve life insurance, hospitalization protection, old-age homes, visiting nurse service, and general relief service to its members under all the adversities of life. The main purpose of the association is to provide social and fraternal intercourse for its members, and benefits in the way of life insurance to the families of its deceased members.

The association has, during its entire history, paid in death benefits more than $230,000,000, and it has paid in old-age benefits and general relief benefits under its certificates in excess of $30,000,000. It has a large sick and accident department. The present assets of the association are in excess of $56,000,000, and it possesses a membership of 250,000. It works under the lodge system and ritualistic ceremonies, and its form of government is thoroughly democratic, every member having a voice in the conduct of its affairs, in the making of its laws, the election of its officers, and the fixing of their compensation through representatives chosen by the direct voice of the members. The general meeting of the law-making body (The Supreme Tent as it is called), is held once quadrennially. In the interim between the meetings of its governing body, its affairs are administered by a board of nine trustees, consisting of the Supreme Commander and eight others elected by the Supreme Tent.

One of the safeguards of the organization is its laws, providing that all investments must be made in municipal, state, provincial, and governmental bonds, or real estate including homes and only such real estate as has an earning capacity. The loans do not exceed 50 per cent of the appraised value of such property.

E. W. THOMPSON,
Supreme Commander.

MACCABEES, The Woman's Benefit Association of the, an adequate rate fraternal order for women with headquarters at Port Huron, Mich. Organized in 1892, as the Ladies of the Maccabees of the World, reorganized under its present name in 1915 and established in the United States and Canada, the order has 3,000 local bodies with 192,000 members and a reserve fund of $12,000,000; provides whole life, term and disability protection; 20-year plans; junior protection for children of members; sick, last illness and burial; and maternity benefits. It maintains a free hospital service in every state for needy sick.

McCALL, Edward Everett, American jurist: b. Albany, N. Y., 6 Jan. 1863; d. New York City, 12 March 1924. He was educated at the Albany High School and the New York University, was admitted to the bar in 1884 and practised in New York from 1884 till 1902. From that year until 1913 he was justice of the Supreme Court of New York (1st district) and Democratic candidate for mayor of New York in 1913, but was defeated by the late John Purroy Mitchel (q.v.).

McCALL, mą-kâl', **George Archibald,** American soldier: b. Philadelphia, 16 March 1802; d. 25 Feb. 1868. He was graduated at West Point in 1822; in 1836 reached the rank of captain, and that of colonel in 1850. Having served against the Seminoles in Florida, he won distinction in the Mexican War; in 1850 he became inspector-general, resigning from the army three years later. In 1861 he was given command of the Pennsylvania Reserves, with the rank of brigadier-general of volunteers, and participated in the work of the Army of the Potomac, particularly in the Peninsular campaign of 1862, in which he was engaged with his troops at Mechanicsville, Gaines' Mill and Frazier's Farm (qq.v.). At Frazier's Farm, 30 June, he was taken prisoner and was confined for several weeks in Libby prison. In August he was exchanged, but impaired health pre-

vented him from returning to the army, and in 1863 he resigned. He wrote *Letters From the Frontier* (1868).

McCALL, John Augustin, American insurance official: b. Albany, N.Y., 2 March 1849; d. Lakewood, N.J., 18 Feb. 1906. He was educated in his native city and served for several years as clerk in the Connecticut Mutual Life Insurance Company. In 1877 he entered the New York State insurance department in which he served as clerk, deputy superintendent and superintendent. In 1887 he was made comptroller of the Equitable Life Assurance Company and in 1892 became president of the New York Life Insurance Company. In 1905 the Armstrong insurance investigation led to his resignation in 1906 and he died two months after resigning.

McCALL, Samuel Walker, American public official: b. East Providence, Pa., 28 Feb. 1851; d. Winchester, Mass., 4 Nov. 1923. In 1874 he was graduated at Dartmouth College, studied law and was admitted to the bar in 1876 and practiced in Boston. He was editor-in-chief of the Boston *Daily Advertiser* in 1888–89 and served as delegate at the Republican National Conventions of 1888, 1900, and 1916. He was member of the Massachusetts House of Representatives in 1888, 1889, and 1892 and was a member of Congress from 1893 to 1913 from the 8th Massachusetts District. He was an unsuccessful candidate for the governorship of Massachusetts in 1914 but was successful the following year, being elected governor for 1916. He was re-elected for the two successive terms of 1917 and 1918. He published *Life of Thaddeus Stevens* (1899); *Dartmouth Centennial Address on Daniel Webster* (1902); *The Business of Congress* (1911); *Life of Thomas B. Reed* (1914); *The Liberty of Citizenship* (1915), and magazine articles.

MacCALLUM, William George, American pathologist: b. Dunnville, Ontario, 18 April 1874. He was graduated from the University of Toronto in 1894 and in 1897 was graduated from the medical school of Johns Hopkins University. In 1900–08 he was associate professor of pathology, and in 1908–09 professor of pathological physiology at Johns Hopkins University. In the latter year he became professor of pathology at Columbia University, where he remained until 1917 when he returned to Johns Hopkins University as professor of pathology and bacteriology. He was a fellow of the American Association for the Advancement of Science; a member of the Association of American Physicians; the National Academy of Sciences, and an honorary member of the Society Medicorum Sverana of Stockholm, Sweden. He wrote *Text-Book of Pathology* (1916), and was a frequent contributor to medical journals on pathological subjects. Died Baltimore, Md., 3 Feb. 1944.

MacCAMERON, mă-kăm'ĕr-ŏn, **Robert Lee,** American painter: b. Chicago, 1866; d. New York, 29 Dec. 1912. After studying in the public schools he began to make sketches for the newspapers in Chicago, and soon removed to New York, where he illustrated for newspapers and studied under William M. Chase. He then went to Paris and studied at the Beaux Arts under Gérôme and Collin. He became a successful portrait painter and for several years before his death kept studios in London, Paris, and New York. For his *Mi-Carême* he received honorable mention in the Paris Salon, and in 1912 he was made a chevalier of the Legion of Honor. He was a member of several foreign and American art societies. Among his best portraits are President Taft, President McKinley, Archbishop Ryan, Justices of the Supreme Court, Harlan and Brewer, Nellie Melba, and Auguste Rodin (Metropolitan Museum, New York). MacCameron also achieved reputation for his *cafés* and scenes in theaters. *A Group of Friends,* also called *Wormwood,* painted in 1908, is in the Corcoran Gallery, Washington; the *Daughter's Return,* painted in 1909, is in the Metropolitan Museum, New York. *Les Habitués* (*The Old Customers*) hangs in the Wilstach Gallery, Philadelphia. He also painted a religious picture, *The Last Supper,* in 1909. His last work was *The People of the Abyss* (1912). Consult *Harper's Weekly* (February 1913).

McCAMMON, Joseph Kay, American lawyer: b. Philadelphia, 13 Oct. 1845; d. 2 Jan. 1907. He graduated at Princeton in 1865; studied law; became register in bankruptcy in 1870; was special counsel of the United States in Washington, 1871; president of the board for investigation of the Indian service, 1877; assistant attorney general of the United States, 1880–85, and in 1881 was appointed United States commissioner of railroads. Under Presidents Garfield and Arthur he conducted treaties with various Indian tribes. Among his writings are a *Report on Indian Service* (1878); *Report of Councils with Bannock and Shoshone Indians* (1881); *Report of Councils with Flathead and Other Indians* (1882); *Arguments in Cases Affecting Pacific and Other Railroads.*

McCARREN, mă'kär'ĕn, **Patrick Henry,** American politician: b. East Cambridge, Mass., in 1849; d. Brooklyn, 22 Oct. 1909. In 1851 he removed to Williamsburg (Brooklyn, N.Y.) and was apprenticed to a cooper, but soon left trade and entered local politics. Before he was 21 he had been defeated for the leadership of his district. In 1881 he was elected to the New York Assembly and was re-elected in 1883 and 1887. In 1889 he was elected to the state Senate and was continuously a member of that body until his death. In 1893 he became virtually the leader of the Brooklyn Democrats. He broke with Charles F. Murphy, the leader of Tammany Hall, and from that time a bitter fight was kept up between these two politicians for the control of the Brooklyn Democrats. In 1904 one of the bitterest chapters in the history of New York politics occurred. McCarren also opposed W. J. Bryan and Charles E. Hughes. McCarren was a man of keen intellect and an aggressive fighter. He was identified with the Standard Oil Company and the American Sugar Company.

McCARTER, Margaret Hill, authoress; b. Charlottesville, Ind., 2 May 1860; d. 31 Aug. 1938. She taught in elementary schools in Indiana in 1876; graduated A.B. at the State Normal School, Terre Haute, Ind., in 1884; was principal of the High School, Rensselaer, Ind., 1884–87; held other educational positions to 1894, and was a lecturer of the State Board of

Education. She married, 5 June 1890, William Arthur McCarter, D.D.S., of Topeka, Kan. She became widely known by her fiction which is as popular in her State as that of William Allen White of Emporia. Her publications include 'The Overflowing Waters' (1903); 'The Cottonwood's Story' (1903); 'Cuddy's Baby' (1907); 'The Old Quirra' (1908); 'Cuddy and Other Stories' (1908); 'The Price of the Prairies' (1910); 'The Peace of the Solomon Valley' (1911); 'Vanguards of the Plains' (1917); 'The Reclaimers' (1918); 'Paying Mother' (1920); 'Widening Waters' (1924); 'The Candle in the Window' (1925).

McCARTHY, D'Alton, Canadian politician: b. near Dublin, Ireland, in 1836; d. Canada, 11 May 1898. He was the son of an Irish barrister who found a home for his family on the shores of Kempfendfeldt Bay, Ontario, after a six weeks' voyage in a sailing vessel. Educated at the Barrie Grammar School, he studied law and was called to the bar in 1858. In 1872 he was made queen's counsel, and attained high rank both in jury cases and appeal cases. In 1876 he was elected to the House of Commons as a Conservative and held this seat until his death, which was occasioned by a railway accident. He seceded from the Conservative party and aided the Liberals in opposing special legislation in the interest of Roman Catholic education. He was for a time president of the Canadian branch of the Imperial Federation League and a member of the Council of the British Empire League. Consult 'The Late D'Alton McCarthy, Q.C., M.P., an Appreciation,' by Amicus, *Canadian Magazine* (May 1903).

MacCARTHY, Hamilton Thomas, Canadian sculptor: b. London, England, 1847. He studied under his father and in Europe, and in 1885 removed to Canada. He lived in Toronto until 1898, when he took up his residence in Ottawa. He was distinguished for his capacity for expressing contemporary thought. The Royal Canadian Academy elected him a member in 1890 and councillor in 1906. Among his works are 'Burns and Highland Mary' (1877); the statue of Sir John H. Macdonald in Toronto; the bronze monuments for the South African War in Halifax, Ottawa, Charlottetown, Quebec and Brantford. D. 24 Oct. 1939.

McCARTHY, mą-kar'thi, Justin, Irish author and politician: b. Cork, Ireland, 22 Nov. 1830; d. 24 April 1912. He became connected with the Liverpool press in 1853 and in 1864 was made editor-in-chief of the Morning *Star*. He sat in Parliament as a Home Ruler from 1879–1900 and was chairman of the Irish Parliamentary party 1890–96. His stay in the United States extended from 1868 to 1870, during which period he was some time connected editorially with the New York *Independent*. His main work is 'History of our Own Times' (1879–80), which, rejected by one publishing house, made a fortune for the firm that produced it as well as for the author. He also wrote 'History of the Four Georges' (1889), and his novels include 'Lady Judith' (1871); 'A Fair Saxon' (1873); 'Dear Lady Disdain' (1875); 'The Right Honorable' (1886, with Mrs. Campbell-Praed); 'The Story of Gladstone's Life' (1898); 'Modern England' (1898); 'Reminiscences' (1899); 'The Reign of Queen Anne' (1902), and 'The Story of an Irishman' (1904).

McCARTHY, Justin Huntly, Irish journalist and author: b. 1860. He was graduated at University College and from 1884–92 was a member of Parliament. He was a prolific and versatile author, following in the footsteps of his father, Justin McCarthy (q.v.). Among his works are 'Outline of Irish History' (1883); 'Serapion, and Other Poems' (1883); 'England Under Gladstone' (1884); 'Camiola, a Girl with a Fortune' (1885); 'History of the French Revolution' (1897); 'Short History of the United States'; 'The Dryad' (1905). He also wrote plays, such as 'The Candidate'; 'The White Carnation'; 'If I Were King,' and 'Stand and Deliver.' D. 21 March 1936.

McCAUL, mą-kâl', John, Canadian scholar: b. Dublin, Ireland, 1807; d. 1880. He was appointed president of Toronto University in 1848 and was prominent for many years in educational matters in Canada. He edited Horace, Longinus, Lucian and Thucydides as college textbooks, and among his valuable archæological works are 'Britanno-Roman Inscriptions' (1863), and 'Christian Epitaphs of the First Six Centuries.'

MacCAULEY, mą kâl'ĭ, Clay, American Unitarian clergyman and author: b. Chambersburg, Pa., 8 May 1843. He was graduated at Princeton in 1864 and at the Theological Seminary of the Northwest, Chicago, in 1867, and read philosophy and divinity at Heidelberg, 1873. In the Civil War, 1862–63, he was a lieutenant in the 126th Pennsylvania regiment, and served on the staff of Gen. S. D. Sturgis, and in 1864–65 was a member of the Christian Commission in the United States army. In 1880–81 he was a collaborator of the Bureau of Ethnology among Indians east of the Mississippi. Entering the Unitarian ministry he was pastor of the First Church, Waltham, Mass., 1869–72, and of All Souls Church, Washington, D. C., 1876–81. From 1890 to 1900 and again after 1909 he served as director of the Japan mission of the Unitarian Association, and from 1891 to 1899 was president of the College for Advanced Learning at Tokio and professor there of philosophic and historic theology. He lectured on Japan in 1904–09. He wrote 'Christianity in History' (1891); 'The Religious Problem of Japan—How to Solve It' (1894); 'Introductory Course in Japanese' (1896; 1905); 'Japanese Literature' (1899); 'A Day in the Very Noble City, Manila' (1899); and published 'Single Songs of a Hundred Poets' (1899) and other translations from the Japanese; 'Florida Seminoles' (1884); 'Present Religious Condition of Japan' (1902); 'Unitarian Mission to Japan' (1909); 'A Daughter of the Samurai' (1910); 'Thought and Fact for To-day,' also in Japanese (1911); 'The Memorial Most Worthy of Our Patriot Dead' (1911); 'The English Language in the New Georgean Era' (1911); 'Charles Dickens: An Appreciation' (1912); 'The Faith of the Incarnation' (1913); 'Memories and Memorials' (1914); 'The American-Japanese Problem as a Race Question' (1915), and contributions to periodicals in Japan and the United States. He died 15 Nov. 1925.

McCAUSLAND'S RAID, an incursion of the Confederate general McCausland into Maryland and Pennsylvania, the chief incident of which was the burning of Chambersburg, Pa. General Early having defeated General Crook in the battle of Kernstown (q.v.), 24 July 1864, and driven him and Averell across the Potomac at Williamsport, ordered General McCausland with his brigade and that of Bradley T. Johnson, with four guns, in all about 2,500 men, across the Potomac to raid Pennsylvania and then move to Cumberland, Md., to destroy the machinery of the Cumberland coal-pits and the repair shops, stations and bridges of the Baltimore and Ohio Railroad. Early says he wished to open the eyes of the people of the North to the enormities of its armies, by an example in the way of retaliation, and that Chambersburg, Pa., was selected as the town on which retaliation should be made. The sum of $100,000 in gold, or $500,000 in currency was to be demanded of it, in default of which McCausland was ordered to burn the town. Under cover of demonstrations at Williamsport and other points along the Potomac, McCausland crossed the river at McCoy's Ferry, near Clear Spring, above Williamsport, on the 29th, and made straight for Chambersburg, about 25 miles northeast. He met with but little opposition and, on the morning of the 30th, rode into the fated town and demanded the sum fixed by Early. It could not immediately be raised; he knew that General Averell was close upon him, and setting fire to the place, laying a greater part of it in ashes, he hastily marched westward to McConnellsburg and encamped. Averell, who was in Hagerstown when he heard that McCausland had crossed the Potomac, started in pursuit with about 2,600 cavalry, went through the burning town and, a few miles from McConnellsburg, struck McCausland's rear, diverting him from his intended march on Bedford and forcing him back to the Potomac at Hancock, which was reached by noon of the 31st. Here McCausland formed for battle, but upon Averell's appearance and prompt attack he withdrew westward by the National road to Cumberland, where, 1 August, he found General Kelley to oppose him, whom he attacked in the afternoon, and skirmished until night, when he retreated toward Old Town, on the Potomac, leaving 30 of his killed and wounded on the field. At Old Town he forced a crossing at daylight 2 August, capturing or dispersing a regiment of new troops from Ohio, and then moved south into the valley of the south branch of the Potomac, by way of Springfield and Romney. From Romney, 4 August, he moved on New Creek and attacked the garrison, but after a stubborn fight was repulsed, leaving 25 dead on the field, the Union loss being 36 killed and wounded. McCausland then withdrew to near Moorefield, where the south fork joins the south branch of the Potomac, and considering himself safe from pursuit went into camp. Averell, who had remained at Hancock when McCausland drew off toward Cumberland, crossed the Potomac on the 4th, and, after a forced march through Bath, Springfield and Romney, before sunrise of the 7th surprised McCausland in his camp and routed him, capturing his four guns, nearly all his wagons, several hundred horses, three battle-flags, many small arms and 420 prisoners, including 38 officers. McCausland's loss in killed and wounded was about 100. Averell's loss was 41 killed and wounded. McCausland's shattered command fled to the mountains and made its way in squads to the Shenandoah Valley, finally assembling at Mount Jackson. "This affair," says Early, "had a very damaging effect upon my cavalry for the rest of the campaign." Consult 'Official Records' (Vols. XXXVII, XLIII); Pond, 'The Shenandoah Valley in 1864'; Early, 'The Last Year of the War for Independence.'

MacCHESNEY, mąk-chĕ'nē, **Clara T.,** American artist: b. Brownsville, Cal., 1861; d. 6 Aug. 1928. She studied at the San Francisco Art School, at the Gotham Art School, New York, and at the Colarossi School in Paris. Her genre work received favorable recognition. At the World's Columbian Exposition in 1893 she was awarded two medals and she received the Dodge Prize, New York, in 1894. Later she also received three medals from the Colarossi School, a gold medal from the Philadelphia Art Club and the second Hallgarten prize from the National Academy of Design, New York. At the Paris Exposition of 1900 she exhibited 'Pomegranates' and 'The Old Blind Fiddler.'

MacCHESNEY, Nathan William, American lawyer, publicist and writer: b. Chicago, Ill., 2 June 1878. He studied at Chicago University, and graduated from the Law School of the University of Michigan in 1902. He practiced in Chicago, and was a member of many important legal, civic and political boards and organizations. From 1911–17 he served as Judge Advocate General of Illinois, and during the World War was employed in many important legal capacities. From 1924 he was consul-general for Siam. His writings include: 'The Military Policy of the United States'; 'Principles of Military Law'; 'Principles of Real Estate Law'; 'Challenge to American Ideals.'

MACCHIAVELLI, Niccolo. See MACHIAVELLI, NICCOLO.

McCHORD, mă-kôrd, **Charles Caldwell,** American lawyer: b. Springfield, Ky., 3 Dec. 1859. He was educated at Centre College (now Central University), Danville, Ky., and was admitted to the bar in 1882, engaging in practice at Louisville, Ky. He was a member of the law firm, McChord, Hines and Norman, until 1911. He was prosecuting attorney of Washington County, Ky., in 1886–92, and was chairman of the Kentucky Railroad Commission in 1892–95 and in 1899–1907. He served in the Kentucky senate in 1895–99 and introduced the railroad rate bill enacted by the legislature. He was president of the National Association of Railroad Commissioners in 1906–07, and in 1910–26 was a member of the Interstate Commerce Commission, resigning in 1926 to resume his law practice.

McCLAIN, mą-klān, **Emlin,** American jurist: b. Salem, Ohio, 26 Nov. 1861; d. 25 May 1915. He was graduated at the State University of Iowa in 1871, later studying law there, and until 1881 he practised law in Des Moines. He was appointed professor of law at the University of Iowa in 1881 and was subsequently vice-chancellor and chancellor there. He served as judge of the Supreme Court of Iowa in 1901–12. and was its chief justice in 1906–12.

From 1913 until his death he was professor of law at the Leland Stanford, Jr., University. He was a contributor to the 'American Encyclopedia of Law and Procedure,' wrote extensively for the law magazines and was author of 'McClain's Annotated Statutes of Iowa' (1880); 'A Treatise on Criminal Law as Now Administered in the United States' (1897); 'Constitutional Law in the United States' (1905; 2d ed., 1910), etc.

McCLELLAN, mą-klĕl'ąn, **George Brinton,** American soldier: b. Philadelphia, 3 Dec. 1826; d. Orange, N. J., 29 Oct. 1885. He was educated at the University of Pennsylvania and at West Point where he was graduated in 1846. He was brevetted second lieutenant of engineers and immediately ordered to Mexico, where as lieutenant of a company of sappers, miners and pontoniers he rendered valuable service. He was at the siege of Vera Cruz, at Cerro Gordo and in the attack on the City of Mexico; at Contreras and Churubusco he won the brevet of first lieutenant and was brevetted captain for gallantry at Chapultepec. After the war he was ordered to West Point as captain of field labors and instructor in bayonet exercise. In 1851 he was ordered to Fort Delaware to superintend its construction. The next year he accompanied Capt. Randolph B. Marcy (later his father-in-law) on an expedition to explore the Red River, and in September 1852 was ordered as senior engineer to Texas, to survey the rivers and harbors of that State. In 1853 he was detailed for the examination of the western part of the proposed route for a Pacific railroad; and explored the Yakima Pass and various portions of the Cascade Range, and the most direct route to Puget Sound, his report forming the first volume of the 'Pacific Railroad Surveys' published by the government. He was soon afterward detailed to investigate the railroad system of the United States, with a view to obtain all the necessary data on construction, equipment and management for the successful operation of the Pacific railroad. Of the result of his proceedings he presented a full report in November 1854. In March 1854 he was promoted to captain in the 1st Cavalry. In the spring of 1855 he was sent to Europe to study the organization of European armies and observe the war in the Crimea. He wrote one volume of the report of the commission, which was republished in Philadelphia under the title of 'The Armies of Europe' (1861). He resigned his commission in January 1857, and was for three years vice-president and engineer of the Illinois Central Railroad, at the end of which time he became general superintendent of the Ohio and Mississippi Railroad, and two months later president of the eastern division of the same road. He held this office when the Civil War broke out in 1861. He then received a commission as major-general from the governor of Ohio and proceeded to organize the volunteers of the State; the States of Ohio, Illinois, Indiana, the western part of Pennsylvania and western part of Virginia were united to form the Department of the Ohio under his command. About 1 June his army began to cross the Ohio River into Virginia; on the 18th McClellan himself left Cincinnati to take the field, and by the middle of July the whole northwestern part of the State had been cleared of Confederate troops and the Wheeling legislature left free to organize a loyal government.

On 22 July, McClellan was summoned to Washington to take command of the Army of the Potomac, and commissioned as major-general of the United States army. On his arrival at Washington he found everything in disorder and the troops badly demoralized in consequence of the defeat at the first battle of Bull Run, and devoting himself to the organizing and disciplining of his army, he soon brought order out of chaos and had his troops well equipped and in excellent condition. On the retirement of General Scott from active service, McClellan was appointed general-in-chief of the armies of the United States. Plans were then taken under discussion for an attack upon Richmond, and here difference of opinion arose between the President and the Secretary of War and McClellan; the plan finally accepted made the base of supplies on Chesapeake Bay, with line of march upon Richmond from the Peninsula. The army did not move until March 1862, and in the meantime discontent had arisen at Washington on account of the delay. On 10 March the army advanced toward Manassas, but as the Confederates had evacuated that place and had fallen back upon Richmond, the real campaign was begun by transporting the troops to Fortress Monroe. On 11 March, some two weeks before leaving Washington, McClellan was deprived of the chief command, leaving him the command of only the Army of the Potomac; McDowell's corps and other reinforcements on which he had relied were also removed from his army for the defense of Washington. He besieged Yorktown for a month, though opposed by a much inferior Confederate force, whose numbers he greatly overestimated; when Yorktown was evacuated 4 May, he advanced toward Richmond, defeating the Confederates at Williamsburg and Hanover Court House. After reaching the Chickahominy, he found his lines too extended to protect from attack and advance upon Richmond, and decided to retreat to the James River; then followed the Seven Days' Battles which ended when the Federal forces reached Hampton's Ferry. From here McClellan had planned a new advance, but dissatisfaction against him was so strong that he was relieved of his command and ordered to evacuate the Peninsula. (See PENINSULAR CAMPAIGN). He was then put in command of the fortifications of Washington, till after the second battle of Bull Run, when he succeeded General Pope, again taking command of the Army of the Potomac. On Lee's invasion of Maryland, McClellan marched to attack him and fought the battle of Antietam (q.v.), forcing the Confederates to retreat from their position and following them as far as the Potomac. He did not, however, cross the Potomac in pursuit, as he was awaiting supplies; this failure to follow up his victory caused him to be deprived of his command and he was ordered to Trenton, N. J. He took no further part in the war.

In 1864 he was Democratic nominee for President of the United States, and was defeated, the electoral vote stood 212 for Lincoln against 21 for McClellan, but McClellan's popular vote was 1,800,000. He remained abroad from 1864–68, and on his return had charge of the construction of the Stevens' floating battery,

which, however was not completed on account of financial difficulties. In 1870 he was appointed chief engineer of the department of docks for New York City, in 1877 he was elected governor of New Jersey, and during his administration reduced and finally abolished the state tax, improved the system of public education and built up an effective militia; he declined a renomination. As a general, McClellan won the confidence and aroused the enthusiasm of his soldiers to an unusual degree; he excelled as an organizer of armies and had a thorough knowledge of the science of tactics, as shown in his plans of campaign, but in actual campaigning lacked aggressiveness and the power to act quickly and take advantage of his enemy's mistakes. He wrote besides the reports mentioned 'Manual of Bayonet Exercise' (1852) and 'Report on the Organization and Campaigns of the Army of the Potomac' (1864). Consult 'McClellan's Own Story,' edited by W. C. Preine (New York 1887); Michie, P. S., 'General McClellan' (in 'Great Commander' series ib. 1901); Rhodes, J. F., 'The First Six Weeks of McClellan's Peninsular Campaign' (Boston 1896); Ropes, J. C., 'Story of the Civil War' (Vol. II, New York 1895); Webb, A. S., 'Peninsula: McClellan's Campaign of 1862' (ib. 1881), and Bradford, Gamaliel, 'Union Portraits' (in *Atlantic Monthly* Vol. CXIV, Boston 1914).

McCLELLAN, George Brinton, American publicist and public official: b. Dresden, Germany (where his parents were on a visit), 23 Nov. 1865; d. Washington, D. C., 30 Nov. 1940. He was the son of Gen. George B. McClellan (q.v.), and was graduated from Princeton, A.B. in 1886; A.M. in 1889. Taking up journalism, he was a reporter on the staffs of several New York City dailies, and from 1889–92 was treasurer of the Brooklyn Bridge, then a toll structure. In the meantime, he studied law and was admitted to the bar in 1892. In 1893 Richard Croker, then boss of Tammany Hall, picked the youthful «silk-stocking» as window dressing for his municipal ticket and made him president of the New York City Board of Aldermen. In 1894 he was elected to Congress and served as a member thereof continuously until 1903, when Charles F. Murphy, then the Tammany boss, capitalized the McClellan brains and respectability to defeat Seth Low for a second term as mayor of Greater New York. Two years later Murphy again lined up his forces behind Mr. McClellan as the only means of keeping William Randolph Hearst out of the City Hall. But there was trouble brewing. Mr. McClellan had fought vice and gambling, and otherwise had given offense to Murphy and his following. In January 1906 he committed political suicide by asserting: «As a Democrat and as mayor of this town, I am unalterably opposed to Charles F. Murphy and everything he stands for.» He retired from politics in 1909 at the end of his second term, but he left behind a record for efficiency and honesty that forms one of the few bright pages in New York officialdom of that era. As mayor he initiated many outstanding municipal projects including the Catskill water supply, the Queensboro and Manhattan bridges, and the Municipal Building. Mr. McClellan was made honorary chancellor of Union University in 1906, and was Stafford Little lecturer on public affairs at Princeton, 1908–10: university lecturer on public affairs, 1911–12; professor of economic history at Princeton 1912–31; emeritus thereafter. During the World War he served overseas as lieutenant colonel. He was a member of numerous societies and published 'The Oligarchy of Venice' (1904); 'The Heel of War' (1915); 'Venice and Bonaparte' (1931); 'Modern Italy' (1933); also numerous magazine articles. He received the honorary degree of LL.D. from Princeton and Fordham universities in 1905 and from Union University in 1906. In 1889 he married Miss Georgianna L. Heckscher, daughter of John G. Heckscher and niece of August Heckscher. Mr. McClellan traveled extensively, and after leaving Princeton lived in Washington. His collection of Meissen porcelain is famous.

McCLERNAND, John Alexander, American lawyer: b. Breckinridge County, Ky., 30 May 1812; d. Springfield, Ill., 20 Sept. 1900. He was admitted to the Kentucky bar in 1832, but in the same year volunteered for military service against the Sac and Fox Indians. Five years later he was elected to the Illinois legislature, and subsequently sat for two terms in Congress. During the Civil War he served with distinction at the battle of Fort Donelson, was brigadier general of volunteers, and was promoted major general. He led a division at the battle of Shiloh, relieved Sherman before Vicksburg in 1863 and was in command of the 13th Army Corps until 1864, when he resigned. In 1870 he was appointed circuit judge for the Sangamon, Ill., district. He presided at the National Democratic Convention in Saint Louis, 1876, and was appointed by President Cleveland member of the Utah Commission.

MACCLESFIELD, măk'k'lz-fēld, England, market town and municipal borough in Cheshire, 166 miles northwest of London, on the river Bollin and on the London, Midland and Scottish and the London North Eastern railways. In the Domesday Survey it is recorded as part of the estate of the Earl of Chester and is reputed to have become a free borough in the beginning of the 13th century. The first recorded charter, however, dates from 1261. The church of Saint Michael was founded in 1278 and was partially rebuilt and considerably enlarged in 1740. A commercial school was erected in 1840 from the funds of the free grammar school founded in 1502. There are slate and stone quarries in the vicinity and brewing is carried on; but the chief manufactures of the town are in silk and cotton textiles. The first silk mill was set up in 1755, while the manufacture of cotton was begun in 1785. The town has modern water and gas works, an insane asylum, public library, parks, baths and markets. Pop. about 34,797.

McCLINTOCK, Emory, American actuary: b. Carlisle, Pa., 19 Sept. 1840; d. 10 July 1916. He was graduated from Columbia University in 1859, and afterward took special studies in chemistry. He was tutor in mathematics at Columbia 1859–60. He was consular agent at Bradford, England, 1863–66, actuary of the Asbury Life Insurance Company, New York, 1867–77, and of the Northwestern Mutual Life Insurance Company, Milwaukee, 1871–89. From 1889 to 1911 he was actuary of the Mutual Life Insurance Company, New York, of which he was vice-president in 1905–

1911, trustee after 1905 and consulting actuary after 1911.

McCLINTOCK, mâ-klĭn'tŭk, Sir **Francis Leopold,** English admiral: b. Dundalk, Ireland, 1819; d. Nov. 17, 1907. He entered the British Navy in 1831 and was commissioned lieutenant in 1845. He sailed on four Arctic voyages, being sent out in 1848 to search for Sir John Franklin, and again in 1850 and 1852, without discovering any traces of the explorer. In 1857 he renewed the search as commander of the *Fox* and brought back documentary and other evidence of Franklin's death. For his services as an Arctic explorer he was knighted in 1860, made a vice admiral (1877), and admiral (1884). He wrote *Voyage of the Fox* (1859).

M'CLINTOCK, John, American Methodist Episcopal clergyman and educator: b. Philadelphia, Pa., Oct. 27, 1814; d. Madison, N. Y., March 4, 1870. He was graduated at the University of Pennsylvania in 1835. He entered the ministry of the Methodist Episcopal Church and from 1836 to 1851 was professor of mathematics and classical languages at Dickinson College, Carlisle, Pa. From 1848 to 1856 he edited the *Methodist Quarterly Review.* He was delegate to several conferences abroad and in 1857 became pastor of St. Paul's Church, New York. Three years later he was appointed preacher of the American Chapel in Paris. He advocated the Union cause in the Civil War, and after his return to America in 1864 was again pastor of St. Paul's, New York, but failing health compelled his resignation and he retired. In 1866 he became chairman of the Central Centenary Committee of the Methodist Episcopal Church. For the last three years of his life he was president of the Drew Theological Seminary. He was joint editor and compiler with James Strong of the *Cyclopaedia of Biblical, Theological and Ecclesiastical Literature.* Among his other works are *The Temporal Power of the Pope* (1855); a translation of J. A. W. Neander's *Life of Jesus Christ* (1848); *Sketches of Eminent Methodist Ministers* (1854); a translation of L. F. Bungener's *History of the Council of Trent* (1855); *Living Words,* sermons (1871) and *Lectures . . . on Theological Encyclopaedia and Methodology* (1873).

McCLOSKEY, mâ-klŏs'kĭ, **John,** American Roman Catholic prelate: b. Brooklyn, N. Y., March 10, 1810; d. New York, Oct. 10, 1885. His secondary and collegiate studies were made at Mount St. Mary's College, Emmitsburg, Md., and his postgraduate studies in France and Rome. At 24 he was ordained priest and on returning to America was assigned to St. Joseph's Church, New York City. When St. John's College, at Fordham, was opened in 1841, he was made its first president, but in the next year he returned to parish work. In 1844 he was appointed coadjutor to Bishop John Hughes of the diocese of New York, and consecrated titular bishop of Axiern; and three years later was appointed bishop of Albany, a diocese just created from a part of the diocese of New York. For 17 years he worked for the upbuilding of the Albany diocese and the good of his people. He built the Cathedral of the Immaculate Conception at Albany, St. Joseph's Theological Seminary at Troy, established several new parishes and founded educational and charitable institutions, including hospitals, orphanages, homes for the aged and reformatories. He succeeded Archbishop Hughes in the archiepiscopal see of New York, May 6, 1864. He was made a cardinal in 1875, under the title of Santa Maria supra Minervam. He was in attendance at the Vatican Council (q.v.) and a member of the committee on discipline. He was summoned to Rome in February 1878 to attend the conclave for the election of a pope but was too late to cast a vote, Leo XIII having been elected a few hours before his arrival. Cardinal McCloskey was noted for his gentleness, firmness, profound scholarship and great executive ability.

McCLOY, John Jay, United States government official: b. Philadelphia, Pa., March 31, 1895. After attending Amherst College (A.B. 1916), he went on to Harvard Law School to receive his bachelor of laws degree in 1912 and to be admitted to the New York bar in the same year. He had temporarily interrupted his studies to serve overseas during World War I in the 77th and 160th Field Artillery units and with occupation forces in Germany. From 1921 until the end of 1924 he was associated with the New York City law firm of Cadwalader, Wickersham and Taft, and from 1925 to 1940, with the firm of Cravath, de Gersdorff, Swain and Wood.

In October 1940 he entered the government service under appointment by Secretary of War Henry Stimson as the latter's special consultant. The following April, McCloy was appointed assistant secretary of war, serving until November 1945, in which capacity he attended the San Francisco Conference on International Organization and helped formulate plans for the war crimes trials. Later, in Washington, he assisted in framing policies for the administration of liberated and occupied enemy territories. On Feb. 28, 1947, after a brief return to private law practice, he assumed the presidency of the International Bank for Reconstruction and Development. Subsequently he enunciated as world bank policy the necessity of taking "calculated risks" if the bank were to perform effectively. In mid-1949 McCloy was sent to western Germany as the first civilian United States high commissioner, as chief Economic Cooperation Administration representative, and as the American member of the three-power council exercising Allied authority. In early 1951 he was strongly urging the western German government to accept the Schuman plan for the pooling of western European coal and steel resources.

McCLUNG, mâ-klŭng', **Clarence Erwin,** American zoologist: b. Clayton, Calif., April 5, 1870; d. Swarthmore, Pa., Jan. 17, 1946. He was graduated at the University of Kansas in 1892, later studying at Columbia University and the University of Chicago. A member of the faculty of the School of Medicine at the University of Kansas in 1897–1913, he then became professor of zoology and director of the zoological laboratory at the University of Pennsylvania. He was internationally known for his extensive studies on chromosomes and headed scientific expeditions to Oregon, Washington, and western Kansas. He wrote articles on the Cretaceous fish of Kansas, and was managing editor of the *Journal of Morphology.*

McCLURE, mą'kloor', **Alexander Kelly,** American journalist: b. Sherman's Valley, Perry County, Pa., 9 Jan. 1828; d. 1909. He was reared on a farm, educated at home and apprenticed to a tanner in 1842, soon after began to write for the Perry *Freeman* and edited and published the *Juniata Sentinel* at Mifflin, Pa., in the Whig interest, 1846–50. He then published (1850–56) the Chambersburg *Repository,* which he made influential in the cause of anti-slavery. He was State superintendent of printing in 1855; a member of the State convention of 1855 which met at Pittsburgh to organize the Republican party; in 1856 was admitted to the bar and was a delegate to the first Republican National Convention in Philadelphia. In 1857–58 he sat in the legislature as a Republican and was State senator in 1859. As leader of the Pennsylvania delegation in the Republican National Convention of 1860 he aided in the nomination of Abraham Lincoln. In 1862–64 he again published the Chambersburg *Repository,* and in the latter year served as assistant adjutant-general in charge of the draft in Pennsylvania. Two years later he was again a member of the legislature, and in 1868–73 practised law in Philadelphia. He was chairman of the State delegation to the Liberal Republican Convention in 1872, and of the Liberal Republican State Committee, and in that year entered the State senate. In a close election in 1873 he was defeated as an independent candidate for mayor of Philadelphia. In 1875 he established the Philadelphia *Times,* of which he was editor-in-chief till 1901. He published 'Three Thousand Miles Through the Rocky Mountains'; 'Our Presidents and How We Make Them' (1901); 'Recollections of Half a Century' (1902); 'Old Time Notes of Pennsylvania' (2 vols., 1906), etc.

McCLURE, James Gore King, American Presbyterian clergyman: b. Albany, N. Y., 24 Nov. 1848. He was graduated at Yale in 1870, at the Princeton Theological Seminary in 1873 and ordained as a Presbyterian minister in 1874. He was settled (1874–79) at New Scotland, N. Y., and at Lake Forest, Ill., 1881–1905. From 1897 to 1901 he was president of Lake Forest University. In 1905–28 he was president of McCormick (now Presbyterian) Theological Seminary, Chicago. He has written 'The Man Who Wanted to Help' (1897); 'The Great Appeal' (1898); 'Environment' (1899); 'For Hearts that Hope' (1900); 'A Mighty Means of Usefulness' (1901); 'Living for the Best' (1903); 'The Growing Pastor' (1904); 'Loyalty, the Soul of Religion' (1905); 'Supreme Things' (1907), etc.

McCLURE, Sir Robert John Le Mesurier, English vice-admiral: b. Wexford, Ireland, 28 Jan. 1807; d. London, 17 Oct. 1873. He began his naval career in 1824, and in 1836 under Sir John Ross made his first voyage to the Arctic regions. Again he joined an expedition sent to discover the Northwest Passage in 1848, that of Sir James Clark Ross. Two years later he was placed in command of a Franklin search expedition, discovered Prince of Wales Strait which connects the Atlantic and Pacific and thus accomplished one object of the expedition, the discovery of the Northwest Passage. He was forced, however, to abandon his ship, and completed the Northwest Passage by land. On his return he was knighted. From his journals was published 'The Discovery of the Northwest Passage' (by Capt. Sherard Osborne, 1856).

McCLURE, Samuel Sidney, American editor and publisher: b. Frocess, County Antrim, Ireland, 17 Feb. 1857. He was graduated at Knox College, Galesburg, Ill., in 1882. In 1882–83 he was editor and manager of the *Wheelman* for the Pope Manufacturing Company, and in the following year was connected with the De Vinne Press, New York. In 1884 he established a newspaper syndicate which has grown to great proportions and assumed distinctive importance in the publishing world. In 1893 he founded *McClure's Magazine,* which through his able administration soon stood in the front rank of American periodicals. In 1899 he established the publishing house of McClure, Phillips and Company, New York, and was its president until the business was acquired by Doubleday, Page and Company. The magazine was taken over by the McClure Publications, Incorporated. Since 1893 Mr. McClure has been president of the S. S. McClure Company and since 1894 he has been a trustee of Knox College. Consult Mr. McClure's very interesting 'My Autobiography' (New York 1914).

McCLURG, mą-kloorg', **Alexander Caldwell,** American publisher: b. Philadelphia, 1834; d. Saint Augustine, Fla., 15 April 1901. He was graduated at Miami University, Oxford, Ohio, in 1853, engaged in business with S. C. Griggs and Company, publishers, in Chicago and in 1862 entered the Union army. He was captain in the 88th Illinois regiment of infantry, rose to the rank of colonel, was made brevet brigadier-general, and in the Atlanta campaign and during Sherman's great march served as chief of staff to the 14th corps. Returning from the war, he was admitted to partnership in the publishing house above mentioned, and some years later established the firm of Jansen, McClurg and Company, afterward A. C. McClurg and Company. The business of the house prospered, and in 1899 the company was reorganized, the co-operative principle adopted and the employees, among whom the stock was largely distributed, were granted easy terms for increasing their investments.

McCLYMONT, măk-klī'mŏnt, **James Alexander,** Scottish theologian: b. Girvan, Ayrshire, 26 May 1848. He was educated at the universities of Edinburgh and Tübingen, entered the ministry and in 1874–1913 he was in charge of Holburn Church, Aberdeen, when he retired. He was a member of the general committee of the Church of Scotland, and was a chaplain in the territorial force, retired with the rank of colonel. He collaborated in translating Beck's 'Pastoral Theology of the New Testament' and was author of 'The New Testament and its Writers' (1892; 2d ed., 1893); 'The Church of Scotland' (1893); 'New Testament Criticism' (1913), etc. He died 19 Sept. 1927.

MacCOLL, mą-kŏl', **Evan,** Canadian poet: b. Kenmore, Argyleshire, Scotland, 21 Sept. 1808; d. Toronto, 1898. He emigrated to Canada in his 42d year and became known as the poet of the Scottish colony at Kingston. He wrote with fluency in Gaelic and his 'Clàreach nam Beann' created much enthusiasm among

his compatriots. He is also author of many English poems, such as *My Rowan Tree; The Mountain Minstrel* (1887).

McCOLLUM, mă-kŏl′ŭm, **Elmer Verner,** American physiological chemist: b. near Fort Scott, Kansas, March 3, 1879. Graduating from the University of Kansas and Yale University, he taught at the University of Wisconsin from 1907 to 1917, afterwards accepting a professorship in biochemistry at the School of Hygiene and Public Health, Johns Hopkins University, a position he held until 1944 when he was made professor emeritus.

McCollum has specialized in the study of vitamins and the relation of diet to growth. Among his important discoveries were the "fat-soluble" vitamin A in 1913, later, vitamin B in milk sugar, and in 1922 the importance of vitamin D in the treatment of rickets. He was a member of the International Committee on Vitamin Standards, League of Nations, 1931; after 1939 the chairman of the Nutrition section, Pan-American Sanitary Bureau; and after 1942 a member of the Food and Nutrition Board, National Research Council. In 1943 the United States Army called him as a consultant to its Industrial Hygiene Division. McCollum has written extensively in the fields of chemistry and nutrition.

McCOMB, mă-kōm′, **John,** American engineer and architect: b. New York, Oct. 17, 1763; d. there, May 25, 1853. He became prominent for his designs for both public and private buildings in New York, Philadelphia and the Eastern States. He designed the front of the old government house in New York in 1790, Saint John's Church, and was supervising architect of the city of New York at the time of the erection of the city hall. The Montauk (1795), Eaton's Neck (1798), and Cape Henry (1791) lighthouses were also his designs.

McCOMB, city, Mississippi, in Pike County, 60 miles east-southeast of Natchez on U.S. Highway 51 and the Illinois Central Railroad. Located in a timber and agricultural region producing cotton, vegetables, and dairy products, McComb is a trading and shipping center, with lumber mills and railroad shops. Manufactures include cotton textiles, clothing, and cottonseed products. It was founded about 1857 by Col. H. S. McComb, the president of the New Orleans, Jackson, and Northern Railroad, which was built in that year. After the establishment of railroad shops here, McComb grew rapidly and soon became important for its textile industries. The city has a mayor-council form of government. Pop. (1950) 10,401.

MacCONMIDHE, mă-kŏn′mĭ-dē, **Giolla-Brighde** or **Gillabrighde,** Irish historian and poet: b. about 1180; d. around 1260. He was descended from the hereditary poets of the O'Neills, and it is recorded that Brian O'Neill, chief of the Cinel Eoghain, on one occasion paid him 20 horned cows for a poem and on another, 20 cows besides gold and clothing. He traveled in many parts of the country, and at the Battle of Down in 1260, he was with O'Neill when that chief was killed by the Lord Justice Stephen Longespée. His 280-word lament on the defeat and death of Brian is his greatest work. He also wrote religious verse and a poem on King Cathal Croibhdhearg O'Conor (d. 1224). See also GAELIC LITERATURE—*Bardic Poetry.*

McCONNELL, mă-kŏn″l, **Francis John,** American Methodist Episcopal bishop: b. Trinway, Ohio, Aug. 18, 1871. He was educated at the Ohio Wesleyan University and entered the ministry in 1894. He held pastorates in Massachusetts and in 1909 became president of De Pauw University, a post in which he served until 1912 when he was elected bishop. He is the author of several books on religious subjects.

McCONNELLSVILLE, mă-kŏn″lz-vĭl, town, Ohio, seat of Morgan County, 27 miles southeast of Zanesville on the navigable Muskingum River. Altitude 710 feet. It is served by state highways and the Baltimore and Ohio Railroad at Malta, across the river. Located in a farming region, it has a few industries, including the manufacture of meat products, lumber, and cigars. There are also gas and oil wells in the vicinity. It was laid out in 1817 by Gen. Robert McConnell. After 1827 keel boats traded between McConnellsville, Zanesville, and Pittsburgh and by 1850 there was a flourishing river trade connecting with Mississippi ports. With the development of overland travel, however, river traffic declined. Pop. (1950) 1,941.

McCOOK, mă-kŏŏk′, **Alexander McDowell,** American soldier: b. Columbiana County, Ohio, April 22, 1831; d. Dayton, Ohio, June 12, 1903. He was graduated at West Point in 1853, and with the commission of second lieutenant of the 3d Infantry was ordered to New Mexico. In 1861 he gained his captaincy and saw much service during the Civil War. He commanded the Ohio volunteers at Bull Run and rapidly gained promotion, being appointed major general of volunteers in 1862.

McCook's brilliant military reputation was made at the battles of Shiloh, Murfreesboro, Chickamauga, and others, and in 1865 he was brevetted brigadier general in the regular army. He was subsequently placed in command of the military school at Fort Leavenworth, was commissioned major general in 1894 and retired the following year. He represented the United States at the coronation of the czar in 1896 and in 1898–1899 was a member of a commission appointed by President McKinley to investigate the work of the War Department during the War with Spain.

General McCook came of a fighting family. He was the son of Daniel McCook who was killed by Morgan's guerillas in 1863. Seven of the general's brothers took part in the War for the Union, three of whom, like their father, were killed. Four of the eight McCook brothers attained the rank of general.

McCOOK, Anson George, American soldier and politician: b. Steubenville, Ohio, Oct. 10, 1835; d. New York, Dec. 30, 1917. At the outbreak of the Civil War he entered the Federal army as captain of an Ohio company recruited by himself, became colonel of 194th Ohio Infantry and at end of the war was brevetted brigadier general. He was United States assessor of internal revenue at Steubenville, Ohio, and removed to New York in 1873. In 1876 he was elected as a Republican to the

House of Representatives from the 8th Congressional District, New York, and was re-elected in 1878 and 1880. From 1884 to 1893 he served as secretary of the United States Senate, and from 1895 to 1898 as chamberlain of New York City.

His brother, EDWARD MOODY MCCOOK (b. Steubenville, Ohio, June 15, 1833; d. Chicago, Ill., Sept. 9, 1909), was also an army officer. He went to Colorado in 1849, practiced law, and in 1859 served as a member of the legislature of Kansas Territory. At the outbreak of the Civil War he joined the Kansas Legion in Washington and then became a cavalry officer. He fought with distinction in the campaigns of 1862 and 1863 and rose to rank of lieutenant colonel. In 1864 he was appointed brigadier general of volunteers and commanded the cavalry of the Army of the Cumberland. In the following year he was breveted brigadier general of the United States Army and major general of volunteers, and served briefly as military governor of Florida. He resigned his commission in 1866 and was appointed United States minister to Hawaii, where he remained until 1869, when he became governor of the Territory of Colorado, serving except for a short period (1873–1874) until 1875.

A second brother, HENRY CHRISTOPHER MCCOOK (b. New Lisbon, Ohio, July 3, 1837; d. Oct. 31, 1911), was a clergyman and naturalist. He was graduated from Jefferson (now Washington and Jefferson) College in 1859, studied at Western Theological Seminary (1860–1863), and was ordained a minister of the Presbyterian Church in 1861. He served as first lieutenant and then as chaplain in the 41st Illinois Volunteers in 1861–1862. In 1863–1864 he was pastor of a church in Clinton, Ill., and from 1864 to 1869 did home mission work in St. Louis. From 1870 to 1902 he was pastor of the Tabernacle Presbyterian Church in Philadelphia. He began to study spiders in 1873, and he wrote a number of papers on spiders and ants. He served as vice president of the Academy of Natural Sciences and as president of the American Entomological Society and the American Presbyterian Historical Association. His published works include "Mound-Making Ants of the Alleghanies, Their Architecture and Habits," *Transactions of the American Entomological Society,* November 1877; *The Natural History of the Agricultural Ant of Texas* (1879); *The Honey Ants of the Garden of the Gods and the Occident Ants of the American Plains* (1882); *Tenants of an Old Farm: Leaves from the Note Book of a Naturalist* (1885); *American Spiders and Their Spinning Work* (3 vols., 1889–1893); and *Ant Communities and How They are Governed, a Study in Natural Civics* (1909).

A third brother, JOHN JAMES MCCOOK (b. New Lisbon, Ohio, Feb. 2, 1843; d. Hartford, Conn., Jan. 9, 1927), was a clergyman and educator. He attended Jefferson (now Washington and Jefferson) College from 1858 to 1860, studied law, and then served in West Virginia in the early part of the Civil War. He was graduated from Trinity College in 1863 and from Berkeley Divinity School in 1866, and in the following year was ordained a priest of the Protestant Episcopal Church. From 1868 until his death he served as rector of St. John's Church, East Hartford, Conn. In 1883 he became instructor of Latin at Trinity College, and in 1886 professor of modern languages there, a position he retained until 1923. He was interested in welfare work and prison reform, and in 1895 was named chairmen of the first commission of the Connecticut Reformatory.

McCOOK, city, Nebraska, seat of Red Willow County, situated at an altitude of 2,510 feet, on the Republican River, 65 miles south of North Platte. It is served by the Chicago, Burlington & Quincy Railroad and by Mid West Airlines. The city is the trading center of a rich agricultural region and serves as a railroad division point. The railroad repair shops are the chief industrial enterprise, but the packing and shipping of food products are also important in the city's economy. McCook was the home of George W. Norris (q.v.). It is the seat of McCook Junior College and has a public library, a municipal auditorium, and two municipal airports. Founded as Fairview in 1881, the city was renamed in the following year for Gen. Alexander McDowell McCook (q.v.). It was incorporated as a town in 1883, and as a city in 1933. Government is of the city manager type. Pop. (1950) 7,768.

McCORMACK, John, Irish American tenor: b. Athlone, Ireland, June 14, 1884; d. Booterstown, County Dublin, Sept. 16, 1945. He was educated at Summer Hill College, County Sligo, and in 1902 won the gold medal for singing at the National Irish Festival. In the following year he became a member of the choir of Dublin Cathedral and studied with its organist, Vincent O'Brien, and later in Milan. He made his operatic debut at Covent Garden, London, on Oct. 15, 1907, as Turiddu in *Cavalleria Rusticana.* He sang in Naples in 1909, and on November 10 of that year made his New York debut with the Manhattan Opera Company in *La Traviata.* Subsequently he sang with the Metropolitan, Chicago Grand, and Monte Carlo opera companies. His best roles were Rodolpho in *La Bohème, Faust,* Pinkerton in *Madame Butterfly,* and Don Ottavio in *Don Giovanni.* In 1913 he turned to the concert stage, where he achieved great popularity, especially for his singing of Irish songs. In 1919 he became a United States citizen. He was made a papal count in 1928. His retirement was marked by a farewell tour in 1938.

McCORMICK, Cyrus Hall, American inventor and manufacturer: b. Rockbridge County, Va., Feb. 15, 1809; d. Chicago, Ill., May 13, 1884. In 1831 he invented a successful reaping machine. He patented it in 1834 and later improved the basic design. He moved to Cincinnati in 1845, and two years later to Chicago, where he began to manufacture the machine on a large scale. McCormick successfully fought patent infringements, and his pioneer work in the use of modern business methods helped to bring him great wealth. In 1879 he formed the McCormick Harvesting Machine Company and served as its president until 1884, when he was succeeded by his son and namesake, who, in 1902, became first president of the International Harvester Company.

McCORMICK, Joseph Medill, American journalist and legislator: b. Chicago, Ill., May 16, 1877; d. Washington, D.C., Feb. 25, 1925. The son of Robert Sanderson McCormick and the grandson of Joseph Medill (qq.v.), he was graduated from Yale University in 1900 and joined the staff of the Chicago *Daily Tribune,* whose publisher he later became. He supported Theodore Roosevelt's candidacy for the presidency at the

Convention of 1912. He was vice-chairman of the Progressive National Committee, 1912–14. He was twice elected to the General Assembly of Illinois, and in 1916 was elected to the National House of Representatives. He was elected to the United States Senate in 1918, but was defeated for renomination in 1924. He died at Washington, D. C., 25 Feb. 1925.

McCORMICK, Leander James, American inventor: b. in Virginia, 1819; d. Chicago, 20 Feb. 1900. In early life he worked with his father in manufacturing reaping-machines; removed to Chicago in 1848, and entered into partnership with his brother, Cyrus Hall McCormick (q.v.), and superintended the manufacturing department of their reaping-machine plant until 1879, when the firm was incorporated as the McCormick Harvesting-Machine Company. Ten years later he retired from active business. Many of the improvements in the famous McCormick reaping-machine were made by him. In 1871 he gave an observatory with a powerful telescope to the University of Virginia.

McCORMICK, Robert Sanderson, American diplomat, father of Joseph Medill McCormick and Robert Rutherford McCormick: b. Rockbridge County, Va., 26 July 1849; d. Chicago, 16 April 1919. He was educated at the University of Virginia and entered the diplomatic service as secretary of the American legation at London in 1889–92. He was appointed first Ambassador to Austria-Hungary in July 1902; was Ambassador to Russia from December 1902 to 1905; and Ambassador to France in 1905–07. He was decorated with the Order of the Rising Sun, Japan, 1907. During the Russo-Japanese War Mr. McCormick represented the interests of Japan in Russia.

McCORMICK OBSERVATORY. See LEANDER McCORMICK OBSERVATORY.

McCORMICK THEOLOGICAL SEMINARY, in Chicago, Ill.; opened in 1830 under the auspices of the Presbyterians, as a department of Hanover Academy, at Hanover, Ind. Ten years after its opening the school was removed to New Albany, Ind. Cyrus H. McCormick (q.v.) offered the institution a liberal endowment, which generous gift caused the removal of the school to Chicago, in 1859. It was at first known as the Presbyterian Theological Seminary of the Northwest. In 1886 it was named in honor of its liberal benefactor. It is now called the Presbyterian Theological Seminary. No fees are charged, and some of its income is used in assisting needy students. Recently there were connected with the seminary 15 professors and instructors and 174 students. The library contained about 55,000 volumes. The total income on productive funds and from other sources, but excluding benefactions, was about $125,000. Its buildings and grounds were valued at nearly $1,450,000 and its endowment funds at about $112,375,000.

McCOSH, mą-kŏsh′, **James,** Scotch-American author and educator: b. Carskeoch, Ayrshire, 1 April 1811; d. Princeton, N. J., 16 Nov. 1894. He was educated at the University of Glasgow, which he entered at 13, and at the University of Edinburgh, where he went in 1829. He became a minister of the Church of Scotland; was settled at Arbroath in 1835, and at Brechin in 1839; but at the disruption of the Scottish Church joined the Free Church, whose organization he was active in promoting. In 1850 he published 'The Method of the Divine Government, Physical and Moral,' in which he applied the philosophy of Sir William Hamilton to questions of theology with such skill as to elicit from him the highest commendation. This work at once gave McCosh wide fame as a philosophical thinker, and in 1851 he was appointed professor of logic and metaphysics in Queen's College, Belfast, where he remained 18 years, not only discharging his professional duties, but also entering earnestly into work of religious and social improvement, through which his spirit of benevolence and his enlightened zeal for general education accomplished lasting results. In 1868 he was elected president of the College of New Jersey (now Princeton University), having previously visited this country and become impressed with its educational promise. This promise was especially bright when he assumed the presidency of Princeton, but the conditions of transition in the sphere of higher education were such as to demand consummate powers of leadership. Such powers McCosh, although a foreigner, brought to his work with most satisfying success. During the 20 years of his administration at Princeton he saw the number of students and professors more than doubled and prosperity increased in all departments. His resignation in 1888 was due to the advance of years, and he was able to continue in the chair of philosophy beyond that period. As a philosopher he maintained the principles of the Scottish metaphysicians against all empirical methods, but went beyond his predecessors in the direction of intuitionalism, although he once declared that this "rose out of rationalism as frogs rise out of the melted ice," and few orthodox theologians were abreast of him in welcoming the evolutionary features of the new biology. His writings on theology, philosophy and psychology are very numerous and include 'Typical Forms and Special Ends in Creation,' in collaboration with Dickie (1856); 'The Intuitions of the Mind Inductively Investigated' (1860); 'The Supernatural in Relation to the Natural' (1862); 'An Examination of Mill's Philosophy' (1866); 'Laws of Discursive Thought' (1869); 'Christianity and Positivism' (1871); 'The Scottish Philosophy, Biographical and Critical' (1874); 'The Development of Hypothesis' (1876); 'The Emotions' (1880); 'Psychology of the Cognitive Powers' (1886); 'Psychology of the Motive Powers' (1887); 'Realistic Philosophy Defended' (1877), and 'Our Moral Nature' (1892). Consult Dulles, J. H., 'A McCosh Bibliography' (Princeton 1895), and Sloane, W. M., 'The Life of James McCosh' (New York 1896).

McCOY, Isaac, American missionary and Indian agent: b. near Uniontown, Pa., 13 June 1784; d. Louisville, Ky., 21 June 1846. His early life was spent in Kentucky. Reared on the frontier, his educational advantages were very limited, but he was of a studious disposition. He was married at the age of 20 and was ordained to the ministry of the Baptist Church at 24, settling in Indiana about the same time. After serving eight years as pastor of a church, he entered the mission field among the Miami

Indians, in the valley of the Wabash River, in 1817. He subsequently labored among the people of the Pottawatomie and Ottawa tribes in Michigan. During the course of his work among the Indians he became impressed with expediency of removing the Indians from the contaminating influences of the white settlements. In June 1824 he submitted the matter to the consideration of the Baptist Mission Board at Washington, D. C., and was authorized to present the matter to the attention of the President of the United States. He failed to secure an audience with President Monroe, but he was successful in interviewing the Secretary of War, John C. Calhoun, under the jurisdiction of whose department was included all matters pertaining to the administration of Indian affairs. Secretary Calhoun approved of the scheme thus proposed for the establishment of an Indian Territory west of the Mississippi and became its champion. Although several tribes had removed to the West prior to that time, the government had no settled policy in regard to the matter until after Secretary Calhoun took it up officially after the suggestion was made by Mr. McCoy. In 1827 he again visited Washington, where he interviewed President John Quincy Adams and Secretary Barbour of the War Department. In 1828, Mr. McCoy and Capt. George Kennerly of Saint Louis were appointed by the Secretary of War as commissioners to conduct delegations representing the Choctaw, Creek, Pottawatomie and Ottawa tribes on an inspection of the region to be included in the proposed Indian Territory, in the performance of which duty they made two tours of the wilderness region west of Missouri and Arkansas during the late summer and autumn of 1828. During the ensuing 10 years Mr. McCoy was almost constantly in the Indian Territory (i.e., the present States of Kansas, Nebraska and Oklahoma), selecting and surveying locations for immigrant Indian tribes for the government, and, at the same time, aiding in the location and establishment of missions and schools among them. He published a brief annual pamphlet entitled *The Annual Register of Indian Affairs within the Indian (or Western) Territory,* during the years 1835 to 1838 inclusive. Previous to that he had published a pamphlet, 'The Practicability of Indian Reform.' He was also the author of 'A History of Baptist Indian Missions.' His last years were spent at Louisville, Ky., where he had charge of the work of the American Indian Mission Association.

McCOY, Joseph G., American pioneer in the overland cattle trade: b. Springfield, Ill., 20 Dec. 1837; d. Kansas City, Mo., 19 Oct. 1915. Reared on a farm, he made a specialty of feeding cattle for the beef market. At the conclusion of the Civil War the scarcity and high price of beef and the seeming impossibility of transporting the cheap cattle from the overstocked ranges of Texas to the Northern markets, because of the introduction of splenitic fever which was certain to follow among native herds, appealed to the typically American genius of McCoy for achieving that which had been reputed to be impossible. He finally proposed the establishment of a shipping point on one of the new railways, which were then being built westward across the great plains, to which the beef stock of Texas might be slowly driven northward during the grazing season, keeping well to the westward of the frontier settlements, and shipped thence by rail to the market at Chicago for immediate slaughter. This proposal, though simple, was so novel that railway managers at first refused to consider it seriously. McCoy finally induced one of the railway companies to back him in the enterprise and he arranged to build shipping pens at Abiliene, Kan. As the result of a diligent advertising campaign a few Texas ranchmen were persuaded to undertake to drive herds across the Indian Territory to the designated shipping point on the Kansas Pacific Railway, during the season of 1867. Thirty-five thousand head of beef cattle were thus marketed that season. The next year the number thus driven overland to the shipping point was increased to 75,000 head; in 1869, this number was doubled, and in 1870 the number was doubled again. When the overland cattle trade was well established the railway company soon ceased to pay the stipulated royalties to McCoy, but he continued his active interest in the live-stock business until old age forced his retirement. He published 'Historic Sketches of the Cattle Trade in the West and Southwest' (1874). He was a pioneer settler at El Reno, Okla., in 1889, and was nominated as the candidate for Territorial delegate to Congress by the convention of the Democratic party in 1890.

McCRACKAN, ma-krăk'an, William Denison, American author and lecturer: b. Munich, Germany, 12 Feb. 1864; d. New York City, 12 June 1923. He received his earliest education at the Latin Gymnasium, Stuttgart, Germany, Saint Paul's School, Concord, N. H., and was afterward graduated at Trinity College, Hartford, Conn., in 1885. He wrote 'The Rise of the Swiss Republic' (1892); 'Romance and Teutonic Switzerland' (1894); 'Swiss Solutions of American Problems'; 'Little Idyls of the Big World' (1895); 'The Huntington Letters' (1897); 'Fair Land Tyrol' (1905); 'The Italian Lakes' (1907); 'Christian Science: Its Discovery and Development' (1912). From 1901–04 he was a member of the Christian Science Committee on Publication.

MacCRACKEN, Henry Mitchell, American Presbyterian clergyman and educator: b. Oxford, Ohio, 28 Sept. 1840; d. Orlando, Fla., 24 Dec. 1918. He was graduated at Miami University in 1857; for four years was a teacher and school superintendent; studied at the United Presbyterian Theological Seminary, Xenia, Ohio, and at the Princeton Theological Seminary, and later at Tübingen and Berlin universities. He was minister of the Westminster Church, Columbus, Ohio, 1863–67, and of the First Presbyterian Church at Toledo, Ohio, 1869–81. In 1867 he was deputy to the General Assembly of the Free Church of Scotland, and to that of the Presbyterian Church of Ireland in 1884. From 1880 to 1884 he was chancellor of the Western University, Pittsburgh, Pa., and in the latter year became vice-chancellor and professor of philosophy in the University of the City of New York, of which he was made chancellor in 1891. Since then the name of the institution has been changed to New York University, and the seat of the University College and School of Applied Science has been re-

moved to University Heights, New York City. Under his administration the Hall of Fame for Great Americans (q.v.) was added to the university, its growth and prosperity greatly increased and the extension of its work and influence has given it a leading position in the field of American education. During Dr. MacCracken's active connection with the institution it grew from a college with 91 students to a university with 4,113 students, and the property increased in value from $547,000 to $5,211,000. He resigned the chancellorship 28 Sept. 1910. Besides numerous papers on subjects of education, religion and philosophy, he published 'Tercentenary of Presbyterianism' (1870); 'Popular Sermons' (1875); 'Leaders of the Church Universal' (1879); 'John Calvin' (1888); 'Cities and Universities' (1882); 'The Scotch-Irish in America' (1884); 'A Metropolitan University' (1892); 'Educational Progress in the United States' (1893); 'Lives of Church Leaders: or Heroes of the Cross' (1900); 'The Three Essentials' (1901); 'The Hall of Fame' (1901); 'Urgent Eastern Questions' (1912).

MacCRACKEN, Henry Noble, American educator: b. Toledo, Ohio, 19 Nov. 1880. He is the son of Henry Mitchell MacCracken (q.v.) and was educated at New York and Harvard universities. He was instructor in English at the Syrian Protestant College in 1900–03; Harvard Fellow in 1907–08; instructor and afterward assistant professor of English at the Sheffield Scientific School at Yale in 1908–13. He was professor of English at Smith College in 1913–15, and in 1915 became president of Vassar College. In 1917–18 he was national director of the junior membership in the American Red Cross. He has written for the magazines on philology; has edited 'The Serpent of Division' (1910); 'The College Chaucer' (1913); 'Shakespeare's Principal Plays' (1914), etc. He is author of 'First Year English' (1902); and part author of 'English Composition in Theory and Practice' (1909).

MacCRACKEN, John Henry, American educator: b. Rochester, Vt., 30 Sept. 1875. He is the son of Henry Mitchell MacCracken (q.v.), and was educated at the New York University, the Union Theological Seminary and the University of Halle. He was associated with New York University as Fellow, instructor and assistant professor of philosophy in 1894–99; was president of Westminster College, Missouri, in 1899–1903; syndic and professor of politics at New York University in 1903–15; and in 1915–26 was president of Lafayette College, Easton, Pa.

McCRADY, mą-krā'dĭ, **Edward,** American soldier and historian: b. Charleston, S. C., 8 April 1833; d. there, 2 Nov. 1903. He was graduated at Charleston College, admitted to the bar in 1855, and joined earnestly in the movement which led to the secession of his State. He took part in the capture of Castle Pinckney, 27 Dec. 1860, and was present at the bombardment of Fort Sumter in the following April. As captain of the first military company raised in South Carolina for the whole war, he entered the Confederate army, 27 June 1861, was made major and then lieutenant-colonel, was badly wounded at the second battle of Bull Run (or Manassas), 30 Aug. 1862, and in January 1863 received an injury in camp from a falling tree, in consequence of which he was transferred from field service to the command of a camp of instruction at Madison, Fla., in 1864. He remained at that post until the end of the war. Later he became major-general of State troops and a member of the South Carolina legislature (1880–90), where he proposed the South Carolina Election and Registration Law. Among his more important writings may be mentioned 'The History of South Carolina Under the Proprietary Government, 1670–1719' (1897); 'The History of South Carolina Under the Royal Government, 1719–1776' (1899); 'The History of South Carolina in the Revolution, 1775–1780' (1901); and 'The History of South Carolina in the Revolution, 1780–83' (1902).

McCRAE, John David, Canadian physician, soldier and poet: b. Guelph, Ontario, 30 Nov. 1872; d. of pneumonia in France, 28 Jan. 1918. The second son of Lieut.-Col. David McCrae (who organized and took over a battery to France), he was educated at the University of Toronto and took his M.D. degree in 1910. He became Governor's Fellow in Pathology at McGill University; afterwards lecturer in pathology and in medicine. After attaining the M.R.C.P. he was appointed assistant physician to the Royal Victoria Hospital, Montreal, and physician to the Alexandra Hospital. With Professor Adami he was co-author of a textbook on pathology and also contributed to the 'System of Medicine' by Osler and McCrae, the latter being his elder brother (see McCRAE, THOMAS). He served as a lieutenant of artillery in the South African War, taking part in several important engagements. At the outbreak of the European War he volunteered for service and crossed the sea in September 1914 with the Canadian Field Artillery. He served in the field till after the second battle of Ypres, when he was placed in charge of medicine and second in command of the hospital unit provided by McGill University. Shortly before his death he had been appointed consultant to the British Armies in the Field, but had not yet entered upon that post. McCrae attained the rank of lieutenant-colonel; besides achieving high military, professional and academic distinction, he had earned a creditable reputation as a poet. He did not write much, yet his verses have obtained a permanent place in modern anthologies. One of his best-known works is the now famous lyric, 'In Flanders' Fields,' written during the battle of Ypres and originally contributed to *Punch*. The style is peculiarly his own:

> In Flanders' Fields the poppies blow
> Between the crosses, row on row,
> That mark our place, and in the sky
> The larks still bravely singing fly,
> Scarce heard amidst the guns below.
> We are the dead. Short days ago
> We lived, felt dawn, saw sunset glow,
> Loved and were loved; and now we lie
> In Flanders' Fields.
>
> Take up our quarrel with the foe,
> To you from failing hands we throw
> The Torch — be yours to hold it high;
> If you break faith with us who die,
> We shall not sleep, though poppies grow
> In Flanders' Fields.

McCRAE, Thomas, American physician: b. Guelph, Ontario, Canada, 16 Dec. 1870. He was educated at the universities of Toronto and Göttingen, and in 1904–12 was associate in medicine at Johns Hopkins Hospital, serving as associate professor of medicine of the university in 1906–12. He was professor of medicine at Jefferson Medical College, Philadelphia, and physician to the Jefferson and Pennsylvania hospitals from 1912. He was associate editor of Osler's 'System of Medicine'; was co-author, with Sir William Osler, of 'Cancer of the Stomach' (1900); and assistant author of Osler's 'Practice of Medicine' (1912; new ed., 1918). Died 30 June 1935.

McCRARY, George Washington, American justice and legislator: b. Evansville, Ind., 29 Aug. 1835; d. Saint Joseph, Mo., 23 June 1890. He went with his family to the Wisconsin Territory, now a part of Iowa, when a year old, studied law in Keokuk, Iowa, and was admitted to the bar in 1856. He was elected to the State legislature in 1857, and in 1861–65 served in the State senate where he was chairman of the committees on military affairs and the judiciary. He was a member of Congress from 1869–77, and was appointed to the committees on naval affairs, revision of laws, elections, railways and canals, and the judiciary. He proposed the formation of a joint committee for the purpose of determining the electoral vote in the Hayes-Tilden Presidential election, and was connected with the preparation and passing of the Electoral Bill. He was Secretary of War under President Hayes in 1877–79, when he was appointed justice of the United States Circuit Court. He resigned in 1884 and removed to Kansas City, Mo., where he acted as general consulting attorney for the Atchison, Topeka and Santa Fé Railroad until his death. He is author of 'American Law of Elections' (1875).

McCREA, Dorothy Frances, Australian poet and story writer. See McCrea, George Gordon.

McCREA, George Gordon, Australian poet: b. Anchorfield, near Edinburgh, Scotland, 29 May 1833. His father went to Australia in 1841 as warden of the Gold Fields of Australia, taking his family with him. Young McCrea was educated privately and entered the Audit Office in 1854. After serving in the office of the chief secretary and the registrar-general, he became senior examiner of patents and deputy registrar-general. He was retired on a pension after 40 years' service. Among his published works are 'Balladeadro and Mamba' (1866–67); 'Karakorok'; 'The Man in the Iron Mask' (1873); 'A Rosebud from the Garden of Taj,' 'Afloat and Ashore' and a vast amount of material the greater part of which still remains unpublished. Among this are two dramas and 'A History of Seychelles' in two volumes. His son, Hugh Raymond McCrea, is an artist and poet well known in Australia; and his daughter, Dorothy Frances, is a clever story writer and a poet of some reputation in Australia. Deceased.

McCREA, Hugh Raymond, Australian artist. See McCrea, George Gordon.

McCREA, mą-krā', **Jane,** American Revolutionary heroine: b. Bedminster (now Lamington), N. J., 1753; d. near Fort Edward, N. Y., 27 July 1777. She was the daughter of a Scotc Presbyterian clergyman, at whose death sh went to live with her brother near Fort Ed ward, N. Y. At the commencement of th Revolution she was betrothed to David Jone an officer of the Crown. When Burgoyne army was advancing from the north she wa visiting a Mrs. MacNeil at Fort Edward. He brother, sharing the general alarm felt throug out the region, sent for his sister, intending t remove to a safer locality. On the mornin fixed upon for her departure, a band of Indian in the employ of Burgoyne suddenly swoope down upon the MacNeil household and the together with Miss McCrea, were mad prisoners. Mrs. MacNeil and her party arrive in safety at Burgoyne's camp, but half an hou later another party of Indians arrived, bearin a number of freshly severed scalps, one o which bore the long glossy hair of Miss Mc Crea, whose body was later found by a roadsid The precise manner of her death never becam known. The Indians claimed that she wa killed by a random shot from an American de tachment, whereupon her captors determine to secure the reward for her scalp. It has bee surmised that a quarrel arose among the Indian as to whose captive she was and that one of the in a frenzy tomahawked her. Other authoritie credit the story that Lieutenant Jones hired th Indians to bring his betrothed to camp when they were to be married and that she was kille in a controversy which arose as to whose cap tive she was. Lieutenant Jones denied this story he lived to an old age, a morose and gloom man. At all events the tragedy caused a gen eral feeling of horror throughout America an England. Burgoyne called a council of h Indian chiefs in order to reprove them, but a his allies would have deserted him the offende was allowed to go unpunished. A blasted pin long marked the spot where tradition relate the beautiful young girl was murdered, and he grave may be seen in a small cemetery near th ruins of Fort Edward. Consult Bascom, R. C 'The Fort Edward Book' (Fort Edward 1903 and Wilson, D., 'The Life of Jane McCrea (New York 1853).

McCREARY, James Bennett, America lawyer: b. Madison County, Ky., 8 July 1838; 8 Oct. 1918. He was graduated at Centre Co lege, Danville, Ky., in 1857, and from the La School of Cumberland University, Tennesse 1859. He entered the Confederate army in 1862 major of cavalry and served until close of wa being then lieutenant-colonel of the 11th Ken tucky Cavalry, C. S. A. He was a member the Kentucky house of representatives in 186 1871 and 1873 (being Speaker 1871–73); gove nor of Kentucky 1875–79, and a member of Co gress in 1885–97. He was a delegate to the I ternational Monetary Conference at Brusse Belgium, in 1891, and in 1903 became Unit States senator. In 1911–15 he was aga governor of Kentucky. He was delegate-a large to the Kansas City National Democrat Convention and to the Baltimore Convention 1912.

McCREERY, James, American merchan b. Ireland; d. Aiken, S. C., 1893. He came the United States when about 20 and engag in the dry goods business in Baltimore, and the beginning of the Civil War removed to Ne

York, where he soon established a business of his own which made him ultimately one of New York's leading merchants. He was a member of many public boards, one of the founders of the silk industry in America and director of numerous commercial enterprises. He was one of the Chamber of Commerce delegation sent to England two years before his death, and was a leading member of various clubs, chiefly of an educational or public character.

McCULLOCH, mą-kŭl'ō, Benjamin, American soldier: b. Rutherford County, Tenn., 11 Nov. 1811; d. 7 March 1862. He became a skilled hunter and boatman and joined other frontiersmen in settling Texas. In 1835 he served in the Texan war for independence, being in the battle of San Jacinto. Later he settled as surveyor at Gonzales and was elected to the Texas Congress in 1839. In the following year he was engaged in fighting the Comanches and operating against Mexican raiders. He also commanded a company of rangers in the Mexican War under Taylor and Scott, did important work as a scout, and was specially distinguished at the battles of Monterey and Buena Vista, and in the siege of the City of Mexico. In 1853 he was appointed United States marshal in Texas. In 1857 he was one of the commissioners appointed to settle the Mormon difficulties in Utah. During the Civil War he served in the Confederate army, was appointed brigadier-general and sent into Missouri, where he was defeated at the battle of Dug Spring, but later united his forces with those of General Price and then defeated the Federals under General Lyon (q.v.) at Wilson's Creek. He commanded a corps at the battle of Pea Ridge, Ark., where he was killed by a sharpshooter while making a reconnaissance. Consult Reid, S. C., 'Scouting Expeditions of McCulloch's Rangers' (Philadelphia 1859).

McCULLOCH, mą-kŭl'ōh, Hugh, American financier: b. Kennebunk, Me., 7 Dec. 1808; d. near Washington, D. C., 24 May 1895. He was educated at Bowdoin College and went in 1833 to Fort Wayne, Ind., where he established a law practice which he continued until 1835 when he entered a branch of the State Bank of Indiana. He was chosen director in 1836 and in 1857 became president of the newly incorporated State Bank of Indiana. He was appointed Comptroller of the Currency in 1863 and in 1865 became Secretary of the Treasury under President Lincoln. Owing to the enormous expenses incurred by the Civil War, the finances of the country were in a critical condition; in six months the large sum due 500,000 soldiers and sailors was paid together with other heavy expenses, and a reduction of the national debt was begun. McCulloch converted more than $1,000,000,000 of short-time obligations into a funded debt, and in less than two years had succeeded in putting the finances of the country on a sound basis. Congress approved his course and his plan for a speedy resumption of specie payment, but he met with opposition in his purpose to retire the legal-tender notes. He occupied the office until 1869 and in 1871 opened a banking business in London where he remained until 1878. He was reappointed to the Secretaryship of the Treasury by President Arthur in 1884 and continued in office until the close of the administration. He wrote 'Men and Measures of Half a Century,' and many of his speeches together with a large share of his correspondence have been published. He was the last living member of Lincoln's distinguished cabinet.

McCULLOCH, John Ramsay, English political economist: b. Whithorn, Wigtownshire, 1 March 1789; d. London, England, 11 Nov. 1864. He was educated at Edinburgh; became editor of *The Scotsman,* an Edinburgh newspaper, 1818–20, and from 1818 wrote many articles for the *Edinburgh Review.* He was professor of political economy in London University, 1828–32, and in 1838 was appointed comptroller of the stationery office. Among his many books may be mentioned 'The Principles of Political Economy' (1825); 'Historical Sketch of the Bank of England' (1831); 'Dictionary of Commerce' (1832); 'Geographical Dictionary' (1841); 'A Treatise on the Principles and Practical Influence of Taxation and the Funding System' (1845); 'The Literature of Political Economy' (1845), etc. He was one of the earliest advocates of free-trade in Great Britain.

MacCULLOUGH, mą-kŭl'ōk, John Edward, American tragedian: b. Coleraine, Ireland, 2 Nov. 1837; d. Philadelphia, 8 Nov. 1885. He came to the United States in 1853, studied for the stage and made his début in Philadelphia, 1857. He played with Edwin Forrest, who left him at his death all his manuscript plays. In 1869 he managed, with Lawrence Barrett, the Bush Street Theatre in San Francisco, Cal. His appearance in England in 1881 was not successful, but his popularity in America remained unbroken. Despite his lack of literary education, a serious handicap, he won high rank in his profession. He played De Mauprat to Edwin Booth's Richelieu, and Richmond to his Richard III. His interpretation of Virginius was unexcelled during his day. Among his leading rôles were Hamlet, Macduff, Richelieu, Spartacus, etc. In 1884, at the height of his brilliant career, he suddenly collapsed, both physically and mentally; he died a year later in an insane asylum in Philadelphia. Consult Clark, 'John McCullough as Man, Actor, and Spirit' (Boston 1905).

McCULLOUGH, John Griffith, American politician: b. Welsh Tract, near Newark, Del., 16 Sept. 1835; d. 29 May 1915. He was graduated from Delaware College in 1855 and from the law department of the University of Pennsylvania in 1858. He removed to California in 1859, engaged in law practice in Mariposa County, was elected to the State legislature in 1861, to the senate in 1862 and in 1863–67 was attorney-general. In 1867–73 he practised law in San Francisco and then removed to Bennington, Vt., where he became director and president of several railway systems and prominently connected with various banking and commercial enterprises. He was elected to the Vermont senate in 1898 and in 1902 was elected governor of the State.

McCUMBER, m'kŭm'bėr, Porter James, American legislator: b. Crete, Will County, Ill., 3 Feb. 1858. He was graduated at the University of Michigan in 1880 and engaged in the practice of law. He was the senior mem-

ber of the law firm of McCumber and Bogart at Wahpeton, N. Dak. (1881–1900). He served in the territorial House of Representatives in 1885–1889; was state's attorney, Richland County, in 1896–1897. He was elected to the United States Senate in 1899 and re-elected four times. He died May 18, 1933.

MacCUNN, mȧ-kŭn′, **Hamish,** Scottish composer: b. Greenock, Scotland, March 22, 1868; d. London, Aug. 2, 1916. Was educated in Greenock and at the Royal College of Music, London, made his début in the musical world in 1887, and in 1888 became a junior professor of harmony in the Royal Academy of Music, which position he resigned in 1894. As a composer he attained high rank; his productions are rich in melody, and his command of the orchestra is remarkable. His work is typically Scottish in character and in choice of subject. Among the more important of his numerous works are overtures, etc., *The Land of the Mountain and the Flood; Chior Mhor; The Dowie Dens o' Yarrow; The Ship o' the Fiend;* dramatic cantatas, *Lord Ullin's Daughter; Bonny Kilmeny; Lay of the Last Minstrel,* and the operas, *Jeannie Deans* and *Diarmid.*

MacCURDY, mȧ-kûr′dĭ, **George Grant,** American anthropologist: b. Warrensburg, Mo., April 17, 1863. He was graduated from the State Normal School, Warrensburg, 1887; from Harvard, 1893, A.M. in 1894, and thereafter studied at Vienna, Paris and Berlin. Since 1898 he has been connected with Yale University, becoming in 1923 research associate, with rank of professor, and curator of anthropological collections. His publications include *Some Phases of Prehistoric Archaeology* (1907); *Antiquity of Man in Europe* (1910); *Human Origins* 2 vols. (1924); *Prehistoric Man* (1928); *The Coming of Man* (1932). Since 1931 he has been professor emeritus.

McCURDY, James Frederick, Canadian Orientalist: b. Chatham, N. B., Feb. 18, 1847; d. April 30, 1935. He was educated at the University of New Brunswick, Princeton Theological Seminary and in Germany. He was assistant professor in Oriental languages at Princeton, 1873–1882; and Stone lecturer there in 1885–1886.. In 1886 he was appointed lecturer in University College of Toronto, and from 1888–1914 was professor of Oriental languages in that college. Among his works are *Aryo-Semitic Speech* (1881); *History, Prophecy and the Monuments* 3 vols. (1894–1901); *Life and Work of D. J. Macdonnell* (1897); an original commentary on Haggai, and various translations for the American edition of *Lange's Commentary.*

McCURDY, Richard Aldrich, American capitalist: b. New York City, Jan. 29, 1835; d. Morristown, N. J., March 6, 1916. He was graduated at Harvard University in 1856, and engaged in the practice of law in New York. He became attorney for the Mutual Life Insurance Company in 1860, vice president in 1865 and was president in 1885–1906. The investigation of his company in 1905 revealed mismanagement and gross extravagance, particularly in the matter of salaries for the officials. He resigned and retired in 1906.

McCUTCHEON, mȧ-kŭch′ŭn, **George Barr,** American novelist: b. near Lafayette, Ind., July 26, 1866; d. 1928. Educated at private schools and at Purdue University. After leaving college, before graduation, he became a reporter on the Lafayette *Morning Journal,* at a salary of $6 a week. Prior to that time he had written a series of dialect letters for the *Sunday Leader,* of Lafayette, under the caption *Waddleton Mail,* published in that paper in 1890. After three years on the *Journal,* he became city editor of the Lafayette *Daily Courier,* servin that capacity until June 1902, when newspaper work was abandoned for novel writing alone. While with the *Courier,* he contributed to that newspaper a serial story entitled *The Wired End,* which has never been published in book form; and also contributed short stories to various magazines during these years. He went to Chicago to reside in 1902, and in July 1910 removed to New York City.

His novels include *Graustark* (1901), dramatised; *Castle Craneycrow* (1902); *Brewster's Millions* (1903), dramatised; *The Sherrods* (1903); *The Day of the Dog* (1904), novelette; *Beverly of Graustark* (1904), dramatised; *The Purple Parasol* (1905), novelette; *Nedra* (1905); *Cowardice Court* (1906), novelette; *Jane Cable* (1906); *The Flyers* (1906), dramatised, novelette; *The Daughter of Anderson Crow* (1907); *The Husbands of Edith* (1908), novelette, dramatized; *The Man from Brodney's* (1908); *Truxton King* (1909), dramatized; *A Fool and His Money* (1913); *Black is White* (1914); *The Prince of Graustark* (1914); *Mr. Bingle* (1915); *The Light That Lies* (1917); *Shot with Crimson* (1918); *Sherry* (1918); *Anderson Crow, Detective* (1920); *Yollopp* (1922); *Oliver October* (1923); *East of the Setting Sun* (1924); *Romeo in Moon Village* (1925).

McCUTCHEON, John Tinney, American cartoonist: b. near South Raub, Ind., May 6, 1870; d. Lake Forest, Ill., June 10, 1949. He was graduated from Purdue University in 1889 and was connected with the leading newspapers of Chicago from 1889, his work as a cartoonist becoming famous in the campaign of 1896. He started around the world on dispatch boat *McCulloch* in January 1898; was on board that vessel, during the war with Spain, in the Battle of Manila Bay 1898. In 1899 he made a tour of special service in India, Burma, Siam, and Cochinchina and later in northern China, Korea, and Japan, returning to the Philippines during the fall campaign there. He followed the various campaigns on the islands until April 1899 when he was sent to the Transvaal. He joined the Boers in the interest of his paper and furnished political cartoons for the Chicago *Record* during the campaign of 1900. In 1909–1910 he visited Africa, the while contributing articles and cartoons for the Chicago *Sunday Tribune.* He went to Mexico as special correspondent in 1914; was with the Belgian and German armies in the autumn of the same year, and in France, Salonika and the Balkans in 1915–1916. He has published *Stories of Filipino Warfare* (1900); *Cartoons by McCutcheon* (1903); *Bird Centre Cartoons* (1904); *The Mysterious Stranger and Other Cartoons* (1905); *Congressman Pumphrey the People's Friend* (1907); *In Africa* (1910); *T. R.* in *Cartoons* (1910); *Dawson '11—Fortune Hunter* (1912); *An Heir at Large.* In 1931 he was

awarded a Pulitzer Prize for the excellence of his cartoons. He was president of the Chicago Zoological Society from 1921; and a fellow of the Royal Geographical Society.

McDANIEL, Henry Dickerson, American state governor: b. Monroe, Ga., Sept. 4, 1836; d. there, July 25, 1926. He graduated from Mercer University, Macon, Ga., 1856, and was admitted to the bar in 1857. He attended as delegate the Georgia Secession Convention in 1861; and served in the Confederate Army until the end of the war, attaining the rank of major in the 11th Georgia Infantry. In 1865 he was a member of the Georgia Constitutional Convention. He served in the state legislature, 1873–1874, and was state senator, 1874–1883; from 1883 to 1886 he was governor of Georgia.

McDANIEL, Walton Brooks, American philologist and educator: b. Cambridge, Mass., March 4, 1871. He graduated from Harvard in 1893. He was assistant in Latin and Greek at Harvard in 1896–1897, instructor there and at Radcliffe College in 1899–1901, and from 1909 was professor of Latin at the University of Pennsylvania. He wrote *Roman Private Life and Its Survivals* (1924); and *Guide for the Study of English Books on Roman Private Life* (1926).

McDIARMID, măk-dĭr'mĭd, **Hugh** (pseudonym of CHRISTOPHER MURRAY GRIEVE), Scottish author and poet: b. Langholm, Dumfriesshire, Aug. 11, 1892. An ardent nationalist, he is known as one of the founders of the Scottish Nationalist Party and the editor of *The Voice of Scotland,* a quarterly magazine. Among his works in prose are *Annals of the Five Senses; Albyn, or the Future of Scotland; Scottish Scene; Scottish Eccentrics; The Scottish Islands;* and an autobiography entitled *Lucky Poet.* His volumes of verse include: *Sangschaw; Penny Wheep; A Drunk Man Looks at the Thistle; Stony Limits; First Hymn to Lenin; Cornish Heroic Song for Valda Trevlyn.*

McDONALD, Andrew Archibald, Canadian statesman: b. Three Rivers, Prince Edward Island, Feb. 14, 1829; d. March 21, 1912. He entered public life in 1853 as a member of the island assembly, serving until 1858, and again in 1863–1874. He was a delegate to the Quebec Conference on the Union of the Provinces in 1864; and in 1873 became provincial postmaster general, also serving as acting post office inspector until 1884. In 1884–1889 he was lieutenant governor of the province, and from 1891 he was a member of the Dominion Senate.

MacDONALD, Arthur, American criminologist and author: b. Caledonia, N.Y., July 4, 1856; d. Washington, D.C., Jan. 17, 1936. He was educated at the University of Rochester and the Princeton and Union theological seminaries, and later studied medicine at Berlin, Leipzig, Paris, Zürich, and Vienna. From 1892 till 1904 he was connected with the United States Bureau of Education as a specialist in possibilities of education for the abnormal and weakling classes. He represented the United States at three international psychological and criminological congresses, and was honorary president of the Congress of Criminal Anthropology, in Europe. He made a special study of American and European prisons and asylums for the insane and for inebriates. His books include: *Abnormal Man* (1893); *Education and Patho-Social Studies* (1896); *Statistics and Crime, Suicide and Insanity* (1903); *Juvenile Crime and Reformation* (1908); *Mentality of Nations and Social Pathology* (1912).

MACDONALD, SIR **Claude Maxwell,** British soldier and diplomat: b. June 12, 1852; d. London, Sept. 10, 1915. In 1872, after attending the Royal Military College, Sandhurst, he was commissioned 2d lieutenant in the 74th Highlanders. He served in the Egyptian campaign in 1882, and took part in the Suakin expedition, in the eastern Sudan, during 1884–1885; in 1887 he was appointed consul general at Zanzibar. Transferred to West Africa a year later, in 1891 he became the first British administrator in the Oil Rivers Protectorate (which later became the colony of Nigeria). In 1896 he was appointed British minister at Peking (Peiping); he organized the defense of the foreign legations in that city, when they were besieged during the Boxer Rebellion (see BOXERS). June–August, 1900. Appointed in October 1900 Great Britain's first ambassador ot Tokyo (previous diplomats holding only the rank of minister), he was responsible in considerable measure for effecting the Anglo-Japanese alliance of 1905.

MACDONALD, Duncan Black, American professor of theology: b. Glasgow, Scotland, April 9, 1863; d. Hartford, Conn., Sept. 6, 1943. After graduating from the University of Glasgow in 1885 he studied at the University of Berlin, and came to the United States in 1892, from which date until 1931 he was professor of Semitic languages at Hartford Theological Seminary. He was Haskell lecturer on comparative religion at the University of Chicago, 1906; special lecturer at Wellesley College, 1907–1909; at the Episcopal Theological School, Cambridge, 1912; Lamson lecturer on Mohammedanism at Hartford Theological Seminary, 1909; head of the Mohammedan department at the Kennedy School of Missions, Hartford, 1911–1925; Haskell lecturer, Oberlin College, 1914; lecturer on the Old Testament, Berkeley Divinity School, 1917–1918. He discovered in the Bodleian Library (q.v.) in 1910 the only known Oriental manuscript of *Ali Baba and the Forty Thieves* which he published in the *Journal* of the Royal Asiatic Society of Great Britain, of which he was a member. His writings include *The Development of Muslim Theology* (1903); *Aspects of Islam* (1911); *Hebrew Literary Genius* (1933); *Hebrew Philosophical Genius* (1935).

MACDONALD, Flora, Scottish Jacobite heroine: b. Milton, South Uist, Hebrides, 1722; d. Kingsburgh, Scotland, March 5, 1790. She lost her parents early, and was brought up by the chief of her clan, Macdonald of Clanranald; later she was adopted by Lady Macdonald of Skye. After the Battle of Culloden, in 1746, her assistance was sought in securing the escape of Prince Charles Edward, who had taken refuge at Benbecula, where Flora MacDonald was then living. The prince was disguised as a woman servant and the party succeeded in reaching Skye in safety. Flora's assistance to the prince became known, however, and she was imprisoned in the Tower of London, but was soon after-

ward permitted to live outside the prison, although under charge of a jailer. The Indemnity Act of 1747 secured her complete liberty. She was married to Allan Macdonald in 1750, and in 1774 they emigrated to America, settling in Fayetteville, N.C. Her husband served in the British Army in the Revolutionary War, and was taken prisoner. Flora returned alone to Scotland in 1779, and was later rejoined by her husband. She was a woman of great beauty and charm of manner, Dr. Samuel Johson among others, being warm in her praises. Five of her sons served in the British Army or Navy. Consult Ewald, A. C., *Life and Times of Prince Charles Edward* (1886); Macgregor, A., *Flora Macdonald and Her Adventures with Prince Charles* (1901).

MACDONALD, George, Scottish poet and novelist: b. Huntly, Aberdeenshire, Dec. 10, 1824; d. Ashtead, Surrey, Sept. 18, 1905. He was educated at Aberdeen University and at King's College, London, and entered the Independent ministry, from which he afterward retired and became a lay member of the Anglican Church. Macdonald's work comprised poetry, novels, and religious and juvenile books, and was marked by deep religious feeling and devotion to lofty ideals of life. His novels dealt chiefly with Scottish character and scenery, in which they held the place of classics. The best known of his many books were *David Elginbrod* (1862); *Alec Forbes of Howglen* (1865); *Annals of a Quiet Neighborhood* (1866); *Robert Falconer,* his best work (1868); *The Miracles of Our Lord* (1870); *Malcolm* (1875); *The Marquis of Lossie* (1877); *Sir Gibbie* (1879); *Castle Warlock* (1882).

MACDONALD, Sir Hector Archibald, British army officer: b. Muir of Allan-Grange, Ross-shire, Scotland, April 13, 1853; d. Paris, France, March 25, 1903. In 1870 he enlisted in the 92d (Gordon) Highlanders, and for nine years served in the ranks. He first saw active service in the Second Afghan War, in 1879, acquitting himself with such distinction that he was given a commission as second lieutenant. During the Anglo-Boer War of 1880–1881 he was captured at Majuba Hill. He was sent to Egypt in 1884 to aid in reorganization of the Egyptian Army, and took part in the operations on the Nile in 1885 and the Suakin campaign in 1888–1891; for his part in the capture of Tokar in 1891 he was awarded the Distinguished Service Order. During the Dongola expedition of 1896 he commanded a brigade of Egyptian troops, and by his adroit handling of his troops at the Battle of Omdurman, in 1898, he turned into victory what might have proved a disaster. He was promoted colonel that same year, and in 1899, with the rank of major general, he commanded troops in the Punjab Province of India. In December 1899, following outbreak of the South African War (q.v.), "Fighting Mac," as he was popularly termed, was given command of the Highland Brigade, for service under Lord Roberts (see Roberts of Kandahar). He captured Koodoesberg early in February 1900, and after Kimberley was relieved, led his Highlanders in a series of engagements which resulted in the surrender at Paardeberg of Gen. Piet Arnoldus Cronjé (q.v.). In 1901 he received a knighthood, and the next year was appointed to command the troops in Ceylon. Recalled to Britain to answer charges against him, he committed suicide in a Paris hotel.

MACDONALD, Sir Hugh John, Canadian statesman, son of Sir John Alexander Macdonald (q.v.): b. Ontario, March 13, 1850; d. March 29, 1929. He was educated at Queen's College and at the University of Toronto, became a barrister in 1872, practicing in Toronto until 1882, when he removed to Winnipeg. In 1891–1893, and again in 1896–1897, he was a member of the Canadian House of Commons; and in 1896 he was minister of the interior. He was premier and attorney general of Manitoba in 1900. After 1911 he was police magistrate of the city of Winnipeg, and he also served as commissioner of railways in Manitoba. He served in the Fenian Raid of 1866 and the Red River Expedition of 1870; and in the Northwest Rebellion he was captain of the 19th Regiment. He was knighted in 1913.

MACDONALD, Jacques Étienne Joseph Alexandre, Duc de Tarente. French military officer: b. Sedan, Nov. 17, 1765; d. Courcelles-le-Roi, Sept. 7, 1840. Of Scottish descent, he was related to Flora Macdonald (q.v.). He served in the French Revolution as colonel, brigadier general and general. In 1798 he was made governor of the Roman states, and of Naples the following year. In 1805 he lost the favor of Napoleon, but four years later was given command of the right wing of the army in Italy; he was made a marshal for his services at Wagram, July 6, 1809. He served in Spain and in the Russian campaign, assisted in covering the retreat from Leipzig, and in 1814 advised Napoleon's abdication. At the Restoration (q.v.) he gave his allegiance to Louis XVIII. Created a peer of France, in 1816 he became major general of the royal bodyguard; he retired in 1830.

McDONALD, James, Canadian statesman and jurist: b. East River, Nova Scotia, July 1, 1828; d. 1912. He was educated at New Glasgow, was admitted to the bar in 1851, and became queen's counsel in 1867. He served in the legislature of Nova Scotia in 1859–1867 and in 1871–1872, when he resigned; and was a member of the Canadian Parliament in 1874–1881. In 1863–1864 he was chief railway commissioner for Nova Scotia, and financial secretary from 1864 until the union with the Dominion of Canada in 1867. He was minister of justice of Nova Scotia in 1878–1881, and chief justice in 1881–1904.

MACDONALD, James Alexander, Canadian journalist: b. East Williams, Middlesex County, Ontario, Jan. 22, 1862; d. Toronto, Ontario, May 13, 1923. Nationally known as "Masdonald of the *Globe*," James Alexander was educated at Knox College, Toronto, and in 1891 was ordained to the ministry of the Presbyterian Church. In 1891–1896 he was pastor of Knox Church, St. Thomas, Ontario. In the latter year he founded a religious paper in Toronto, which he called the *Westminster*. In 1902 he became managing editor of the Toronto *Globe*. In this post he acquired a national reputation and great influence and left his mark on Canadian journalism and on Canadian public life. Ill health forced a partial retirement in 1916. He collected many of his papers and addresses in *Democracy and the Nations* (1915) and *The North American Idea* (1917). He also published a memorial volume on William Caven of Knox College (1908).

McDONALD, James Alexander, Canadian jurist: b. 1858, Huron County, Ontario; d. Victoria, British Columbia, Dec. 20, 1939. Educated at the University of Toronto, he became a barrister in 1890 and king's counsel in 1906. He engaged in practice in Toronto until 1896 when he removed to Rossland, British Columbia, where he practiced until 1909. In that year he became chief justice of the Court of Appeals, British Columbia, and in 1929 he became chief justice of British Columbia. He retired in 1937.

MacDONALD, James Ramsay, British statesman: b. Lossiemouth, Scotland, Oct. 12, 1866. He received an elementary education and became a teacher. In 1884 he came to London where he worked as a clerk for $3.12 per week. In the capital he continued his education by attendance at evening classes. His experiences led him to embrace Socialism and in 1894 he joined the Independent Labor Party. He was elected to the London County Council in which body he developed his abilities as a public speaker. In 1897, Mr. MacDonald visited the United States and Canada and subsequently visited South Africa, New Zealand, Australia and India. He helped found the Labor Party in 1900. Six years later he was elected to Parliament from Leicester. He opposed Great Britain's entry into the World War, was widely denounced therefor, and in the election of 1918 lost his seat. In 1922 he was re-elected and as head of the Labor Party became leader of the opposition. Following the general election of 1923, the Labor Party expressed its willingness to take office and on Jan. 24, 1924 a Labor Government, the first in British history, took the reins of government, with Mr. MacDonald as Prime Minister and Foreign Secretary. He remained in office until his party suffered defeat in the election of October 1924. He and his party were returned to power in May 1929 and Mr. MacDonald again assumed the Premiership. He visited President Hoover the same year. His government was at once faced with the problem of unemployment and managed to weather many storms until the financial crisis in the summer of 1931 forced a policy of retrenchment on the government in which the rank and file of the Labor Party was unwilling to follow its leader. Mr. MacDonald thereupon formed a "National" government in which he included members of all parties. In the elections of October 1931, the Labor Party suffered a serious setback, but MacDonald headed the new coalition government (Nov. 1931), and continued in office until he resigned, June 7 1935, because of ill health. Died at sea, Nov. 9, 1937.

MacDONALD, James Wilson Alexander, American sculptor: b. Steubenville, Ohio, Aug. 25, 1824; d. Aug. 14, 1908. He studied under Waugh in Saint Louis and in New York in 1849. Among his numerous works are statues of *Joan of Arc; Italia; Edward Bates;* etc.

MACDONALD, Sir John Alexander, Canadian statesman: b. Glasgow, Scotland, Jan. 11, 1815; d. Ottawa, Ontario, June 6, 1891. In early youth he emigrated with his father to Canada. At 21 he was a practising barrister at Kingston, Upper Canada, and in 1844 he was elected to the Canadian Parliament for that constituency. He became a cabinet minister in 1847, and, after various vicissitudes of his party, Prime Minister in 1857. Macdonald's most important work is connected with the federation of Canada. The French and the English provinces, previously independent, had been united under one Parliament in 1841, and during the next 25 years each party had both an English and a French leader. Ministries changed rapidly, and in 1864 there was a deadlock. This made necessary some wider union; and in that year a conference of delegates met at Quebec to consider the federation of British North America. Directed largely by Macdonald's tact and resource this conference led to the establishment of the Dominion of Canada in 1867, under the British North America Act, passed by the British Parliament. Macdonald became the first Prime Minister of the Dominion. At first there were only four provinces, but he carried through successfully the negotiations by which the Hudson Bay company ceded its interests in the northwest to Canada; he secured also the entrance of British Columbia on the condition of building rapidly a transcontinental railway. During an election in 1872 Macdonald accepted large sums for party purposes from Sir Hugh Allan, one of the chief projectors of the Pacific railway, and in 1873 owing to this "Pacific Scandal" he was forced to retire from office. In 1878 he again became Prime Minister with a policy of protection and he may be regarded as the father of that system in Canada. He remained Prime Minister until his death in 1891. The confederation of Canada, the acquisition by Canada of the Northwest, the building of the Intercolonial and the Canadian Pacific railways, and the policy of protection were all effected under Macdonald's lead. His brilliant intellect and ready wit made him a really great leader. In 1867 he was created K.C.B., in 1884 G.C.B., and on his death his widow was created Baroness Macdonald in her own right. Consult Pope's *Memoirs of Sir John A. Macdonald* (1894); Parkin, *Sir John A. Macdonald* in *Makers of Canada* (1908).

GEORGE M. WRONG,
Professor Emeritus of History, Univ. of Toronto.

McDONALD, John Bartholomew, American engineer and contractor: b. Ireland, Nov. 7, 1844; d. March 17, 1911. He was brought to the United States in 1847, and received his education in the public schools of New York. Among his successful undertakings may be mentioned the Fourth avenue improvement for sinking the New York Central Railroad tracks in New York City from 42d street to Harlem; West Shore Railroad from Weehawken to Buffalo; Baltimore and Ohio Railroad from Baltimore to Philadelphia; Illinois Central Railroad from Elgin, Ill., to Dolgeville, Wis.; the Georgian Bay branch of the Canadian Pacific Railroad; the Trenton "cut-off" of the Pennsylvania Railroad; the Baltimore Belt Railroad, which carried the great Baltimore and Ohio Railroad under the city of Baltimore, etc. He constructed the Jerome Park reservoir, New York City, one of the largest artificial storage reservoirs in the world. His greatest contract was for the construction, equipment, operation and maintenance of the Rapid Transit Railroad (the "Subway") in New York City.

MACDONALD, John Sandfield, Canadian statesman: b. Saint Raphael's, Canada, Dec. 12,

1812; d. Cornwall, Ontario, June 1, 1872. He was self-educated and admitted to the bar in 1840, practicing successfully in Cornwall. In 1841 he was elected to the Canadian Parliament as member from Cornwall. He was solicitor general in 1849–1851; and was speaker of Parliament in 1852–1854. During the brief Brown-Dorion administration in 1858 he served as attorney general, and was premier from 1862–1864. He was the first premier of the Province of Ontario, 1867–1871.

MACDONALD, Lucy Maud Montgomery, Canadian novelist: b. Clifton, Prince Edward Island, Canada, 1874; d. Toronto, Ontario, April 24, 1942. She was authoress of *Anne of Green Gables* (1908), which was described by Mark Twain as "the sweetest creation of child life ever written"; *Anne of Avonlea* (1909); *Anne of the Island* (1915); *The Watchman* (1916); *The Blue Castle* (1926); and *Jane of Lantern Hill* (1937).

MacDONALD, Malcolm, British statesman: b. Lossiemouth, Scotland, Aug. 17, 1901. He attended Bedales School, Petersfield, England, and afterward was graduated from Queen's College, Oxford. A Laborite, he entered the British House of Commons in 1928 representing the Bassetlaw Division of Nottingham. Two years later he entered the British ministry as parliamentary under secretary of state for Dominion affairs, and in 1935 he became a member of the Cabinet as secretary of state for the colonies—a post which he again held in 1938–1940. Meanwhile, in 1935–1938 he served as secretary of state for Dominion affairs, and again held the post in 1938–1939. He was made a privy councilor in 1935. In 1941 he was chosen to succeed Sir Gerald Campbell as British high commissioner to Canada, a position he held until 1946, when he was appointed governor general of Malaya and British Borneo. He has been commissioner general for the United Kingdom in southeast Asia since 1948.

MacDONALD, William, American journalist and historian: b. Providence, R. I., July 31, 1863; d. New York, New York, Dec. 15, 1938. He was graduated at Harvard in 1892, and was professor of history and economics at Worcester Polytechnic Institute, 1892–1893. He was professor of history and political science at Bowdoin, 1893–1901; was professor of history at Brown University, 1901–1917; on the editorial staff of *The Nation,* 1918–1931; and lectured on American history at Yale, 1924–1926.

He edited *Select Documents Illustrative of the History of the United States* (1898); *Johnston's High School History of the United States* (1901); *Documentary Source Book of American History* (1908); *Parkman's Oregon Trail* (1911). He was author of *Jacksonian Democracy* (1905); *A New Constitution for America* (1923); *The Intellectual Worker and his Work* (1923); *Three Centuries of American Democracy* (1923); and *The Menace of Recovery* (1934).

MacDONALD, Sir William Christopher, Canadian capitalist and philanthropist: b. Glenaladale, Prince Edward Island, Canada, 1831; d. Montreal, June 9, 1917. He early engaged in business in Montreal and achieved a large financial success as importer, merchant, and tobacco manufacturer. He was a director of the Bank of Montreal, chancellor of McGill University to which he contributed large gifts, and governor of Montreal General Hospital. He also served as president of the Legislative Council of Prince Edward Island. He founded the Macdonald Agricultural College, and made large gifts to the normal school at Ste. Anne de Bellevue, Quebec, and to the Ontario Agricultural College. He was knighted in 1898.

McDONALD, borough, Pennsylvania, in Allegheny and Washington counties; on the Mountour and Pennsylvania railroads; 18 miles southwest of Pittsburgh. McDonald is a coal mining and oil field community; a large coal washing plant is located near by. Pop. (1950) 3,543.

MacDONALD, Lake, lake, Australia, in the western part, 540 miles south of Wyndham. It is 12 miles wide and 20 miles long. During most seasons it is dry, but is surrounded with swamps.

MacDONELL, măk-dŏn'ĕl, **Alexander,** Canadian Roman Catholic prelate: b. Inverness, Scotland, July 7, 1762; d. Dumfries, Jan. 14, 1840. He was educated at the Scots College, Spain, entered the priesthood in 1787, and was for several years a missionary. He assisted in the organization of the Glengarry Fencibles and was their chaplain and in 1803 established for its disbanded members a colony in Glengarry County, Ontario, Canada. He also assisted in raising the Canadian regiment of Glengarry Fencibles, which was actively engaged in repelling the American invaders in the War of 1812–1814. In 1819 he was made vicar apostolic of Upper Canada and through his influence 48 parishes were established in Upper Canada. He was the first Roman Catholic bishop in Upper Canada, being consecrated bishop of Kingston, Feb. 14, 1826. He was called to the Legislative Council in 1831. He died in Scotland while on a mission to obtain funds for the founding of Regiopolis College, Kingston, and is buried in his episcopal city.

MacDONELL, măk-dŏn"l, **Arthur Anthony,** English Sanskrit scholar: b. Lochgarry, India, May 1, 1854; d. Dec. 28, 1930. He was educated at Göttingen and at Corpus Christi College, Oxford. He was teacher of German at Oxford, 1880–1899; and professor of Sanskrit in 1888–1899, after which he was Boden professor of Sanskrit there. He made a tour of study and research in India in 1907–1908, and in 1914 received the Campbell Memorial Gold Medal for Oriental Research from the Royal Asiatic Society of Bombay. He was keeper of the Indian Institute; and a fellow of Balliol College and of the Royal Danish Academy.

He was author of *Sanskrit-English Dictionary* (1892); *Vedic Mythology* (1897); *A History of Sanskrit Literature* (1900); *The Brhaddevatā,* translated and critically edited, 2 vols. (1904); *Vedic Grammar* (1910); *A Vedic Grammar for Students* (1916); and *India's Past . . .* (1927).

MacDONNELL, Antony Patrick, Baron MacDonnell of Swinford, British government administrator: b. March 7, 1844; d. London, England, June 9, 1925. He was educated at Queen's College, Galway, and entered the Indian Civil Service in 1865. He was appointed acting chief commissioner of Burma in 1889, chief commis-

sioner of the Central Provinces in 1891, acting lieutenant-governor of Bengal in 1893, and served on the council of the viceroy of India in 1893–95. He was lieutenant-governor of the Northwestern Provinces and chief commissioner of Oudh in 1895–1901, was a member of the Council of India in 1902, and Under Secretary of State in Ireland in 1902–08. He was created a baron in 1908.

McDONNELL, Charles Edward, American Roman Catholic prelate: b. New York, N. Y., 1 Feb. 1854; d. 8 Aug. 1921. He was educated at the De La Salle Institute and Saint Francis Xavier's College in New York and studied theology at the American College, Rome, Italy, where he received the degree of D.D., and was ordained priest by Bishop Chatard 18 May 1878. Returning to America the same year, he was appointed assistant at Saint Mary's Church, New York City, and in 1879 was transferred to Saint Patrick's Cathedral. On the death of Bishop Loughlin, Dr. McDonnell, who, at the time was Archbishop Corrigan's secretary, was named bishop of Brooklyn, being consecrated by Archbishop Corrigan 25 April 1892. At his invitation the Benedictine Fathers came from the Bahama Islands to establish themselves in his diocese, and the Redemptorists also made a foundation in Brooklyn. On the passage of the French law separating Church and State, Dr. McDonnell invited a number of French communities of men and of women to take up their residence in his diocese. He was spiritual adviser of the Catholic Benevolent Legion, and also honorary president of the International Catholic Truth Society.

McDONOGH, măk-dŏn'ō, **John,** American philanthropist: b. Baltimore, Md., 29 Sept. 1779; d. McDonogh, La., 26 Oct. 1850. He was educated at an academy in Baltimore and entered the mercantile business there, removing in 1800 to New Orleans, where he rapidly acquired great wealth. He was deeply interested in the problem of slavery and devised a system through which his slaves were enabled to earn their freedom; he educated those among them who desired it, and sent to Africa shiploads of those who had earned their freedom. He was president of the American Colonization Society and was a generous contributor to its support. The bulk of his fortune of more than $2,000,000 he bequeathed to the cities of New Orleans and Baltimore for the establishment of free schools. The will was adjudged valid after years of litigation and Baltimore established the McDonogh schools while New Orleans invested its portion of the bequest in its public schools.

MACDONOUGH, măk-dŏn'ō, **Thomas,** American naval officer: b. Newcastle County, Del., 23 Dec. 1783; d. at sea, 18 Nov. 1825. He entered the navy as midshipman in 1800 and in 1803 was attached to the frigate *Philadelphia,* one of the squadron employed against Tripoli. On 26 Aug. 1803 the *Philadelphia* captured off the coast of Spain the Moorish frigate *Mesboa* and MacDonough, being left at Gibraltar with the prize, escaped the subsequent capture which befell the officers and crew of the *Philadelphia.* In 1804 he participated in the various attacks made upon Tripoli and under Decatur assisted in the capture and destruction of the *Philadelphia,* 16 Feb. 1804. In 1810 he was furloughed and for a while commanded a vessel in the merchant service. On the outbreak of the War of 1812 he was for a time first lieutenant on the *Constitution,* and commanded for some months at Portland. In 1814 he had command of the squadron on Lake Champlain which gained an important victory at Plattsburg harbor over the British squadron commanded by Commodore George Downie. For his valuable services on this occasion he was promoted to the rank of captain, then the highest in the United States navy, and received from Congress a gold medal and an estate at Cumberland Head, near Plattsburg, from the Vermont legislature. He afterward held various commands, the last of which was on the *Constitution* in 1824, in which he made a cruise to the Mediterranean. Consult Babcock, K. C., 'Rise of American Nationality' (New York 1906).

MACDOUGAL, mak-doo'gal, **Daniel Trembly,** American botanist: b. Liberty, Ind., 16 March 1865. He was graduated at De Pauw University in 1890 and studied in Germany. In 1891–92 he was engaged in explorations in Arizona and Idaho for the United States government, and in 1893–99 was instructor in plant physiology at the University of Minnesota. He was appointed director of the laboratories of the New York Botanical Gardens in 1899, and after 1905 was director of the botanical research department of the Carnegie Institution. He was president of the American Society of Naturalists in 1910. Among his books are 'Nature and Work of Plants' (1900); 'Practical Text-book of Plant Physiology' (1902); 'Elementary Plant Physiology' (1902); 'Influence of Light and Darkness upon Growth and Development' (1903); 'Botanical Features of North American Deserts' (1908); 'The Water-Balance of Succulent Plants' (1910); 'The Condition of Parasitism in Plants' (1910); 'Organic Response' (1911); 'The Salton Sea' (1913); 'Growth in Trees' (1924).

McDOUGALL, Alexander, American soldier: b. Island of Islay, Scotland, 1731; d. New York, 8 June 1786. He emigrated with his father to America in 1755 and later became a merchant in New York. He devoted himself to the cause of the colonies and was imprisoned for a time for writing an address called 'A Son of Liberty to the Betrayed Inhabitants of the Colony.' At the outbreak of the Revolution he enlisted in the American army, serving as colonel, brigadier-general, and in 1777 was promoted major-general. He commanded at Long Island, White Plains and also attained distinction in the action at Germantown. He was elected member of the Continental Congress in 1781 and was for a time Minister of Marine. Re-elected in 1784–85 he served for a time and then resigned, preferring active service in the field. He was elected Minister of Marine and thereby became the first Secretary of the United States Navy. He was a member of the New York State senate at his death.

McDOUGALL, George Millward, Canadian pioneer missionary: b. Kingston, Ontario, 1820; d. Canadian North West, January 1876. He removed to Georgian Bay with his parents when a child, later studied at Victoria College.

and in 1850 entered the Wesleyan Methodist ministry. He was deeply interested in the welfare of the Indians, whose habits and character he knew thoroughly, and spent his life as a missionary among them. His field covered at different times a considerable portion of the Northwest Territory and his experience made him often a valuable aid to the government in dealing with Indian affairs. He made a tour of eastern Canada and visited New York and Great Britain in 1875. His career was suddenly ended by his death on the plains within a short distance of his camp. He is commonly reputed to have perished in a snowstorm; but his son, who was with him on the journey toward camp, ascribes the end to some unknown physical infirmity as the weather was favorable and his father a master woodsman. McDougall is among the most famous of the pioneer missionaries of Canada. Consult McDougall, J., 'George Millward McDougall, Pioneer, Patriot and Missionary' (Toronto 1888).

McDOUGALL, John, Canadian missionary, son of George Millward McDougall (q.v.): b. Owen Sound, Ontario, 27 Dec. 1842. He was educated at Victoria University, entered the Methodist ministry in 1866 and was ordained in 1872. He was reared among the Indians of the Georgian Bay and Lake Superior regions and before entering the ministry he taught school in the North Western Territory. As a clergyman his work was chiefly among the Indians, where his knowledge of their language and customs made his work unusually effective, and he was also able to render important services to the government in connection with Indian affairs. He was peace commissioner after the uprisings of 1869–70 and 1885. He was also closely associated with the treaties made with the Indians in his district. He was chairman of the Saskatchewan district in 1876 and of the Indian district in 1897. Author of 'A Cree Hymn Book' (1888); 'Forest, Lake and Prairie' (1895); 'Saddle, Sled and Snowshoe' (1896); 'In the Days of the Red River Rebellion' (1900); 'On the Western Trail in the Early Seventies' (1902). D. 15 Jan. 1917.

MacDOUGALL, Sir Patrick Leonard, British general and military author: b. Boulogne-sur-Mer, France, 10 Aug. 1819; d. Kingston Hill, Surrey, 28 Nov. 1894. He was educated at the military academies of Edinburgh and Sandhurst and received his commission as second lieutenant in 1836. He served as regimental officer with the Royal Canadian Rifle regiment at Toronto and at Kingston in 1844–54; served as superintendent of studies at Sandhurst the following year, and in 1855 was sent on a special mession to the Crimea. He was again superintendent at Sandhurst in 1856–58. He was appointed adjutant-general of the Canadian militia in 1865, took an active part in the suppression of the Fenian Raid of 1866 and received high commendations for his skilful organizing of the militia. In 1873–78 he was head of the intelligence branch of the War Office. He was again appointed to the command in Canada in 1878, at the time when relations were strained between England and Russia. He volunteered to organize a body of 10,000 trained soldiers for use whenever and wherever they might be needed, and the acceptance of his offer established the precedent of colonial military aid to the empire in time of need. He retired from active service in 1885. Author of 'The Theory of War' (1856); 'Modern Warfare as Influenced by Modern Artillery' (1864) 'The Army and Its Reserves' (1869), etc.

McDOUGALL, William, an Anglo-American psychologist: b. Lancashire, England, 1871. He studied at Owens College, Manchester, and at Oxford, Cambridge and Gottingen universities. In 1914, at the outbreak of the World War, he was reader in mental philosophy and fellow of Corpus Christi College, Oxford. During the war, he was attached to the medical service of the British army, and at its close returned to Oxford. In 1920 he was called to Harvard University to become head of the department of psychology. He remained there until 1927 when he accepted the chair of psychology at Duke University, Durham, N. C. His published works deal chiefly with the problems of national psychology which involve ethical theory, and cannot be discussed in terms of mere science. D. Durham, N. C., 28 Nov. 1938.

MacDOWELL, măk-dow'ĕl, **Edward Alexander,** American composer: b. New York 18 Dec. 1861; d. there, 23 Jan. 1908. MacDowell was Scotch-Irish by birth, if not by training and temperament. It was from his father, a man of pronounced artistic tastes, that the composer inherited or acquired that fine æsthetic sense and that highly sensitive artistic tendency which played so great a part in his life and practically determined the character of his work. MacDowell's musical education was begun at the age of eight, when Juan Buitrago, a friend of the family, gave him his first piano lessons. But not being at all precocious — MacDowell was no musical prodigy — his early progress was neither rapid nor encouraging. It was not until he came to receive instruction from the professional piano teacher, Paul Desvernine, with occasional supplementary lessons from the famous virtuoso, Teresa Carreño, that MacDowell's great musical gifts became manifest. Then, at the age of 15, the lad was taken abroad by his devoted mother for a thorough musical education. Entering the Paris Conservatory, young MacDowell studied for two years under the two eminent music masters Marmontel (piano) and Savard (theory and composition). Going next to Germany, he continued his musical studies at the Stuttgart and Frankfort conservatories, studying piano with Karl Heymann and composition with Joachim Raff, the well-known German composer. MacDowell's unusual talent so impressed both his German teachers that in 1881 they warmly recommended their American pupil for the university chair left vacant by Heymann's own resignation. Nothing but his extreme youthfulness (MacDowell was only 20 at the time) seems to have kept from him this much coveted Frankfort professorship. Failing of this, MacDowell accepted an instructorship at the Darmstadt Conservatory. But his duties as principal piano instructor there were so onerous and his compensation so inadequate that he soon had to resign from this position. Returning to Frankfort, MacDowell devoted himself to composition and private teaching.

It was there, at Frankfort, during his student days, that MacDowell's career as a composer really began. His 'First Modern Suite

for Piano' so impressed the great Liszt, whom MacDowell was induced by Raff to visit at Weimar in 1882, that he had it performed the same year at the Allgemeiner Deutscher Musikverein festival held at Zürich. A year later this suite and its successor, 'The Second Modern Suite,' were published by the famous Leipzig music publishers, Breitkopf and Härtel. Thus encouraged by his early success, and more especially by the sincere praise of Raff, Liszt and others, MacDowell resolved to settle in Germany permanently. And, save for a short visit to America in 1884 (when he married a former pupil of his, Marian Nevins), he did live there uninterruptedly for 12 years. In 1888 MacDowell returned to America and settled in Boston, which marks a turning point in his life. His European recognition, both as pianist and as composer, naturally had paved the way for his American successes. Almost immediately on his arrival MacDowell made his first public appearance in America in the double capacity of pianist and composer, performing one of his own compositions at a Kneisel Quartet concert (19 Nov. 1888). Shortly after he played his 'Second Piano Concerto' under Theodore Thomas at New York, winning such success with this composition and its performance that he soon repeated it with the Boston Symphony Orchestra. Thenceforth MacDowell's rise to fame was phenomenal. His services as pianist were in great demand — far greater than his virtuoso ambitions — while his orchestral compositions were performed almost as soon as they were written. Between 1890, when his symphonic poem, 'Lancelot and Elaine,' was performed by the Boston Symphony Orchestra, and 1896 when the same organization placed both his 'Indian Suite' and his 'Piano Concerto' on the same program — which was a most signal honor for a new composer — MacDowell's name appeared prominently and frequently on American orchestral programs. In 1891–92, too, he gave his first piano recitals which further enhanced his American fame. A couple of years later (14 Dec. 1894) MacDowell achieved unprecedented success by his performance, with the Philharmonic Society at New York, of his own 'Second Concerto for Piano and Orchestra.' By 1896, then, his name and fame as pianist and composer were fully established in America, if not also in Europe.

That year another important turning point in MacDowell's life was reached. Accepting the chair of music in the then newly-created music department at Columbia University, MacDowell plunged into teaching with such zeal and energy — devoting almost all his time and vitality to his arduous task — that eight years of it (1896–1904) was enough to undermine his health beyond repair. In 1905, one year after MacDowell had resigned his Columbia professorship (owing to a disagreement with the faculty as to the proper place of music in the college curriculum), alarming symptoms of a mental disorder appeared, which soon culminated in hopeless insanity. In this sad state MacDowell lingered till 23 Jan. 1908, when he died in New York, in his 47th year.

The list of MacDowell's compositions is a long one. His works extant (the composer himself, in a moment of ruthless self-criticism, destroyed a number of his compositions) include two suites for orchestra (the 'Indian Suites' Nos. 1 and 2), which are his most pretentious and best-known orchestral compositions; two concertos for piano and orchestra, which rank among the best of their kind; four sonatas for piano (the 'Norse,' the 'Keltic,' the 'Eroica' and the 'Tragica'), which alone would have made any composer famous; five symphonic poems ('Hamlet and Ophelia,' 'The Saracens,' 'Lamia,' 'Lovely Alda' and the 'Lancelot and Elaine,' already mentioned), which possess much originality and considerable melodic charm; two most delightful piano suites (the 'Woodland Sketches' and the 'Sea Pieces'), which contain some of MacDowell's most popular and fascinating shorter pieces, and numerous songs of charming simplicity and melodiousness.

As may be inferred from his musical titles, MacDowell is a romantic composer. His music is program music of the poetic, not the descriptive, kind; for MacDowell does not delineate objects, but rather the moods aroused by them. A pupil and disciple of Raff, MacDowell frequently gives his music the woodland flavor. Such titles as 'Forest Idyls,' 'New England Idyls' and 'Woodland Sketches,' among others too numerous to mention, clearly indicate that MacDowell is the Wordsworth of music. His lyrical pieces show the unmistakable influence of Grieg, whose music the American composer greatly admired; while as a romanticist he should be classed with Schumann and Mendelssohn. Consult Gilman, Lawrence, 'Edward MacDowell' (New York 1909), and Page, E. F., 'Edward MacDowell; His Work and Ideals' (ib. 1910).

McDOWELL, Ephraim ("FATHER OF OVARIOTOMY"), American surgeon: b. Rockbridge County, Va., 11 Nov. 1771; d. Danville, Ky., 20 June 1830. He studied medicine at Staunton, Va., and at the University of Edinburgh, then the most famous medical institution in the world. He established himself in practice at Danville, Ky., and became known throughout the Southern and Western States as the best surgeon in his part of the country. In 1809 he performed the hitherto unknown operation of extirpation of the ovary with complete success, and twice repeated the feat before he made an official report of the cases in 1816. His delay in reporting the first case and the seeming impossibility of the performance subjected him to considerable criticism in high quarters both at home and abroad. However, the fact of the success of the operation, several times repeated, is fully substantiated and the method he conceived and carried out has been but little modified, with the exception of asepsis and the use of anæsthetics. In lithotomy he had operated 22 times before 1828 without a fatality. Author of a report of his most famous cases in the *Eclectic Repertory and Analytic Review* (1817). Consult Gross, S. D., 'Origin of Ovariotomy' (1853); Jackson, J. B., 'Biographical Sketch of Ephraim McDowell' (1873); Letcher, J. H., 'Memoir of Ephraim McDowell' (1875).

McDOWELL, Irvin, American soldier: b. near Columbus, Ohio, 15 Oct. 1818; d. San Francisco, Cal., 5 May 1885. He studied at the College de Troyes, France, and was graduated at West Point in 1838. During the Canadian troubles he was stationed on the Niagara

and on the Maine frontiers, and in 1841 served at West Point as assistant instructor in tactics, becoming adjutant in 1845. In 1845 he went to Mexico as aide-de-camp to General Wood and for gallant conduct at Buena Vista in 1847 was promoted brevet captain, shortly afterward attaining the rank of assistant adjutant-general. Subsequently he was stationed at the War Department in Washington and in 1856 was raised to the rank of brevet major. He was on General Wood's staff at the outbreak of the Civil War and assisted in inspecting and organizing the volunteer troops at Washington. In May 1861 he was made brigadier-general of the volunteers and given command of the Army of the Potomac. Constrained by the impatience of the North, McDowell moved in July to meet the enemy and despite his carefully laid plan met a disastrous defeat at Bull Run, 21 July 1861, owing to the imperfect organization of his raw recruits. Shortly after McClellan was given command of the army and McDowell was retained at the head of one of its divisions. In 1862 he was promoted major-general of volunteers and placed in command of the First corps, which became the Army of the Rappahannock, stationed to guard Washington. In August 1862 he received command of the Third corps of the Army of Virginia and fought under General Pope at the battles of Cedar Mountain, Rappahannock Station and the second battle of Bull Run, where he performed especially good service. He was removed from the field in September 1862. Considering this action of the War Department a direct reflection upon his military services, he asked for an investigation, the result of which was favorable to him. From May to July 1863 he was president of a board appointed to investigate alleged cotton frauds, and during the following 10 months presided over the board for retiring disabled officers. In July 1864 he was placed in command of the Department of the Pacific Coast, and in March 1865 was made brevet major-general in recognition of his gallant services at Cedar Mountain. In 1872 he succeeded General Meade as major-general in the regular army and was in command of various military departments until 1882, when he was retired. The last years of his life were spent in California.

McDOWELL, James, American statesman: b. in Rockbridge County, Va., 1796; d. 1851. He was graduated at Princeton in 1817; in 1831 was elected to the Virginia legislature; was governor of that State, 1842–44, and from 1847 to 1851 represented it in Congress. He favored the gradual abolition of slavery, although advocating the claim of State rights. As orator and debater in Congress he bore a prominent part in the proceedings of that body leading up to the Compromise of 1850.

McDOWELL, William Fraser, American M. E. bishop: b. Millersburgh, Ohio, 4 Feb. 1858; d. 26 April 1937. He was educated at the Ohio Wesleyan and Boston universities and was ordained in the Methodist ministry in 1882. He held pastorates at Lodi, Oberlin and Tiffin, Ohio, and in 1890–99 he was chancellor of the University of Denver. He was corresponding secretary of the board of education of the Methodist Church in 1899–1904 and was elected bishop in 1904. He was Cole lecturer at Vanderbilt University in 1910, served as international commissioner of the Y. M. C. A. after 1899 and from 1906 was president of the board of trustees of Northwestern University. He made an official tour of India, China, Japan and the Philippines in 1910–11. Author of 'In the School of Christ' (1910); 'Good Ministers of Jesus' (1917); 'Making a Personal Faith' (1924).

MACDUFF, măk-dŭf', Scottish thane, or Earl of Fife, a half-mythical personage, commemorated in Shakespeare's play, 'Macbeth.' He is said to have been the principal agent in the overthrow of the usurper Macbeth and the restoration of Malcolm Canmore to the throne of Scotland. For this he was granted many privileges, among them that of a place of refuge to which he and his descendants could flee in case of committing unpremeditated murder. This sanctuary, in the form of a cross, stood till 1559, near Newburgh in Fife, in the pass leading to Strathearn. It was then demolished by the Reformers, but its pedestal yet remains.

McDUFFIE, măk-dŭf'i, **George,** American statesman and orator: b. in Columbia (now Warren) County, Ga., 1788; d. in Sumter District, S. C., 11 March 1851. He was graduated at South Carolina College in 1813, admitted to the bar in 1814 and in 1818 elected to the South Carolina legislature. From 1821 to 1834 he was a member of Congress, and from 1834 to 1836 governor of South Carolina. In 1843 he took his seat in the United States Senate, resigning on account of impaired health in 1846. In his political views and in his Congressional career, he was a close follower of J. C. Calhoun (q.v.), being at the outset a liberal constructionist in constitutional questions, but afterward becoming a strong opponent of the tariff and other economic policies of the government, and also a bold advocate of nullification. Although a supporter of Andrew Jackson (q.v.) in 1828, he became bitterly antagonistic to him, not only in respect to the tariff and State rights, but especially so on the question of the United States Bank, which, as chairman of the Committee on Ways and Means, he strongly defended against the hostile policy of the President. In 1832, as a member of the South Carolina Nullification Convention, he drafted the address of South Carolina to the people of the United States. He was one of the ablest orators of his day, and his prominence in public affairs was maintained in spite of an early wound received in a duel, from which he suffered for the remainder of his life.

MACÉ, Jean, zhŏn mä-sā, French educator and writer: b. Paris, France, 22 April 1815; d. there, 13 Dec. 1894. He was educated at the Collège Stanislas, served in the French army, 1842–45, was editor of *La République* in 1848 and as such was a strong supporter of the Revolution of that year. In 1851, on the *coup d'état,* he had to withdraw from Paris, and subsequently taught school in Alsace for 10 years. In 1866 he founded a league of instruction in the Belgian manner. He was decorated with the Legion of Honor in 1880, and elected senator in 1883. He was the author of many popular books for young people, the aim of which was mainly educational, among them his best-known work, 'Contes de petit-chateau' (1862), called in the English translation 'Home Fairy Tales'; 'History of a Mouthful of Bread' (1861);

'Servants of the Stomach' (1866); 'France Before the Franks' (1881).

MACE (Lat. *macir*, Greek *μάκερ*, an East Indian spice), an aromatic spice made from the arillode or false aril which covers the seed of a nutmeg (*Myristica fragrans*). The yellow external covering of the nutmeg (q.v.) being removed, the red, rather fleshy, arillode which partially conceals the nutmeg is encountered. After drying in the sun for several days this becomes more or less translucent and usually orange yellow and waxy. In this form it is largely exported from the Spice Islands, where it is native, and from the West Indies, where it has been introduced into cultivation. The powerful but agreeable nutmeg-like odor and flavor characteristic of it are due to a volatile oil which is obtained by distillation for use in perfumery and culinary articles. A buttery fixed oil obtained by expression is used after the admixture of the volatile oil under the names nutmeg balsam and nutmeg butter. White mace is obtained from *M. otoba* and red mace from *M. tingens;* also a low grade from *M. fatua,* but this is rarely found in the market. Mace is also largely used whole or ground in cookery.

MACE, a weapon of war formerly in use in Europe, chiefly among the cavalry, as late as the 16th century, and still used among savage tribes. It consists merely of a staff about five feet long, with a knob at the end. In England the mace is used as an emblem of the officers of state, before whom it is carried. It is made of the precious metals, or of copper, gilt and ornamented. A mace is also carried by the Sergeant-in-Arms of the House of Representatives and it is placed to the right of the Speaker.

MACEDO, Joaquim Manoel de, hō-ä-kēn' mä'noo-el dā mä-sā'dō, Brazilian poet, novelist and statesman: b. Sao João d'Itaborahi, 24 June 1820; d. Rio de Janeiro, 11 April 1882. He studied medicine, but presently began to write and became professor of national history in the College of Dom Pedro at Rio de Janeiro. He was one of the most prominent of Brazilian authors in the 19th century, and being keenly interested in politics was elected to the Brazilian Chamber in 1854. His works include 'Moreninha,' a novel (1844; 5th ed., revised, 1877); 'O Moço Louro,' a novel of the early stages of the Portuguese conquest (1845); 'O Dous Amores' (1848); 'Vicentina' (1853); 'A Nebulosa,' a poem (1857), his greatest work, consisting of six cantos in unrhymed hendecasyllables; 'Cobé,' a drama; 'Fantasma Branco,' a comedy (1856); 'Nociones de cronografía do Brasil' (1873; translated into French by Halbout), etc.

MACEDO, José Agostinho de Padre, Portuguese poet and author: b. Beja, 1761; d. 1831. He received his education in Latin and rhetoric under the Oratorians at Lisbon and became a member of the Augustinian Order in 1778. Temperamentally unfitted for a monastic life he failed to conform to the discipline of the order and in consequence was imprisoned in one convent or another the greater share of the time. He eventually abandoned the monastery and his subsequent excesses caused him to be unfrocked in 1792. Intercession on the part of influential friends, however, secured for him a papal brief which secularized him but restored his ecclesiastical status. He then entered journalism and his preaching gained for him a foremost position among the orators of his day. In 1802 he was appointed a court preacher. He established and contributed to a large number of journals and was famous for his keen satire and wit, although he also gained the reputation of being the "chief libeller of Portugal." He was a staunch adherent of absolutism and seriously advocated the massacre of all opponents of Miguel. He was censor of books in 1824–29, when he resigned upon being threatened with proceedings by his own political party, his support having become harmful to its interests. He had gained a considerable reputation through his verse, which introduced into Portugal didactic and descriptive poetry, and his 'Meditation' (1813) was a notable production. His ambition then led him to covet the place held by Camoens as Portugal's leading poet, and in 1814 he published 'Oriente', for which he unwisely chose the subject of Camoens' 'Lusiads,' the discovery by Gama of the sea route to India. While the verse itself was not without strength and grace the epic, as a whole, was flat and insipid, and failed utterly to cause its author to outshine Camoens. Macedo then published his 'Censura dos Lusiados,' in which he bitterly attacked Camoens, and brought upon himself Bocage's scathing 'Pena de Talião.' His 'Os Burros' is no less pitiless in its betrayal of his own evil character than shameless in its excoriation of men and women in all grades of society, living or dead. He translated the 'Odes' of Horace and made several attempts at drama but these are not particularly notable. He was at his best in his odes to Wellington and to Alexander, and in the verse in his 'Lyra anacreontica.' There is some doubt concerning 'A Demonstration of the Existence of God' as being from his pen, but it is usually credited to him and shows high ability. He was notorious for his ingratitude, and merciless in his satire, but he died with many friends and a great reputation, although his fame was of brief duration. Consult T. Braga's edition of 'Memorias para la vida intima de José Agostinho de Macedo' (1899); 'Cartas e opusculos' (1900).

MACEDONIA, măs-ē-dō'nĭ-ȧ, a territory in the Balkan Peninsula (q.v.). Never having had a separate existence as a political or administrative unit in modern times, it has no precisely defined boundaries. The territory generally considered to be within Macedonia (approximately 25,000 square miles) is bounded on the east by the Mesta River and the Rhodope Mountains, on the north by the Rila Mountains and the Crna Gora, on the west by the Shar Mountains and the Ohrid-Prespa lake district, and in the south by the Vistritsa (Haliakmon) River and the Aegean Sea. It is a mountainous area except in its southern and eastern sectors, which are the most productive agricultural lands in modern Greece. The strategic significance of Macedonia has been great throughout the course of history, for it is crossed by two major European trade routes which link the Aegean Sea with central Europe and with the Adriatic. These routes meet near the mouth of the Vardar River at the port of Salonika (Thessalonike)

the only large city in Macedonia. It is the natural commercial port for the trade of a large part of the Balkan Peninsula. In the low-lying areas of eastern and southern Macedonia near Salonika the chief crops are cereals and tobacco, of which a considerable surplus is produced for consumption outside Macedonia. In the northern and western parts the climate and the economy are like those of the neighboring areas of the central Balkan Peninsula; crop yields, principally cereals, are low and living standards are near the subsistence level.

In ancient times Macedonia was a monarchy which had its beginnings in the coastal area at the head of the Thermaic Gulf, now the Gulf of Salonika (Thermaikos). King Philip II of Macedonia in the 4th century B.C. extended his kingdom to include all the territory now known as Macedonia, including the Peninsula of Chalcidice (Khalkidike). The district which he conquered from Thrace, lying between the Strymon (Struma) and the Nestos (Mesta) rivers was called *Macedonia adjecta*. Under Philip and his son, Alexander the Great, Macedonia conquered all of Greece and then the greater part of the civilized world. After Alexander's death in 323 B.C., the immense Macedonian Empire was divided; in 197 B.C., after a resounding defeat in battle by the Romans, Macedonia lost even its dominion over Greece and returned to its ancient limits. After further military defeats it became a Roman province in 146 B.C. As such it is mentioned in the New Testament, and Saint Paul's letters to the Thessalonians and Philippians are addressed to Macedonian Christians. In 395 A.D. Rome lost possession of Macedonia and it became a part of the Byzantine Empire, which held it, except for intervals when it fell under the control of the Bulgars and the Serbs, until the conquering Ottoman Turks wrested it from the feeble Byzantine emperors in the 14th and 15th centuries.

The earliest known inhabitants of Macedonia stemmed from two major groups, the Thracians and Illyrians, apparently with a large admixture of Dorians. Migrations during the course of the Middle Ages completely changed the character of the population. By the time of the Turkish conquest the original inhabitants had been pushed out or absorbed by the masses of Slavs who settled in Macedonia. The province had become predominantly Slavic except in the coastal area where Greeks had established themselves. These two groups have remained the basic elements in the population. Minor elements which setttled there at various times and are there today include the Albanians, who filtered into Macedonia from the west; Kutzo-Vlachs, who speak a dialect of Rumanian and are principally a shepherd people; Turks, who formed the privileged class during the period of Ottoman rule and owned much of the land; gypsies; and Spanish-speaking Jews, concentrated in Salonika, whose forbears found refuge in the tolerant Ottoman Empire after their expulsion from Spain. Although the number of nationalities present in Macedonia has added to the complexities of the Macedonian «problem,» the basic factors in it have been the antagonism between Slavs and Greeks and the dispute between Serbs and Bulgarians over the Macedonian Slavs. Until the rise of nationalism in the 19th century these conflicts did not arise in acute form. Then, however, Serbian, Bulgarian, and Greek nationalists began to stake out conflicting claims to Turkish territory. The Macedonian Slavs, claimed as blood brothers by both Serbs and Bulgarians, numbered approximately 1,150,000, about one half the total population of Macedonia. In language they were neither Serbs nor Bulgarians but were closely related to both. By 1870, however, their linguistic and cultural ties were much closer with Bulgaria, which like Macedonia was still under Turkish administration, than with Serbia, which enjoyed political autonomy. In that year the Bulgarians secured the establishment at Constantinople of an autonomous Bulgarian Orthodox Church, or Exarchate, the jurisdiction of which extended to Macedonia. The treaty of San Stefano, which was forced on defeated Turkey by Russia in 1878, provided for the inclusion of Macedonia within the boundaries of an autonomous Bulgarian principality. The Treaty of Berlin in the same year revised that settlement and left Macedonia under direct Turkish rule with a promise of reforms which were to improve the lot of the population. Since that time Bulgaria has regarded Macedonia as lost national territory which must be regained. During the decades following the Treaty of Berlin the Turkish administration in Macedonia went from bad to worse, and the neighboring states (Bulgaria, Serbia, and Greece) engaged in bitter rivalry to win the allegiance of the Macedonian population by propaganda and by more violent methods. In 1893 the Internal Macedonian Revolutionary Organization (I.M.R.O.) was founded at Resan in Macedonia with a program of independence. Shortly afterward a Supreme Macedonian Committee was formed in Bulgaria with a program of liberating Macedonia from the Turks and annexing it to Bulgaria. These organizations hoped that the disorder they were helping to create in Macedonia would provoke Turkish reprisals against the population and thus would force the European powers to intervene. In 1902–03 a widespread insurrection broke out and was brutally crushed by the Turks. Thereupon Russia and Austria, the two great powers most directly interested, drew up a scheme of reforms (1903) which Turkey was forced to accept. It provided for the inspection and supervision of certain aspects of the administration by representatives of the European powers. This scheme never functioned efficiently, partly because the neighboring Balkan States, desirous of a more drastic solution of the problem, did not intend that it should. In 1912 they formed a military alliance and attacked Turkey with the aim of eliminating the Ottoman power from the soil of Europe. In this they were nearly successful; they defeated the Turkish armies, overran Macedonia, Albania, and a part of Thrace, but could not agree over the division of the Macedonian spoils. The Greeks, who had occupied Salonika, and the Serbs, who had taken over most of the remainder of Macedonia, joined to defeat the Bulgarians in the Second Balkan War in 1913 and divided the disputed territory between themselves, leaving only a small corner of it to Bulgaria. This settlement was confirmed by the Treaty of Bucharest (1913). (See BALKAN LEAGUE; BALKAN WARS.) Bulgaria's entry into the First World War in 1915 on the side of the Central Powers was in part motivated by the desire to acquire Macedonia. When the Serbian Army was driven to the Adriatic coast in that

same year, the Bulgarians occupied Serbia's share of Macedonia and held it until the victory of the Allies in 1918. The Salonika front was the scene of the great Allied breakthrough which knocked Bulgaria out of the war and made untenable Germany's entire position in the southeast. The territorial settlement of 1919 restored, with some slight modifications, that of 1913. Yugoslavia and Greece were confirmed in possession of all of Macedonia except the Petrich district which remained in Bulgaria. During the 1920's, as a result of exchanges of populations between Greece and Turkey and between Greece and Bulgaria, Greek Macedonia became over 90 per cent Greek in population. It presented a far less acute problem than Yugoslav Macedonia which contained over 650,000 Slav inhabitants whom Bulgaria claimed as Bulgarians but whom Yugoslavia officially designated as «South Serbians.» Severe treatment of this population by the Yugoslav government, coupled with terroristic outrages and the violation of the frontier on the part of bands organized on Bulgarian soil, made normal relations between the two countries very difficult. In Macedonia itself there were partisans of Bulgaria, of Yugoslavia, and of the idea of an independent Macedonia which had persisted since the early days of revolutionary activity against the Turks. Some of the tension was removed from the Macedonian question after the Bulgarian government broke up the terroristic Macedonian organization in Bulgaria in 1934 and signed a treaty of friendship with Yugoslavia in 1937. However, Bulgaria did not hesitate to occupy Yugoslav Macedonia when Germany crushed the Yugoslav Army in 1941 and to treat it as liberated Bulgarian territory. At the same time Bulgaria occupied the eastern part of Greek Macedonia between the Struma and Mesta rivers and began to resettle Bulgarians there. Having made these territorial gains with German aid, Bulgaria was reluctant to give them up and remained loyal to its alliance with Germany long after German military fortunes began to decline, partly because it saw no chance at all to maintain the new «Greater Bulgaria» in the event of a United Nations victory.

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MACEDONIAN, The. See UNITED STATES AND MACEDONIAN, BATTLE OF.

MACEDONIANS, followers of Macedonius, author of the Macedonia heresy; also called Pneumatomachi, or «Adversaries of the Spirit.» The Macedonians came into existence toward the decline of the Arian controversy, when Macedonius became patriarch of Constantinople (341), and taught that the Holy Ghost was «subordinate to the Father and to the Son, unlike to them in substance, and a creature.» He was a semi-Arian; was deposed by the Arians in 360; and his special tenets condemned at the Council of Constantinople in 381. In that council the clauses defining the nature of the Holy Ghost were added to the Nicene Creed.

MACEIÓ, mä-sā-yō', Brazil, formerly MAÇAYO, city and capital of the state of Alagôas, on the Atlantic Coast, 135 miles southwest of Pernambuco. The city has a cathedral, lyceum, government and other buildings. It has manufactures of machinery and cotton goods, and considerable ship-building is carried on here. Cotton, sugar and rum are the chief items of export. Maceió is the seat of a United States consular agent. Pop. 129,000.

McENTEE, Jervis, American painter: b. Rondout, N.Y., 14 July 1828; d. there 27 Jan. 1891. He made his first contribution to the American Academy of Design in 1853, was elected associate of that institution in 1860 and academician in 1861. He belonged to the «Hudson River School» of artists and his favorite subject was the autumn type of landscape, although his work is by no means confined to one phase or season. Among his paintings are *The Melancholy Days Have Come* (1860); *Sea From Shore* (1873); *Old Mill in Winter* (1874); *Clouds* (1879); *Glimpse of Hunter Mountain* (1886); *A Cliff in the Catskills* (1888). His *Autumn Landscape* hangs in the Metropolitan Museum, New York.

MACEO, mä-sā'ō, **Antonio,** Cuban patriot: b. Santiago de Cuba, 14 July 1848; d. near Mariel, 2 Dec. 1896. He joined the insurgent army as a private in 1868, and his natural military ability and personal magnetism as a leader soon brought him to the front, making him second only to Gomez. Under his skillful leadership Martinez Campos was defeated at Demajayabo and at La Galleta; his campaign in Baracoa in 1878 evidenced masterly generalship, as did also his utter rout of Santacledes at San Ulpiano. Maceo alone of all the Cuban generals refused to sign the Peace of Zanjón and made a tour of the United States and other countries in America seeking support for the cause of Cuban independence. He was the first of the Cuban leaders to land in 1895, and his achievements in the campaign are among the most brilliant feats in the history of Cuba's long struggle for independence. While crossing the trocha between Majana and Mariel, attended only by his staff, he was surrounded by a Spanish force and killed.

MACEO, José, hō-sā, Rafael, Cuban patriot: b. Santiago de Cuba, 1846; d. La Loma del Gato, Cuba, 5 July 1896. He was a brother of Antonio Maceo (q.v.) and took a conspicuous part in the Rebellion of 1868–78. He remained in Santiago de Cuba after the Peace of Zanjón, which he with his brother refused to sign. He lived in Costa Rica from 1885 until the outbreak of the rebellion in Cuba in 1895, when he raised a large force which he commanded with signal success. He was killed in a furious engagement at La Loma del Gato in which the Cubans were finally victorious. For an adequate account of the importance of the Maceo brothers consult General Weyler's *Mi Mando en Cuba, 10 Febrero 1896 a 31 Octubre 1897* (5 vols., Madrid 1910–11).

MACERATA, mä-chā-rä'tä, central Italy, an episcopal city, capital of the province of the same name, picturesquely situated on an eminence, 1,207 feet high, between the Apennines and the sea, 21 miles south of Ancona. It is encircled by walls, pierced by six gates, has a cathedral, provincial palace and theatre on the central public square, town-hall (13th century), a college founded in 1290, museum, etc. Terra cotta, chemicals and matches are among its manufactures. Pop. of commune

(1943) 26,708. The province is watered by the Chienti and Potenza rivers which flow eastward into the Adriatic. The coastline, lying chiefly between the mouths of these two rivers, is about 12 miles long. The province is mountainous in the west; the rest is hilly, except for flat strips along the rivers and the coast. The raising of grains, grapes and livestock are the chief activities. Area 1,071 square miles; pop. (1947 est.) 303,000.

MacEWEN, măk-ū'ĕn, **Walter,** American artist: b. Chicago, Feb. 13, 1860; d. New York, March 20, 1943. He studied under Cormon and Tony Robert-Fleury in Paris, and lived much abroad. His work includes landscapes, portraits, decorative panels and figure subjects, and is marked by excellent sense of line and strong feeling for color. He executed panels for the Liberal Arts Building at the Columbian Exposition, Chicago, and for the Congressional Library, Washington, and many of his paintings have been acquired by public galleries. Among them are *Sunday in Holland* (in the Luxembourg Museum, Paris), *An Ancestor* (Corcoran Gallery, Washington), and *Judgment of Paris* (Art Institute, Chicago).

MACEWEN, măk-ū'ĕn, Sir **William,** Scottish surgeon: b. Rothesay, June 22, 1848; d. Glasgow, March 22, 1924. He was educated at Glasgow University, and became regius professor of surgery there in 1892; president of the British Medical Association in 1922; knighted, 1902. He was noted as a pioneer in the surgery of the brain and spinal cord and in the field of bone grafting. Among his works are *Osteotomy* (1880); *Atlas of Head Sections* (1893); *Pyogenic Diseases of the Brain and Spinal Cord* (1893); and *The Growth of Bone* (1912).

McFARLAND, măk-fär'lănd, **John Horace,** American master printer and horticulturist: b. McAlisterville, Pa., Sept. 24, 1859; d. Harrisburg, Pa., Oct. 2, 1948. He was privately educated, learned the printing business and in 1878 established his own firm, which after several changes was incorporated as the J. Horace McFarland Company in 1891. He was an active member of various leagues for improving and beautifying American cities and towns, and an ardent advocate of national parks and forest conservation. Besides the many periodicals which he printed, illustrated, or wrote for, he was editor of *The American Rose Annual* from 1916 to 1943, and author of *Photographing Flowers and Trees* (1902); *Laying out the Home Grounds* (1915); *My Growing Garden* (1915); *The Rose in America* (1923); and *Roses of the World in Color* (1936).

MACFARREN, Sir **George Alexander,** English composer: b. London, March, 2, 1813; d. there, Oct. 31, 1887. He was educated at the Royal Academy of Music, where in 1837 he became a professor of harmony and composition and in 1875 principal. In the same year he was elected professor of music in Cambridge University. Among his compositions are the operas *The Devil's Opera* (1838), *Robin Hood* (1860), and the oratorios *St. John the Baptist* (1873) and *King David* (1883). He also wrote several treatises, among them *Harmony* (1860) and *Counterpoint* (1879). He was knighted in 1883. In 1860 he became blind, and his wife thereafter wrote his compositions from his dictation.

MAC FLECKNOE, or A SATYR UPON THE TRUE-BLEW-PROTESTANT POET, T. S., a satire by John Dryden (q.v.), published in 1682 to ridicule Thomas Shadwell, who later replaced him as poet laureate (1689). Dryden here introduced the name of Richard Flecknoe (1600–?1678), who by the author is represented as an Irish priest famed for his dull verse, but who is described by Andrew Marvell as "an English priest at Rome." Flecknoe was disliked by Dryden because of the former's abuse of actors and his attacks on their morality or rather absence of it. The name served also as a stalking-horse from behind which Shadwell might be pilloried as the "adopted" son (Gaelic *Mac*) and heir of Flecknoe. The satire served Pope as model for his *Dunciad.* The authorship of *Mac Flecknoe,* long disputed and attributed to Dryden, was called in question in 1918 when there appeared a possibility that it might have been written by John Oldham, Dryden's friend. A manuscript of the latter's poems in the Bodleian Library contains *Mac Flecknoe,* but Dryden claimed authorship of the piece and his friend Oldham never did.

MacGAHAN, mà-găn', **Januarius Aloysius,** American journalist: b. near New Lexington, Ohio, June 12, 1844; d. Istanbul, June 9, 1878. He followed different callings in Western states, then went to Europe and studied law in Brussels. Upon the outbreak of the Franco-Prussian War in 1870 he went to the field as correspondent of the New York *Herald,* and was with Bourbaki's army. He visited Bordeaux and Lyon and his interviews with clerical, monarchical and republican leaders attracted wide attention. He was the only newspaper correspondent in Paris during the whole period of the Commune and narrowly escaped death. In 1873, after heroic exertions, with extreme hardships, he reached the Russian army before Khiva, and sent to the *Herald* reports of the campaign which won for him high admiration both at home and in Europe, his account of the capitulation of the city being regarded as a masterpiece of military journalism. Returning to America, he went to Cuba to report on the *Virginius* affair, then to Spain, upon the Carlist uprising, where he spent 10 months with the army of Don Carlos, was captured by the Republicans, mistaken for a Carlist, condemned to death and saved by the intervention of the United States minister. He then went to England, and in 1875 accompanied the Arctic expedition on the *Pandora.* In 1876 he joined the Turkish Army, in the service of the London *Daily News,* and did memorable work in his description of the Bulgarian atrocities, his accounts standing approved before the world in face of all attempts to discredit them. On behalf of Bulgaria he appealed to Russia, was at the front in the Russo-Turkish War that followed, and was hailed as a chief instrument of Bulgaria's resulting independence. While nursing his friend Lieut. Francis V. Greene he contracted typhus which in a few days caused his death. In 1884 the Ohio legislature secured the removal of his body from its foreign grave to its final resting place at New Lexington. He wrote *Campaigning on the Oxus, and the Fall of Khiva* (1874); *Under the Northern Lights*

(1876), and *Turkish Atrocities in Bulgaria* (1876).

McGEE, mȧ-gē′, **Thomas D'Arcy,** Irish-Canadian journalist and statesman: b. Carlingford, Ireland, April 13, 1825; d. Ottawa, Ontario, April 7, 1868. In 1842 he emigrated to the United States, but having attracted the notice of Daniel O'Connell, he went to London as a correspondent of the *Freeman's Journal* and, later, the *Nation,* an organ of the Young Ireland party. The failure of the revolt of his party caused him to seek refuge in the United States in 1848. McGee then founded and edited the New York *Nation* and, soon after, the *American Celt* at Boston. In 1857, however, having become converted to constitutional methods for the redress of Irish grievances, he went to Montreal where he edited *The New Era,* advocating the creation of a Canadian nation. He entered Parliament in 1857; was president of the council, 1862–1863; and minister of agriculture, 1864–1868; living to see the confederation which his eloquence and persuasiveness had done much to popularize. His opposition to the extremists of the Fenian Brotherhood is believed to have been the cause of his assassination. Among his works are *A History of the Irish Settlers in North America* (1851); *Speeches and Addresses, Chiefly on the Subject of the British American Union* (1865); and *A Popular History of Ireland,* 3 vols. (1862–1869).

McGEE, William John, American scientist: b. near Farley, Iowa, April 17, 1853; d. Washington, D.C., Sept. 4, 1912. He was self-educated, and from 1873 to 1875 surveyed land and practised in the courts. He also improved several agricultural implements, some of which he patented. In 1877–1881 he made geologic and topographic surveys of northeastern Iowa, and for the United States Geological Survey he surveyed and mapped 300,000 square miles in the southeastern part of the country, and performed many other important services in the departments of geology, ethnology and anthropology. From 1893 to 1903 he was ethnologist in charge of the Bureau of American Ethnology. He was president of the American Anthropological Association, chief of the Department of Anthropology and Ethnology of the Louisiana Purchase Exposition and associate editor of the *National Geographic Magazine.* He wrote *Geology of Chesapeake Bay* (1888); *Pleistocene History of Northeastern Iowa* (1891); *The Lafayette Formation* (1891); *Potable Waters of the Eastern United States* (1894); *The Siouan Indians* (1897); *Primitive Trephining in Peru* (1897); *The Seri Indians* (1898); *Primitive Numbers* (1900); *Soil Erosion* (1911); *Wells and Subsoil Water* (1913), and many scientific memoirs.

McGIFFERT, mȧ-gĭf′ẽrt, **Arthur Cushman,** American theologian: b. Sauquoit, N. Y., March 4, 1861; d. Dobbs Ferry, N. Y., Feb. 25, 1933. He was graduated at the Western Reserve College in 1882, and at Union Theological Seminary in 1885, and continued his studies at the universities of Berlin and Marburg, Germany, and in France and Italy. In 1888–1890 he was instructor in church history at Lane Theological Seminary, Cincinnati, and professor there 1890–1893, in 1893–1927 he was professor of church history and in 1917–1926 president of Union Theological Seminary, New York. In 1897 he published *A History of Christianity in the Apostolic Age,* and because of criticism and threatened denominational disturbance, involving his possible trial for heresy, to which this book gave rise, he withdrew from the Presbyterian ministry, and later, while still retaining his professorship, joined the Congregational Church. His other publications include *Dialogue Between a Christian and a Jew* (doctor's thesis, 1888), and a translation of Eusebius' *Church History,* with prolegomena and notes (1890); *The Apostles' Creed* (1902); *Protestant Thought Before Kant* (1911); *Martin Luther, the Man and his Work* (1911); *The Rise of Modern Religious Ideas* (1915); *The God of the Early Christians* (1924); *A History of Christian Thought,* 2 vols. (1931–1932).

McGIFFIN, mȧ-gĭf′ĭn, **Philo Norton,** American naval officer: b. Washington County, Pa., Dec. 13, 1860; d. New York, Feb. 11, 1897. He was graduated in 1882 at the United States Naval Academy and was stationed in China, and at the outbreak of the war between China and France was permitted to resign from the United States Navy to enter the service of China. He established a naval academy at Weihaiwei, of which he had charge. When the Sino-Japanese War broke out he was placed in command of the *Chen Yuen,* and was the first American or European to command a modern warship in action. He was in command at the Battle of Yalu River, Sept. 17, 1894, in which action he was so severely injured that he afterward shot himself at a hospital in New York.

McGILL, mȧ-gĭl′, **James,** Canadian philanthropist: b. Glasgow, Scotland, Oct. 6, 1744; d. Montreal, Dec. 12, 1813. He was educated in Glasgow and in 1770 moved to Canada, where he engaged in the northwest fur trade, afterward becoming a merchant in Montreal. McGill was a member of the Parliament of Lower Canada and held the rank of brigadier general in the War of 1812. He used much of his wealth in philanthropic work and at his death founded McGill University (q.v.) in Montreal.

McGILL UNIVERSITY, Montreal, Canada, founded through a bequest of the Honorable James McGill, a leading merchant and prominent citizen of Montreal who died in 1813 and in his will left money for a university "for the purpose of education and advancement of learning." In 1821 the university was established, by a royal charter granted by the crown of the United Kingdom, and to this day the governor general of Canada is ex officio the visitor of the university.

The McGill campus is situated in the heart of the great Canadian metropolis, with a compact group of buildings housing the various faculties and schools, the stadium, gymnasium-armory-swimming pool, libraries, laboratories and research institutes, and the adjacent Royal Victoria Hospital, one of the teaching hospitals of the university. Its first building was erected on the land given by James McGill which was a farm on the outskirts of the city, but in the intervening century and a half the city grew up around the university property, so that in 1950 the value of the buildings and grounds was close

to $50,000,000. However, Macdonald College, on a separate campus twenty miles from Montreal, houses the faculty of agriculture, the school of household science and the school for teachers, and was provided and generously endowed in 1907 by another leading merchant and philanthropist of Montreal, Sir William Macdonald. This part of the university is a residential college which houses more than 800 students.

The campus in Montreal comprises Douglas Hall and Wilson Hall, men's residences, and the Royal Victoria College for women students. Actually, however, only a small proportion of the students of the university live in residence, the majority finding homes in the city.

Many generous benefactors have made possible the great development of this Canadian university, one of the few privately endowed institutions. Situated in the French Canadian Province of Quebec, it has not received any large measure of financial support from the provincial government.

In recent times, principals of McGill University have included Gen. Sir Arthur Currie, G.C.M.G., K.C.B., who had been the commander of the Canadian Army Corps in Europe in World War I, and who served as principal from 1920 to 1933; Mr. Lewis Williams Douglas, later American Ambassador at London, England, who served from 1937 to 1939, and Dr. F. Cyril James, a native of London, England, who was a professor in the Wharton School of Finance and Commerce at the University of Pennsylvania. Dr. James became principal of McGill University in 1940.

On the battlefields in the two world wars students and staff of the university made a notable contribution. There were 6,500 on active service, 272 were killed or died, 618 received military decorations, and 359 served with the United States Army and 151 in the United States Navy.

The faculties embrace arts and science, law, music, divinity, agriculture, medicine, dentistry, engineering; there are schools of commerce, architecture, physical education, social work, graduate nursing, physiotherapy and the library school. Between 1930 and 1950 the faculty of graduate studies and research saw its enrollment of students increase from 100 to over 700, many coming to this center of higher studies from the United States and other parts of the world. The faculty of medicine is known all over the world and receives over 2,000 applications each year from students who wish to pursue their medical studies at McGill, but the annual admissions are restricted to 100, owing to the shortage of the facilities for clinical teaching. Sir William Osler was for some years a professor at McGill, and the magnificent Osler Library in the Medical Building is presided over by his nephew, Dr. W. W. Francis. The three teaching hospitals of the university comprise the Royal Victoria Hospital, the Montreal General Hospital and the Children's Memorial Hospital.

The Neurological Institute which houses the university department of neurology and neurosurgery was founded in 1933 with financial assistance from the Rockefeller Foundation and has become a recognized world center for the study of brain and diseases of the nervous system. The Allan Memorial Institute of Psychiatry was similarly founded through a generous grant from the Rockefeller Foundation and provides for the study, treatment, and cure of psychiatric ailments. The Pathological Institute houses the departments of pathology and bacteriology. The faculty of engineering, which has sent its graduates into all corners of the earth, has about 1,500 students in the courses leading to degrees in various branches of engineering and in architecture. The Institute for Pulp and Paper Research, which is also on the McGill campus, is a joint undertaking of the federal government, the pulp and paper industry of Canada, and the university.

In many of its scientific departments McGill University is prominent. The laboratories of the departments of chemistry and physics occupy a high place, and played a significant role in wartime problems. Among the discoveries was the production of RDX, an explosive more powerful than TNT. The only cyclotron and radiation laboratory in Canada is at McGill, and a large corps of research workers engage on problems of nuclear physics. The Eaton Electronics Laboratory was opened in October 1950.

Important studies of the medical and biological departments during World War II included blood storage, the treatment of shock, the cure of motion sickness in aviation and, in the agricultural departments, many problems of nutrition, human and animal, are being solved.

The athletics facilities include the Percival Molson Stadium which has been enlarged to accommodate 23,000, and the Sir Arthur Currie Memorial Gymnasium-Armoury and War Memorial Hall and Swimming Pool.

The adult education program of the university embraces accountancy diploma courses, summer schools in French and geography and, for teachers, extension lectures, and a comprehensive program for rural adult education which began with the support of the Carnegie Corporation about 1930 and has become self-supporting.

To accommodate the record enrollment of students after the close of World War II, the university took over two former air force stations, one at Lachine, Que. and one at St. Johns, Que. Dawson College, as it became known, at St. Johns, at the height of its activity housed over 1,800 students and provided there complete courses of instruction and laboratories in the subjects of the first and second years of science, commerce and engineering, the regular university staff making the daily journey from nearby Montreal to give lectures there as well as on the Montreal campus. Owing to the graduations of veterans and the prospect of a return to normal numbers these two residences were closed by the university at the end of the 1949–1950 session.

Before the outbreak of World War II in 1939 McGill University enrolled approximately 3,000 students in the full-time courses leading to degrees and diplomas, but during the postwar era its registration increased to 8,500, half of whom were veterans who had returned from active service to academic studies under the government plan of subsidizing their education. In 1950 the enrollment was approximately 7,500 and there were only about 1,000 veterans left.

MACGILLICUDDY'S REEKS, mă-gĭl'ĭ-kŭd-ĭz rēks, mountain range, Ireland, located in County Kerry, extending for 13½ miles from the Lakes of Killarney on the east to Lough Carra on the west, and covering an area of 28 square miles. It is the loftiest moun-

tain range in Ireland, culminating in Carrantuohill, 3,414 feet high.

McGILLIVRAY, mȧ-gĭl'ĭ-vrā, **Alexander,** chief of the Creek Indians: b. in Alabama about 1759; d. Pensacola, Fla., Feb. 17, 1793. His father was a Scottish merchant of good family and his mother a half-breed. He received a good education at Charleston, S. C.; was placed in a mercantile establishment in Savannah; but soon returned to the Creek country, where he became partner in a large trading house and rose to a high position among the Indians. After the death of his mother, a member of the ruling stock, he became chief of the Creeks, having received a call from a formal council, and styled himself Emperor of the Creek Nation. During the revolution the McGillivrays, father and son, were zealous adherents of the royal cause, the former holding the rank of a colonel in the British service. After the war Alexander McGillivray, in behalf of the Creek confederacy, entered into an alliance with Spain, of which government he was made a commissary, with the rank and pay of colonel. In 1790 he was induced by President Washington to visit New York, where he eventually signed a treaty yielding certain disputed lands lying on the Oconee. He was also persuaded to withdraw from Spanish service and was rewarded with an appointment as agent for the United States, with the rank and pay of brigadier general.

McGILVARY, Evander Bradley, American linguist and philosopher: b. Bangkok, Siam, July 19, 1864, of American parents. He was graduated from Davidson College in 1884 and from Princeton in 1888. From 1891 to 1894 he was translator for the Presbyterian Board of Foreign Missions in Siam, and in 1894 began graduate work at the University of California, where he later became assistant professor. In 1899 he was appointed Sage professor of ethics at Cornell. In 1905 he was appointed professor of philosophy at the University of Wisconsin. He has translated the Gospels of Matthew, Luke and John, and the Acts of the Apostles into the Lao dialect of Siamese.

McGLYNN, mȧ-glĭn', **Edward,** American Roman Catholic clergyman: b. New York, Sept. 27, 1837; d. Newburgh, N. Y., Jan. 7, 1900. He was educated at the College of the Propaganda in Rome, and from 1866 was pastor of Saint Stephen's Church in New York. He favored the education of children by the state rather than in parochial schools and in 1886 warmly supported the candidacy of Henry George for the mayoralty, thereby bringing upon himself the censure of the church for his political activities. He was summoned to Rome to exculpate himself, but refused to go, pleading his ill-health. Persisting in his refusal he was excommunicated in 1887. He was one of the founders of the Anti-Poverty Society and was its president. In 1893, after a hearing before the papal delegate, Monsignor Francesco Satolli, the ban of excommunication was removed, after the signing of a document drawn up by the apostolic delegate to the effect that his economic views were not in conflict with the Catholic faith. He was in charge of Saint Mary's parish in Newburgh at his death.

McGOVERN, mȧ-gŏv'ẽrn, **John,** American author: b. Troy, N. Y., Feb. 18, 1850; d. Dec. 17, 1917. He was connected for 16 years with the Chicago *Tribune,* and after 1880 was engaged in literary work and lecturing chiefly on great writers and historical characters. In the action of S. E. Gross, author of the play *The Merchant Prince of Cornville,* against Edmond Rostand, author of *Cyrano de Bergerac,* he acted as literary expert for the former. The United States Court at Chicago issued a decree in 1902 sustaining the claim of Gross to priority of authorship and forbidding the representation of *Cyrano de Bergerac* in this country. McGovern's numerous writings include *The Empire of Information* (1880); *King Darwin,* a novel (1894); *American Statesmen* (1898); *Famous Women of the World* (1898).

MacGRATH, mȧ-grȧth', **Harold,** American novelist and journalist: b. Sept. 4, 1871; d. Oct. 29, 1932. He was educated in Syracuse and in 1890 launched his career as a reporter on the Syracuse *Herald.* His first novel, *Arms and the Woman,* appeared in 1899 and was quickly followed by many other popular successes. He also contributed the early silent cinema serials *The Perils of Pauline* and *The Million Dollar Mystery.* Later he wrote a column for the Chicago *Evening Mail.* An editor of *The Reader* noted that MacGrath's novels "reflect his own enjoyment and mirror his own optimistic philosophy. . . . ." Among his novels are *The Man on the Box* (1904); *The Princess Elopes* (1905); *Enchantment* (1905); *Half a Rogue* (1906); *The Lure of the Mask* (1908); *The Goose Girl* (1909); *The Drums of Jeopardy* (1920); *The Cellini Plaque* (1925).

McGRATH, James Howard, American public official: b. Woonsocket, R. I., Nov. 28, 1903. He was appointed attorney general of the United States in August 1949. In 1929 he received the degree of bachelor of laws from Boston University. From 1934 to 1940 he served as United States district attorney. He was governor of Rhode Island from 1940 to 1945, and in 1946 he was elected to the United States Senate. He had been active in politics since 1928, when he was vice chairman of the Rhode Island Democratic State Committee. In October, 1947, he became chairman of the Democratic National Committee.

McGRATH, Patrick Thomas, British-American journalist: b. Saint John's, Newfoundland, Dec. 16, 1868; d. June 14, 1929. He was educated at the Christian Brothers' School, Saint John's, and in 1889 became a reporter on the Saint John's *Evening Herald.* He was promoted acting editor in 1893, and in 1894–1907 was editor. He established the *Evening Chronicle,* which in 1912 was united with the *Herald,* and became president of the company. He acted as Newfoundland correspondent of the London *Times* after 1904 and was an extensive contributor to both British and American periodicals. He was president of the Legislative Council of Newfoundland after 1915. He assisted in the preparation of the colony case concerning the French and American fisheries and was the colony's secretary on the occasion of the Dominion's Royal Commission visit to Newfoundland in 1914. He was honorary secretary of the Newfoundland Patriotic Fund, the Newfoundland Regiment Finance Committee and the Newfoundland War Pensions

Board after 1914; and chairman of the High-Cost-of-Living Commission after 1917. Author of 'From Ocean to Ocean' (1911); 'Newfoundland in 1911.'

McGREADY, mą-grā'dĭ, **James,** American Presbyterian clergyman: b. in Pennsylvania about 1760; d. 1817. He studied for the ministry in the school of John McMillan, of Cannonsburg, Pa., and in 1788 was licensed to preach. After some years of work in North Carolina, in 1796 he removed to southwestern Kentucky, and under his direction began the great revival of religion which culminated in 1800 and became memorable in the religious history of the country. He organized and conducted the first camp-meeting, and employed as preachers unordained young men without special theological training, thereby provoking dissension in the Presbyterian Church. Out of this disagreement arose the Cumberland Presbyterian Church (see PRESBYTERIAN CHURCH), organized in 1810. McGready, however, afterward became reconciled to the older Church and resumed his fellowship in it. Two volumes of his sermons were published years after his death, the first at Louisville, Ky., in 1831, the second at Nashville, Tenn., in 1833. Consult Davidson, 'History of the Presbyterian Church in the State of Kentucky' (New York 1847); Edson, 'Early Presbyterianism in Indiana' (1898); Foote, 'Sketches of North Carolina, Historical and Biographical' (New York 1850; 2d series, 1855); Smith, 'History of the Cumberland Presbyterian Church.'

MacGREGOR, măk-grĕg'ẽr, **John** ("Rob Roy"), Scottish traveler, writer and philanthropist: b. Gravesend, 24 Jan. 1825; d. Boscombe, 16 July 1892. He studied at Trinity College, Dublin, and was graduated from Trinity College, Cambridge, in 1847. He was called to the bar in 1851, but after a brief period in which he devoted himself to the law of patents he abandoned the profession and spent his time in travel and in works of philanthropy. He traveled in Europe, Egypt, Palestine, Russia, Algeria and America. He was deeply interested in the history and theory of marine propulsion and was largely instrumental in the introduction of canoeing into British sports. He constructed a canoe which he christened *Rob Roy,* and in which he made extended journeys. His books giving accounts of these expeditions were widely and deservedly popular. He was possessed of ample resources and gave liberally to philanthropic purposes. He sketched cleverly and illustrated his own books, and in early days occasionally contributed sketches to *Punch.* Besides numerous magazine articles he was author of 'Three Days in the East' (1850); 'Our Brothers and Cousins, A Tour in Canada' (1859); 'A Thousand Miles in the Rob Roy Canoe' (1866); 'The Rob Roy on the Baltic' (1867); 'The Rob Roy on the Jordan, Red Sea and Gennesareth' (1869), etc.

McGUFFEY, măk-gŭf'fẽ, **William Holmes,** American educator: b. Washington County, Pa., 23 Sept. 1800; d. Charlottesville, Va., 4 May 1873. He was graduated at Washington College, Pa., in 1826, was appointed professor of ancient languages at Miami University in that year, and in 1832 became professor of moral philosophy there. He was appointed president of Cincinnati College in 1836 and of Ohio University in 1839. He was professor of moral philosophy at Woodward College, Cincinnati, in 1843–45, and thereafter until his death he was professor of moral philosophy and political economy at the University of Virginia. He prepared the series of school reading- and spelling-books known under his name and for many years widely popular in the schools of the United States.

McGUIRE, mă-gwīr', **Hunter Holmes,** American surgeon: b. Winchester, Pa., 11 Oct. 1835; d. near Richmond, Va., 19 Sept. 1900. He was graduated from the Winchester Medical College in 1855, and from the Medical College of Virginia in 1858, studying also in the medical schools of New Orleans and Philadelphia. He was professor of anatomy at the Winchester Medical College in 1856–58 and afterward practised in Philadelphia. He enlisted in the Confederate army at the outbreak of the Civil War, became medical director of the Army of the Shenandoah Valley and later of the Second Army Corps. He was in attendance upon General "Stonewall" Jackson at the time of his death in 1863. In 1865–78 he was professor of surgery at the Virginia Medical College, Richmond. He organized Saint Luke's Home for the Sick in Richmond, with a training school for nurses. He was president of the American Medical Association in 1893.

MACH, mäh, **Ernst,** Austrian physicist and philosopher: b. Turas, Moravia, Austria, 18 Feb. 1838; d. 9 Feb. 1916. After a partly private secondary education he studied at the University of Vienna, taking his doctor's degree in physics in 1860. After spending several years as *privatdocent* he was appointed professor of mathematics at Gratz and in 1867 was called to the chair of physics at the University of Prague. Here he published in 1883 his first important work, 'Die Mechanik in ihrer Entwickelung historisch-kritisch dargestellt,' which has run through seven German and several English editions. Having turned his attention to the relation of physiological and physical processes, he next produced his equally epoch-making 'Analyse der Empfindungen' (1886; 6th ed., 1911). Owing to his increased interest in epistemological and historical problems, Mach gladly accepted in 1895 the offer of a philosophical chair at Vienna, where he read on the history and theory of the inductive sciences. The following year appeared his 'Principien der Wärmelehre,' while his university lectures ultimately took the shape of a substantial volume in 1905 under the caption 'Erkenntnis und Irrtum.' A paralytic stroke suffered in 1898 reduced the remainder of his life to a cripple's martyrdom, though it did not interfere with his mental activity. In spite of his liberal position in politics he was honored with the title of a court chancellor and was made a member of the upper chamber of the Austrian Parliament.

Mach's aim was to liberate science from metaphysical conceptions and thus he became in a sense a precursor of pragmatism. His general trend of thought exerted a profound influence on men like William James, Jacques Loeb, Karl Pearson and Wilhelm Ostwald, and his attempt to substitute the mathematical notion of function in place of the time-honored concept of causality has recently found an ad-

vocate in Bertrand Russell. His definition of science as an economical description rather than an explanation of the universe aroused considerable discussion in philosophical circles. Sympathetic insight, impartiality, a singularly sane judgment and an almost complete freedom from preconceptions render Mach an ideal historian. His principal works are accessible in English translations. For a brief exposition of his philosophy with biographical notes consult Carus, Paul "Professor Mach and his Work," in *The Monist,* January 1911, pp. 18-42.

MÁCHA, mä'kà, **Karl Hynek,** Czech poet: b. Prague, Nov. 10, 1810; d. Leitmeritz, Oct. 5, 1836. His style of poetry is full of sentiment and reflection, a forerunner of the present Czech school of poetry, strongly influenced by Byronic "Weltschmerz," i.e., the spirit bred by the realization of disharmony between ideals and concrete facts of reality. He studied in Vienna and Prague. Extreme poverty caused pulmonary trouble, from which he died after a lingering illness. His chief work, *Maj* (1836), is a lyrical epic. His historic tales, such as *The Gypsies,* etc., are in the style of Walter Scott. His collected works were published in Prague (1862).

MACHAERODUS, mā-kē'rō-dŭs, a genus of huge extinct cats, fossil in the Miocene and subsequent formations, and including the largest of the *Nimravidae.* See SABRE-TOOTHED TIGER.

MACHAERODONTINAE, mą-kē'rō-dŏn-tī'nī, an extinct subfamily of *Felidae,* including the sabre-toothed cats and their allies. This group became separated from the typical cats (*Felinae*) in the Oligocene epoch, and remained a numerous and powerful element of the carnivora of the world until the close of the Pleistocene. The general form and structure were catlike, and produced an equally effective armament, except, perhaps, in speed, for the limbs were shorter and heavier as a rule than in the feline cats of similar size, and the hind foot had five toes, instead of four. Another difference was in the comparative shortness of the tail. Mainly, however, the specialization of this subfamily was in the dentition, which differed from that of the cats in many particulars, and especially in the extraordinary development of the upper canines into huge stabbing-tusks, especially striking in *Smilodon,* one of the most modern and widely distributed American genera.

MACHAR, mą-kär', **Agnes Maule** (FIDELIS), Canadian author: b. Kingston, Ontario, about 1856; d. Jan. 24, 1927. She was educated at Kingston and at an early age her contributions began appearing in the magazines of Canada, England and the United States. She was author of a volume of verse, *Lays of the True North;* two historical works, *Memorials of Rev. Dr. Machar*—the author's father; *The Story of Old Kingston* (1908); *Stories of the British Empire* (1913); and the novels, *Katie Johnston's Cross; Lost and Won; Roland Graeme, Knight* (1892); and *The Heir of Fairmount Grange.*

McHENRY, James, American soldier, secretary of war, and signer of the Constitution: b. Ballymena, County Antrim, Ireland, Nov. 16, 1753; d. Baltimore, Md., May 3, 1816. An Ulsterman, McHenry received a classical education in Dublin, and in 1771 emigrated to Philadelphia, the rest of his family joining him a year later. His father and brother founded an importing business in Baltimore; it prospered and eventually (1790) McHenry inherited it. After attending the academy at Newark, Del., in 1772, he studied medicine under the noted Dr. Benjamin Rush in Philadelphia. At the outbreak of the American Revolution in 1775 he hurried to Cambridge, Mass., and volunteered for military service. In January 1776 he was assigned to the medical staff of the military hospital in Cambridge and on August 10 was appointed surgeon of Col. Robert Magaw's 5th Pennsylvania Battalion. When Fort Washington was taken in November he was among the prisoners. Paroled in January 1777, he was exchanged in March 1778. After brief tenure as "Senior Surgeon of the Flying Hospital, at Valley Forge," on May 15 he was appointed Washington's secretary and never thereafter resumed medical practice. Having won Washington's confidence, he was transferred in August 1780 to Lafayette's staff. Commissioned major, May 30, 1781, McHenry continued in active service until September, when he was elected to the Maryland Senate where he sat for five years. Appointed to Congress in May 1783, he served concurrently until 1786. A delegate to the Constitutional Convention of 1787, he kept a private record of the convention proceedings—one of the important sources for its history. As an ardent Federalist he worked for the adoption of the Constitution and was also a member of Maryland's ratifying convention. After a term in the Assembly, in 1791 he again became a state senator, serving another 5-year term. In January he accepted the post of secretary of war, and when the following year Adams succeeded to the presidency he retained McHenry in his cabinet. But relations between the new president and his war secretary soon became strained. A staunch Federalist, McHenry continued to look to Hamilton for political leadership, and later the president suspected him of intriguing against his re-election. On Adams' demand he resigned his office in May 1800. Thereafter he lived a retired life on his estate at Fayetteville near Baltimore. Fort McHenry, one of Baltimore's defenses, was named for him.

McHENRY, Fort. See FORT MCHENRY.

MACHETE, mä-chā'tā, a large, heavy, sword-like tool, half knife, half cleaver, often two to two and a half feet in length. It is used in Cuba and other countries of tropical America for cutting sugar cane and clearing paths through undergrowth. It is also useful as a weapon, making an excellent cutlass.

MACHIAS, mą-chī'as, Me., town and Washington County seat; altitude 80 feet; on the Machias River, near the sea; 89 miles east of Bangor; on the Maine Central Railroad. There are truck and poultry farms near by, and granite quarries; lumber and shipbuilding are also local industries. A "long lumber" log drive takes place on the river each spring. A state normal school is in Machias, and at East Machias are Washington Academy (1823) and

the summer surveying school of the Massachusetts Institute of Technology. A trading post was established here in 1633 by Englishmen, but they were soon driven out by the French. The first permanent English settlement was made in 1763 and in 1784 the town was incorporated.

In the Revolutionary War Machias participated prominently in the harassing of the British along the coast; in 1775 Machias seamen captured the British armed schooner *Margaretta* and, in reprisal, the town was partly burned by forces from the ship *Ranger*. In 1863, in observance of the town's centennial, an anniversary memorial was published. Pop. (1950) 2,063.

MACHIAVELLI, Niccolò, nē-kō-lō' mä-kē-ä-vĕl'lē or măk-ĭ-a-vel'lĭ, Italian historian and statesman, possibly the greatest prose writer of the Italian Renaissance: b. Florence, May 3, 1469; d. there, June 22, 1527. Of Niccolò's early life and education we know nothing. No trace of him remains previous to his 20th year. But of his times and the scenes amid which he grew up, we know much. It was the calm but demoralizing era of Lorenzo the Magnificent. Machiavelli was a true child of his time. He too was thoroughly imbued with the spirit of the Renaissance; and looked back, fascinated, on the ideals of that ancient world that was being revivified for the men of his day. But philosophy, letters and art were not the only heritage that the bygone age had handed down; politics—the building of states and of empires—this also had engaged the minds of the men of that age, and it was this aspect of their activity that fired the imagination of the young Florentine.

From his writings we know he was widely read in the Latin and Italian classics. But Virgil and Horace appealed to him less than Livy, and Dante the poet was less to him than Dante the politician; for he read his classics, not as others, to drink in their music or be led captive by their beauty, but to derive lessons in statecraft and penetrate into the secrets of the successful empire-builders of the past. It is not known whether he mastered Greek. Like Ariosto, Machiavelli was indebted for his superb literary technique solely to the study of the literature of his own nation.

With the expulsion of the Medici from Florence, Machiavelli, at 30, emerged from obscurity to play a most important role in the Florentine politics of the succeeding decade and a half. In 1498 he was elected secretary to the Ten of War and Peace and from 1498 to 1512 was a zealous, patriotic and indefatigable servant of the republic. His energy was untiring, his activity ceaseless and many-sided. He conducted the voluminous diplomatic correspondence devolving upon his bureau, drew up memorials and plans in affairs of state for the use and guidance of the Ten, undertook the reorganization of the Florentine troops and went himself on a succession of embassies, ranging in importance from those to petty Italian states up to those to the court of France and of the emperor.

He was by nature well adapted to the peculiar needs of the diplomacy of that day; and the training he received in that school must in turn have reacted on him to confirm his native bent and accentuate it until it became the distinguishing characteristic of the man. His first lessons in politics and statecraft were derived from Livy's history of the not overscrupulous Romans; and when he comes to take his lessons at first hand, it is in the midst of the intrigues of republican Florence, or at the court of a Caterina Sforza, or in the camp of a Cesare Borgia. Small wonder that his conception of politics should have omitted to take account of honesty and the moral law; and that he conceived "the idea of giving to politics an assured and scientific basis, treating them as having a proper and distinct value of their own entirely apart from their moral value."

During this period of his political activity we have a large number of state papers and private letters from his pen; and two works of literary cast. These are his *Decennale*, historic narratives, cast into poetic form, of Italian events. The first treats of the decade beginning 1494; and the second, an unfinished fragment, of the decade beginning 1504. They are written in easy *terzine*, and are noteworthy as expressing the sentiment for a united Italy.

When in 1512 the Medici returned to Florence in the train of her invader, Machiavelli was dismissed from his office and banished for a year from the confines of the city. Later, on suspicion of being concerned in a plot against the Medici, he was thrown into prison and tortured. He was afterward included in a general pardon granted by Leo X. But Machiavelli did not return to public life until 1525; and this interval of enforced leisure from affairs of state was the period of his literary activity. A number of comedies, minor poems and short prose compositions did not rise above mediocrity. But in one dramatic effort he rose to the stature of genius. His *Mandragola* achieved a flattering success, both at Rome and in Florence. It has been pronounced the finest comedy of the Italian stage; Macaulay rated it as inferior only to the greatest of Molière's. In its form, its spontaneity, vivacity and wit, it is not surpassed by Shakespeare; but it is a biting satire on religion and morality, with not even a hint of a moral to redeem it.

His lesser prose works are the *Life of Castruccio Castracani* and the *Art of War*, a treatise anticipating much of our modern tactics. A more ambitious undertaking, and his largest work, is the *History of Florence*. At the suggestion of Cardinal Giulio de' Medici, the directors of the studio of Florence commissioned Machiavelli to employ himself in writing a history of Florence, "from whatever period he might think fit to select, and either in the Latin or the Tuscan tongue, according to his taste." He was to receive 100 florins a year for two years to enable him to pursue the work. He chose his native tongue; and revised and polished his work until it became a model of style, and in its best passages justifies his claim to the title of the best and most finished of Italian prose writers.

But though Machiavelli had the historical style, he lacked historical perspective; he arranged his matter not according to objective value, but placed in the boldest relief those events that best lent support to his own theories of politics and statecraft. He makes his facts to be as he wishes them, rather than as he knows them to be. To Machiavelli history was largely to be written as a *Tendenzroman*—manufactured to point a preconceived moral.

Though Machiavelli wrote history, poetry and comedy, it is not by these he is remembered. The works that have made his name a synonym, and given it a place in every tongue, were written almost in the first year of his retirement from political life: 'The Prince' and the 'Discourses on the First Ten Books of Titus Livius.' Each is a treatise on statecraft; together they form a complete and unified treatise, and represent an attempt to formulate inductively a science of politics. The 'Discourses' study republican institutions, 'The Prince' monarchical ones. The first is the more elementary and would come first in logical arrangement. But in the writing of them Machiavelli had in view more than the foundation of a science of politics. He was anxious to win the favor of the Medici; and as these were not so much interested in how republics are best built up, he completed 'The Prince' first, and sent it forth dedicated «to the magnificent Lorenzo, son of Piero de' Medici.» In the 'Discourses,' the author essays «a new science of statesmanship, based on the experience of human events and history.» In that day of worship of the ancient world, Machiavelli endeavors to draw men to a study of its politics as well as its art. In Livy he finds the field for this study.

In his commentary on the course of Romulus in the founding of Rome, we find the keynote of Machiavelli's system of political science. His one aim is the building of a state; his one thought, how best to accomplish his aim. Means are therefore to be selected, and to be judged, solely as regards their effectiveness to the business in hand. Ordinary means are of course to be preferred but extraordinary must be used when needed.

In 'The Prince,' a short treatise of 26 chapters, and making little more than a hundred octavo pages, Machiavelli gives more succinct and emphatic expression to the principles of his new political science. It is the best known of all his works. It is the one always connected with his name, and which has made his name famous. For the model of his prince, Machiavelli took Cesare Borgia and cites him as an example worthy of imitation; and he has shared in the execration that posterity has heaped upon Borgia. The strangest moral contradictions abound throughout 'The Prince,' as they do in all Machiavelli's writings. He is saint or devil according as you select your extracts from his writings.

Shakespeare, reflecting English thought, uses his name as the superlative for craft and murderous treachery. But later years have raised up defenders for him, and his rehabilitation is still going on. He has been lauded as «the noblest and purest of patriots,» and more ardent admirers could «even praise his generosity, nobility, and exquisite delicacy of mind, and go so far as to declare him an incomparable model of public and private virtue.»

His rehabilitation proceeds from two causes. Later research has shown that perhaps he only reflected his time; and his works breathe a passionate longing for that Italian unity which in our day has been realized. He may be worthy canonization as a national saint; but those who are more interested in the integrity of moral standards than in Italian unity will doubtless continue to refuse beatification to one who indeed knew the Roman *virtus*, but was insensible to the nature of virtue as understood by the followers of Christ. And no amount of research into the history of his age can make his principles less vicious in themselves. A better understanding of his day can only lessen the boldness of the relief in which he has heretofore stood out in history. He was probably no worse than many of his fellows. He only gave a scientific formulation to their practices. He dared openly to avow and justify the principles that their actions implied. They paid to virtue the court of hypocrisy, and like the Pharisee of the earlier time, preached righteousness and did evil; but Machiavelli was more daring, and when he served the devil, disdained to go about his business in the livery of heaven. (See PRINCE, THE). Among the editions of the collective works of Machiavelli may be mentioned those of Milan, 1810–11; Florence, 1813; Milan, 1821–22; Florence, 1826, 1843; and Florence (6 vols., 1873–77); Boston English translation (1891). The rendering of the 'Art of War' and 'The Prince' (in the 'Tudor Translations' Vols. XXXIX and XL, London 1905), with Cust's introduction, is an admirable piece of work. Consult Dyer, 'Machiavelli and the Modern State' (Boston 1904); Morley, John, 'Machiavelli' (London 1898); Mourrisson, 'Machiavelli' (Paris 1883); Tommasini, 'La vita e gli scritti di Niccolo Machiavelli' (Turin 1882); Villari, 'Niccolò Machiavelli e i suoi tempi' (Florence 1877–82), and Burd's study (in the 'Cambridge Modern History' Vol. I, Cambridge 1902), with bibliography.

MACHINE COMPOSITION. See COMPOSING MACHINES.

MACHINE DESIGN. See DRAWING, MECHANICAL AND MACHINE DESIGN.

MACHINE ENGRAVING, a mechanical process for engraving on wood, metal or stone. Since 1880 numerous machines have been invented to produce regular tints, geometrical and other designs and patterns, far more rapidly than by hand work. The most complex engraving is now executed wholly by machinery. Engraving by mechanical means is now generally employed in the making of banknotes, diplomas, stock certificates and other papers and documents, where special designs are required. Elaborate gearing systems have been introduced whereby the cutting tools execute a certain number of symmetrical motions and thus produce elaborate geometrical patterns. The first engraving machine was the invention of Wilson Lowry and was employed to engrave the plain background, skies, etc., of a plate. Most modern machines are so fitted that the cutting tool may be moved a certain definite distance after each cut so that the succeeding cut will be a line parallel to and at a regular distance from the last. The cutting tool is also fitted so that the depth and breadth of the cut may be easily regulated. The cutting edge is usually of highly-tempered steel for metal work, except in the case of copper, which is often coated with varnish, next scratched with the design and afterward etched by acid. For stone work, the cutting tool has a diamond-point and weights on the holder regulate the depth of the cut to be made.

MACHINE FORGING. The art of the blacksmith, working by hand at the forge and

anvil, has almost wholly disappeared, and the shaping of wrought iron and steel is now performed by machines. The exact duplication of parts of machinery began in the United States about 1854, and it became necessary to have forgings of uniform size so that they could be properly handled in special fixtures or holders while being machined to exact dimensions.

Drop Forging.— In the first attempt to obtain uniform forgings the smith hammered by hand the rough stock into a rude suggestion of the shape wanted so as to properly distribute the material and then placed it in an impression cut in a block of steel or cast to shape and forced it into the cavity by a series of blows from hand hammer and sledge.

The growing demand for firearms and other accurately made mechanisms developed the necessity for improvements in this line which kept pace with the requirements of the times, until the drop-hammer was produced. These hammers are named invariably by the weight of the hammer-head or ram and they range in sizes from 50 to 5,000 pounds.

Hammers are also constructed to operate by steam power of heavier types. They lift the ram or hammer head and drive it downward by steam power in a manner similar to the regulation steam-hammer. The regular belt-driven drop-hammer, as used in drop-forging, is operated usually by a treadle which the workman trips with his foot. This movement releases a clamp or catch which holds up the hammer-head and allows it to fall or drop. It is raised by the friction of two rolls which revolve rapidly, gripping the surface of a board which is wedged into a slot in the top of the hammer-head or ram. The hammer-head is clamped or latched at the end of the upstroke by an automatic attachment and released at the will of the operator.

The hammer-head or ram is made usually with a dovetail opening at its bottom, into which is placed the upper die. It is held firmly in position by a key driven into place by sledging. The base or anvil of the drop-hammer is made of cast iron or cast steel, and a forged steel seat or holder for the lower die is keyed into the base in a similar manner. This seat or holder is frequently called a "sow" or "shoe," and is adapted merely to save useless wear of the base. It can be renewed at a small cost. A similar dovetail opening is made in this holder into which the lower die is placed. This is keyed into exact position to match the upper die so that when the faces of the dies meet at the end of the down stroke the complete impression is formed.

Drop-hammers are made generally of cast iron, i.e., the base or anvil, the side rails or guides and the lifter frame. The working parts are made from forged steel. Various heights of the fall or drop of the hammer-head can be had by shifting a "latch" or "dog" on the operating rod. From six inches to five feet fall can be obtained if desired. Foundations are best made of solid concrete. In connection with the drop-hammer a press is used to remove by a trimming operation the "flash" or surplus metal which spreads out between the dies after the impression therein is filled. This "flash" is sheared off either hot or cold as the character of the work permits.

Making the Dies.— A model of the part to be forged is made, usually of wood, if it be a form not clearly shown by a drawing. When given this model or a scale drawing and the required weight of the finished forging, the die-sinker has the principal data required by him to make the dies. After selecting the proper size blocks which have been planed smooth and made with dovetails or shanks, the die-sinker determines from his model the best parting line for the forging in much the same way as does the pattern-maker on a pattern for a casting, but the analogy between the two is comparatively slight as the conditions are radically different.

The pattern-maker can use cores and loose pieces to make cavities and overhanging parts, but the die-sinker is practically limited to a die opening in two parts, which must be made to stand the roughest usage. The outline of the piece to be forged is drawn on the surface of the die which has been coppered with a blue vitriol solution, this causing the lines to stand out sharply. The metal is then removed in a manner that is most expedient for that particular example. If the outline be circular the stock is turned out on a lathe. If the shape of the forging be such that other means are required for removing the metal from the die, the profiling machine readily furnishes a way for following the most complicated forms by means of milling cutters of various shapes and sizes. The shaper and milling machines are also impressed into service as well as the planer and drill.

Chipping by hand is commonly done, and in nearly every case a file, riffle, scraper and some emery cloth are required to finish the impression to the required smoothness and regularity.

The forming of an irregular cavity in the face of a high carbon steel die so that when its mating die is matched to it the shape of the space enclosed will not vary from the specified dimensions more than 2-1,000ths of an inch either way is an operation requiring skill and patience.

After the complete impression is made a proof can be taken by filling the cavity with melted lead. A shallow space is cut in the face of each around the impression. This is technically called the flash of the die. As it is practically impossible for the drop-forger to form the bar or billet of steel into just the shape and size required for the forging, this space must be left for the overflow of surplus metal.

If the article to be forged is of a simple form only one pair of forging dies is necessary as the "roughing" or "breakdown" impressions can be cut in the same pair of blocks which contains the finishing impressions. If the piece be more complicated, separate "roughing" or "breakdown" dies are necessary.

Trimming dies, to be used in the press, are necessary to remove the flash. They are made in male and female form; the upper part being the male die and the lower one the female. The male die is made of the outline of the forging through the parting line, and with its face conforming to all the irregularities of the upper part of the forging. The female die is open at the bottom so that the trimmed forging can fall through it into a receptacle under the press. It is also made with its cutting edge conforming to the parting line.

The dies are then heated carefully in furnaces, the heat of which is usually determined by a pyrometer to ensure uniformity of temperature, and are then hardened and tempered. Any warping in hardening which may occur is remedied by grinding the surfaces with an emery wheel. See DIES AND DIE MAKING.

The operation of drop-forging consists of first heating the bar or piece to a proper temperature. The heat depends entirely on the quality of the metal used. It is then placed in the «roughing» or «breakdown» impression and given a number of blows which shape it roughly into form and it is finally placed in the finishing impression and forged to the exact shape. The flash is then trimmed off in the press and the forging is practically complete.

The number of blows required depends entirely on the shape and size of the forging. Some pieces can be made by two or three blows while others may require as many as 100.

If the forgings are made of high carbon steel it is frequently necessary to anneal them so that they can be readily machined, and in many cases pickling in a weak solution of sulphuric acid is resorted to, so as to remove the scale or oxidation which forms on the surface of each forging while cooling.

Drop-forgings can be made from iron, steel, copper, bronze or aluminum, or from any metal which will not disintegrate during heating or while being worked. For instance, brass cannot be forged successfully. They can vary in weight — from a fractional part of an ounce to over 100 pounds each.

Upsetting and Forging Machines.— Toward the close of the 19th century it became recognized that forging could be accomplished by pressure as well as by blows, and this idea was developed into the commercial upsetting and forging machines which now handle the bulk of small parts and a good many large parts of modern machines. Hammer-blows cause jar and vibration which are destructive to the machine itself, and require heavy foundations, heavy bed-plates, etc. The pressure machines do their work with less noise and more scientifically. The very much reduced cost of building automobiles and a great variety of duplicate machines that are turned out in large numbers is due largely to the quick shaping made possible by machine forging. An upsetting and forging machine is made with a very heavy steel bed. The opposed dies for gripping the work are gripped in the machine, and the pressure is applied by a toggle-joint mechanism. In all such machines it is necessary to limit the pressure, else excess would break the machine. This limitation is accomplished in two ways — by placing heavy springs in the machine which give when a certain pressure is attained; and by locking the back of one of the die supports with a bolt of a given strength, arranged between hard square edges which will cut or shear off the bolt when the pressure reaches above a given point.

The method of making a common hexagonal nut in such a forging machine consists in (1) placing the dies in the forging machine; (2) heating a bar of iron between 1,400° and 1,600° F. — the temperature varying with the character of the iron; (3) thrusting the red-hot end of the bar into the lower die in the forging machine, and throwing the lever to cause the machine to squeeze, which upsets the end of the bar and shapes it for a nut; (4) withdrawing the bar quickly and placing in the upper die; (5) repeating the squeeze, which forces the hole through the nut, leaving the removed metal on the bar, and separating the nut. The nut is delivered with a slight fin, which has to be removed, when it is ready to go to the thread-cutter.

The front axle of an automobile may be forged in one of these pressure forging machines in about seven operations. The last squeezing operation delivers the completely formed axle. Any quantity of more or less intricately formed parts are now made of wrought iron and steel in this manner, the heavier operations being done on the steam-hammer, as a rule.

The forging machine is also used for welding or joining separate pieces by pressure. It is just as easy to apply a flux to assist the joining in the forging machine as on the anvil. The Ajax universal forging machine not only compresses the dies, but has an independent vertical press that can be used for any operation within its capacity; also a punching device and a trimmer.

A variety of special forging machines are made for forming common articles, or parts required in large quantity. Many of them are named after the work they accomplish. The hot-pressed centre-feed nut machine is simply a small forging machine designed for making nuts. Bolt-heading machines and bolt and rivet headers are other examples of special forging machines.

Pressed steel is made by great hydraulic presses at the steel works. Pieces requiring but slight shaping are pressed in the cold; more or less complicated forms are heated to a cherry red and then light-pressed. Modern railway steel cars are made in this manner. Armor plates are formed in hydraulic presses under immense pressures which are maintained for a considerable time.

CHARLES H. COCHRANE.

MACHINE GUN. An automatically reloading weapon of small calibre which discharges several bullets per second when pressure is maintained on the trigger; the weapon most destructive of life in modern warfare. There are four general classes of machine guns as to size: submachine guns, and light, heavy, and special machine guns. They may also be classified as gas-operated and recoil-operated, depending upon whether the automatic reloading is accomplished through the action of a part of the escaping gases of each exploding cartridge, or through the action of recoiling parts. Other classifications are based on belt-feeding and magazine-feeding, and air-cooling and water-cooling. Belt-fed guns use cartridges held in the loops of a narrow belt, usually of cloth, which contains several hundred rounds and moves rapidly through the feeding and firing mechanism during firing, until the belt is exhausted and the first cartridge of a new belt must be engaged into the mechanism by hand. Magazine-fed guns use metal cartridge containers (magazines) which are inserted full of cartridges in a receptacle of the gun and remain there till emptied, when, for further firing, the

empty magazine must be removed and a full one inserted. Both belts and magazines can be reloaded and used repeatedly.

Air-cooled guns have projecting, and usually circular, metal fins along the outside of the gun barrel to radiate away the heat generated by firing, and make use of the movement of air over these fins to cool the gun. Water-cooled machine guns have a cylindrical water jacket or tank around the barrel for the same purpose. Air-cooled guns as a rule become hot more readily than water-cooled. With either, it becomes necessary after a few minutes of continuous firing to cease firing and allow the gun to cool off. Otherwise the barrel becomes red hot and its metal softened, so that further firing destroys the accurate rifling within the barrel. Since it may be necessary in combat thus to spoil a barrel, spare barrels are carried for most types of heavy and special machine guns.

Submachine Gun.—This is a magazine-fed weapon of about the weight of a shoulder rifle. It is usually held in both hands and fired from the waist, but can also be fired from the shoulder. The best known type is the Thompson, which uses calibre .45 pistol ammunition in magazines holding 20 or 50 rounds. It is a powerful weapon for fighting at close range, and is used by police and criminals as well as by armies. This weapon is standard equipment in the cavalry of the United States Army, where it is used as a close-in-defense weapon for armored scout cars and combat cars (tanks) and as a weapon for motorcyclists. It is also used in the United States Marine Corps.

Light Machine Guns.—The term «light» simply means that the gun and its mount, usually weighing under 25 pounds, and a few hundred rounds of ammunition can readily be carried in combat by a single soldier, though others must carry enough additional ammunition for the sustained firing of battle. All light machine guns are air-cooled and most of them magazine-fed. This class strictly includes also the «automatic rifle,» a fast-firing shoulder weapon without a mount. The automatic fire of this weapon, however, cannot be held to accurate aim. Consequently, in the United States Army, a folding bipod mount attached near the muzzle and a small, adjustable, single-stand mount attached to the stock have been used to convert the standard Browning automatic rifle, an air-cooled, gas-operated weapon, into a light machine gun. This weapon is still fired from the shoulder like a rifle by the soldier in a prone position, but the additional points of contact with the ground have much increased its accuracy.

Light machine guns, because of possible overheating, are not capable of the high rate and sustained periods of fire of heavy machine guns. The actual rate of automatic fire of most light machine guns is from 250 to 500 rounds per minute. But to avoid overheating and waste of ammunition, they are fired in bursts of four or five rounds, with intervals of several seconds between bursts to observe the effect of the firing and regain accurate aim. Also, time is consumed in exchanging empty magazines for loaded. Hence the maximum practicable rate of fire is seldom over 100 rounds per minute. Most light machine guns can also be limited to single-shot fire by a simple lever adjustment.

In most armies of the world, both light and heavy types of machine guns are of the same calibre as the standard infantry rifle, and thus use the same ammunition. In the United States Army, all machine guns except certain special types are calibre .30.

Light machine guns are used mainly for direct fire against hostile targets visible to the gunner. The method of operation is similar to that of the heavy machine gun in direct fire described below. For tactics of light machine-gun units see INFANTRY.

Heavy Machine Guns.—The weight of a heavy machine gun and its mount and accessories requires its transportation by some other means than carrying by hand, except for short distances in actual battle. Hand-drawn or animal-drawn carts, pack animals, and small motor-truck carriers are all used. The United States Army, between 1930 and 1940, changed from animal to motor transport for heavy machine guns, in all but a few units. European armies, by 1940, were still using animal transport in the main. Tanks and armored cars, and fighting types of airplanes, also are essentially machine-gun carriers of special types. When heavy machine guns must be carried by hand, one member of the gun squad carries the gun, and eight or ten others carry the tripod mount, the extra water containers (for water-cooled guns), the spare barrels and other accessories, and the boxes of ammunition belts or magazines, so that each carries from 25 to 40 pounds.

Heavy machine guns may be either air- or water-cooled and almost all types are recoil-operated. The automatic fire rate of heavy machine guns is from 450 to 600 rounds per minute for those used in ground combat. These are also fired in short bursts, so that the maximum practicable rate of fire is about 250 rounds per minute for ground combat.

Operation of Heavy Machine Guns.—In combat on the ground heavy machine guns are usually fired from a low, sturdy tripod mount to which the gun is firmly clamped. A fixed mount of some kind is necessary. The gunner sits or lies behind the gun to aim and fire it. The tripod has an elevating and depressing mechanism operated by a handwheel for moving the gun up or down, and may also have a traversing mechanism, similarly operated, for moving the gun laterally. Some types require traversing to be done by heavy blows of the hand against the tightly clamped gun to turn the gun and its pintle in the socket of the mount. Most heavy machine guns permit a 360° traverse without moving the tripod, although the gunner can only traverse about 120° without moving around to a new position.

Before firing, the gunner adjusts his aim through sights similar to those of a military rifle. The point of aim may be an actual hostile target, such as troops, in «direct» machine-gun fire; or an established aiming point, such as a mark on a stake, in «indirect» fire conducted at hostile targets not visible to the gunner. Since vibration and smoke make it impossible to look through the sights during firing, the gunner, in direct fire, observes the effect of his fire over the top of the gun and sights, usually by watching the dust or earth raised where the bullets strike the ground. In indirect fire the gunner cannot observe. In both kinds of firing, the gunner pauses briefly after every few bursts to

check his aim through the sights because vibration may settle the mount in the ground. To obviate such settling, bases of wood or concrete, with sandbags or clamps to hold the legs of the tripod solidly in place, are used in machine-gun emplacements of permanent or semipermanent defensive positions.

The fire of heavy machine guns may be directed at a «point» target such as an enemy machine gun or a small group of men, but is mainly used to cover areas of some width and depth. Owing to the vibration of the gun, the discharged bullets do not follow accurately in the same path of trajectory. At a range of half a mile, for example, the bullets strike level ground within a beaten zone which is about 150 feet long and 10 feet wide. Consequently, if a burst or two is fired at one setting of the gun in elevation, and the gun is then alternately fired and traversed through a slight angle in one direction (continually to right or left) a series of adjacent beaten zones of any desired total width up to several hundred feet can be covered by fire. As an example, an area 300 by 300 feet may be assigned to a single gun. By alternately traversing and firing from one side of this area to the other, the gunner covers the full width of the area and about one-half (the nearest half) of its depth, except for the ground sheltered behind rises and depressions which the flat trajectory of the gun cannot reach. The gunner then increases the range by elevating the gun enough for the fire to strike the farthest half of the square area, and alternately fires and traverses in the opposite direction, and thus covers the whole area with fire. By alternately firing bursts and traversing (or elevating or depressing) the gun, the gunner can cover an area of any shape with fire.

For direct fire, heavy machine guns are usually placed in pairs to insure continuous fire in combat because the firing mechanism occasionally jams. Gun squads are thoroughly trained to remedy most stoppages in a few seconds. The two guns of a pair are fired from positions far enough apart to prevent the destruction of both by a single enemy shell but close enough for fire direction under one leader. The two guns of a pair may cover the same area or point target with their fire. But for targets wider than approximately the angle subtended by 100 feet at 1,000 feet, each gunner usually fires on half of the target width. For direct fire on extremely wide targets, four guns may be fired under the direction of a single leader. Guns are used singly only when an extended front must be covered by few guns. Direct machine-gun fire is considered effective at targets up to ranges of about a mile. Beyond that range the effect of the fire cannot be observed, even with field glasses.

Indirect fire, on areas out of sight of the gunners, is effective up to about two miles with accurate, modern, heavy machine guns. For this fire, the guns are usually employed in batteries of four under the direction of one officer. The data from which are found the elevation and directions for pointing the guns to hit the unseen target, are calculated in two ways. Ranges and angles-of-direction may simply be measured on an accurate map or airplane photograph containing the positions of the target and the guns. Or ranges and directions may be measured directly on the ground from some high point from which the guns and the target can both be seen. For the latter method, an optical instrument called a range-finder is used to measure ranges, a magnetic optical instrument such as an aiming-circle, is used to measure vertical angles from the north and horizontal angles. The horizontal angles and ranges from the observation point to the target and to the guns are plotted on a drawing board. A line is drawn from guns to target, the range measured with a scale, and the direction-angle with a protractor. This procedure amounts to a simple survey, and may be expanded to include one or more intermediate observation points between the guns and the point from which the target is visible.

The rapidity of such surveys depends largely upon the accessibility of the observation points. If most of the distance can be traveled in a motor vehicle, a survey from a single observation point can be completed in a few minutes, and the result either signalled or taken back to the guns. To determine the correct angle-of-elevation for the guns to hit the targets requires a simple calculation to allow for the difference in elevation of guns and target, and then a reference to a brief set of firing tables in which range is converted into angular measurement. The guns are then turned and raised to the correct angle. Firing may begin then, or at any time later when the enemy is known or suspected to be occupying the area at which the guns are directed. Surveys are often made, and data calculated and recorded in advance, for a number of possible future targets.

Organization and Tactics of Light and Heavy Machine-Gun Units.—In a broad sense there are no separate tactics for light or heavy machine guns. During the World War of 1914–18, heavy machine-gun units were organized in battalions of three or four companies each manning about 12 guns. The experience of battle proved, however, that three battalions could seldom be used in combat as units, and that even companies had to be split into their separate four-gun platoons for purposes of combat. The battlefield also proved that machine-gun units have no tactical uses distinct from those of the infantry rifle units. And as a result, the tendency in all armies after 1918 was to include heavy machine-gun units in infantry battalions or regiments in the ratio of about one company (12 guns and some 200 men) to three rifle companies (some 600 men), and to include light machine-gun units within the rifle companies and smaller units. Except for the fact that some heavy machine guns were replaced by special antitank machine guns in 1938, this is now true in the United States Army as in other major armies. See INFANTRY.

The part of the machine gun in infantry tactics, both offensive and defensive, is that of a powerful supporting weapon. In an attack, light machine gunners keep close in rear of the leading riflemen and fire to the front through gaps between rifle units, and also across the front of adjacent rifle units which have been held up by hostile fire. Heavy machine guns, from positions farther back, usually on high ground, fire over the heads of the advancing rifle units or along their flanks, as long as it is safe to do so. When the rifle units (including light machine-gun units) have advanced some distance against the enemy, say half a mile, heavy machine guns are rapidly loaded into light cross-country motor

carriers and moved forward to new positions from which they can again support the rifle troops. About half of the heavy machine guns supporting a given number of rifle units are thus moved forward at a time, and the other half are kept in the original firing positions until the others are firing from their new positions. The rear guns then move forward to new positions. This movement forward by bounds from one supporting position to another continues until the leading rifle troops reach and occupy the final objective.

In an attack, the fire of supporting light machine guns and often that of heavy machine guns, is almost always placed on hostile resisting elements, such as groups of riflemen and machine gunners, whose positions are either definitely known or suspected. Whenever possible, fire is delivered at enemy elements whose fire is liable to prevent the continued advance of the rifle units leading the attack. Only when the irregularities of the ground prevent direct fire do heavy machine-gun units employ indirect fire upon areas liable to contain enemy troops but not definitely known to. Thus, in offensive combat, the fire of light and heavy machine guns is never simply an aimless hail of lead striking the general areas that the enemy holds. If there are no known or suspected targets for machine gunners to fire upon, they save their ammunition for a more effective use later on.

If tanks are assisting the leading rifle units in the attack, the work of light and heavy machine guns differs little from that already described. In defensive infantry combat machine guns are the most important weapon. See INFANTRY.

Airplane and Tank Machine Guns.—The heavy machine guns used in the airplanes of an army are usually of the same types used by ground troops except for being air-cooled instead of water-cooled and for having special mounts. Modern fighting planes have as many as eight guns mounted under the wings to fire forward and operated by a single trigger from the cockpit. For air fighting these guns are given a high rate of fire, above 1,200 rounds per minute in some types. For defense against attack by hostile planes, bombardment and other large types of planes have heavy machine guns mounted in cockpits for individual fire upward and downward and to the sides and rear.

Both air- and water-cooled machine guns are used in tanks and armored cars. See TANKS and ARMORED CARS.

Special Types of Machine Guns.—Special machine guns include such weapons as the calibre .50 antitank machine guns used by the infantry and cavalry of the United States Army, and calibre .50 antiaircraft machine guns used by the Coast Artillery Corps. Some fighting aircraft carry such machine guns and they are also mounted in tanks and armored cars. They may be either air- or water-cooled and are recoil-operated and usually belt-fed. They fire bullets several times the weight of those used in rifles and heavy machine guns. Antitank machine guns are mounted on low tripods and antiaircraft machine guns on high ones. Both weigh so much that they are carried by hand only for short distances and are largely transported on motors.

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MACHINERY-MANUFACTURING INDUSTRY IN AMERICA. Owing to the restrictive measures of Great Britain this industry made a late start in America; but when a beginning was made, the very laws by which the mother-country sought to make the States dependent on her proved more stimulating to the development of our machinery-manufacturing industry than the most rigid system of protective tariff would have been. Great Britain wished to confine manufactures to her shores and compel the American colonists to buy their manufactured articles from English factories. At first the colonists were not allowed either to manufacture or to import machinery. In the year 1774 a statute was enacted by Parliament instituting the restrictive system as to textile machinery. This statute was made more stringent in 1781, and it was not actually repealed till 1845. This act prohibited the exportation of «any machine, engine, tool, press, paper, utensil, or implement whatever, which now is, or may at any time be, used in or proper for the preparing, working, pressing, finishing, or completing of the linen, cotton, wool or silk manufactures of this kingdom, or any other goods wherein wool, silk, or cotton is used, or any part of such machine, etc., or any model or plan of any such machine,» under penalty of forfeiture of the tools or machine, the payment of a fine of £200 and imprisonment for one year. Further, foreigners were prohibited, under a penalty of £500 and imprisonment for 12 months, «from seducing artificers, and others employed in the manufactories, to depart out of this kingdom; and if any artificer has promised or contracted to go into foreign parts to practise or teach his trade, such artificer may be obliged to give security, at the discretion of the court, that he shall not go beyond the seas, and may be committed to prison until he give such security.»

These laws were rigidly enforced; and it was seldom that they were evaded. It was impossible even to smuggle a textile machine into this country; and the models that were surreptitiously imported were imperfect. Tench Coxe, the coadjutor of Alexander Hamilton in the Treasury Department, made arrangements to have models of Arkwright's patents sent to him; but before they could be shipped they were detected and forfeited. In 1786 the General Court of Massachusetts appointed a joint committee to investigate textile machinery; and this led later to the employment of Samuel Slater and to the real beginning of machinery-manufacture in this country. Slater landed at New York 17 Nov. 1789; and in the following January he made arrangements with Messrs. Brown and Almy, of Providence, R. I., to construct for them textile machinery on the English plan. He made most of the machinery with his own hands and set it up at Pawtucket, R. I. This was the first textile mill in this country to use the Arkwright system. It was opened 20 Dec. 1790. It must be remembered that Slater brought with him from England no implements to work with, and no plans or models. He had to depend entirely upon his memory. Alexander Hamilton called him «the father of American manufactures»; but, in the first place, he was the father of American machinery. Up to the time of his coming there were no machines in this country, with the exception of the rude saw-mill, grist-mill and fulling-mill; some rolling and slitting

mills, foot-lathes, and a few home-made carding and spinning appliances. The first carding-machine worked in the United States was constructed at Newburyport, Mass., in 1793, by John and Arthur Scofield. Until then the household looms were the only domestic source of supply of woolen cloth.

At this time the manufacture of metal working machinery was in its infancy. The lathe was known only in its simplest form, i.e., two dead centres supporting the work as it was rotated backward and forward by a band around it, one end attached to a spring-pole above it, the other end to the foot of the operator, who held the turning-tool in his hand. Even after the lathe had been provided with a revolving spindle and centre to support and rotate the work, the tools used for turning both wood and iron were still manipulated by hand. The increasing demand for accurately-cut cylindrical iron pieces, which could not be made by hand, led to the general use of the slide-rest. Formerly used only by the optician and the maker of mathematical instruments, it now became a necessary adjunct of the mechanic's lathe. This gave the lathe practically unlimited capacity to turn out exact cylindrical work; but in order for the slide-rest to do its work, it had to be manipulated by the workman. The next step was naturally the introduction of the slide-lathe, by which the rotation of the work and the advance of the cutting tool are accomplished automatically. Owing to the lack of suitable tools to make the long flat surfaces required in such a machine, the slide-lathe had a curious development. The hammer, file, cold-chisel and straight edge were the only tools at hand. The planing-machine was the development of a demand for greater accuracy in the slide-rest. It marked an era in the life of the machinist as great as that of the slide-rest itself. It is doubtful when the first planing-machine was made in the United States; but we know that there were only four such machines in this country in 1838. With this machine the rough and uneven surfaces of castings could be smoothed and reduced to true planes. Up to this time the drill had been limited to a revolving vertical spindle. The boring-mill or vertical lathe was now possible and took its place in the machine-shop for the execution of a large class of turned work that did not require to be supported on centres, such as wheels to be keyed upon their shafts. In fact, the first development of the planing-machine was the key-seating machine. It was soon recognized that such a machine could be turned to other work, and further changes were made accordingly. It was provided with compound slide-rests, with a revolvable table mounted thereon and in this form it took its place as a standard tool in the machine-shop under the name of the slotting-machine. This planer, with its vertically movable tool, was the progenitor of a machine with similar attachments, but with its tool moving horizontally, upon which work could be conveniently shaped in a great variety of forms; and the shaping-machine, as it was called, soon became one of the standard tools of the machine-shop. Meanwhile, the old vertical spindle drill, with its compound tables, movable vertically and adjustable horizontally, in two directions at right angles with each other, had been supplemented by the horizontal drill, with similar tables, but with its drill-spindle parallel to the tables; and the further requirements in this direction had been supplied by the radial drill, in which the vertical drill-spindle is movable about a vertical axis, to which it is adjustable radially.

However, there were other factors entering into the development of our machinery industry. There were other requirements beside these machine-tools, and which these supplied inadequately. Screw-bolts and nuts were needed for putting the machines together. Originally iron screw-bolts had been made by means of a split die provided with spiral threads, by rotating either the bolt or the die backwards and forwards until the thread was partly cut, while a taper-tap was screwed into the nut first from one side, then the other, until the bolt was found to fit into the nut. These bolts were not interchangeable. This primitive system of bolt-manufacture continued until 1847, when the solid die with sectional threads patented by Philetus W. Gates was generally introduced. This die cut the thread at one pass, then the rotation was reversed to unscrew it from the bolt, which marked the thread and was liable to mutilate the die. No compensation for wear was possible. Nothing approaching perfection was attained until 1857, when William Sellers devised a bolt-machine in which dies to cut the thread at one pass, and adjustable to size, could be opened and closed while running continuously in one direction. Since then ordinary screw-bolts have been made interchangeable. In a few years this machine of Sellers' was introduced into England and also continental Europe. The first turret lathe was built by Stone in 1854. It was provided with automatic mechanism for turning the turret in 1855, and perfected to its present condition in 1858. The gear-cutter was another of the early machine-shop tools. This was simply a revolving milling-cutter, mounted upon a spindle above the dividing-plate. The wheel to be cut was forced against this. The machine was adjusted by hand. Such work was slow and very expensive; and up to 1867 the teeth of nearly all wheels, even for fine machines, were cast. In this year a machine was devised by William Sellers which limited the work of the operative to adjusting the wheel to be cut to the cutter. The machine was otherwise automatic; and it was now possible for one workman to attend to several machines, thereby greatly diminishing the cost of such work. From that time cast wheels have been no longer allowable in first-class machines. Another typical machine-tool that deserves mention is the milling machine. It has received its greatest development in this country. The manufacture of metal-working machinery has become highly specialized, and only the older establishments produce a number of different types of machines. New establishments usually make only one type of machine, or at most one class embracing tools of similar type. Some establishments make only engine-lathes, others only planers, others nothing but milling-machines. The effect of specialization has been to make machine-tools more efficient, and, it may be added, more varied. If, for instance, a new construction is designed, as in the automobile, or airplane, and strangely fashioned parts are required, a machine that will make these parts is always forthcoming.

The development of more accurate machinery, as indicated above, led to the system of interchangeability. In the manufacture of

machinery this is an economic principle of the greatest importance. Under more primitive methods individual parts had to be fitted together with great difficulty and at much expense. Now all these parts are made by machines with such exactness that they are completely interchangeable; and there is no longer any question as to their fitting. This method of manufacture has increased the output of the individual workman and reduced the cost of production tremendously. Though first applied in Europe, it remained for the United States to demonstrate its feasibility and actually put it into successful operation, and it is generally referred to as the American system. For the economical manufacture of any kind of machinery in which many parts are to be interchangeable certain definite conditions must be met; and success economically requires that every part shall be finished without the intervention of a skilled workman. The machine must be so designed that it will not only work automatically but work with a high degree of accuracy. Reference standards must be provided with which to compare the several parts in order to determine the amount of variation permissible between the standard and the product; every part must come from the machine in the final finished form. Such are some of the details that make necessary a careful study of every part in order to design a machine that will perform each operation with the most efficiency.

The principle of interchangeability was first suggested and put into operation in a small way by Le Blanc, in France. Its importance and possibilities were at once recognized by American inventors, and its first application in the United States was in the manufacture of fire-arms in our government arsenals under the direction of Eli Whitney, the inventor of the cotton-gin. Simeon North, a maker of pistols, and a neighbor of Whitney, also adopted the system. By 1818 both of these men were using drilling and filing jigs. The growth of the system was slow, being confined for a time to the principal parts; but even in this undeveloped condition it proved successful economically. In 1822 Calhoun, who was then Secretary of War, remarked to Whitney that his improvements were saving the government $25,000 a year at the two public armories. The drop-hammer and dies were first used by Hall, at Harper's Ferry in 1827. Whitney adopted this machinery and thus was able to cut from red-hot metal all the smaller parts of a gun in a form closely approximating the finished article. These forged parts were then subjected to the more accurate milling-machine, which turned out the parts in uniform condition, no matter how varied their shape may have been when they came from the forging-press. It only remained for the drill to fashion the bearings for the working parts and bore the holes to secure the parts together. This was a comparatively simple matter when once the order of procedure had been determined and the guiding templets or jigs provided. The wooden stocks of the gun were also made by machinery and with sufficient accuracy to make them interchangeable. This was accomplished by means of a turning-lathe designed by Thomas Blanchard and patented by him in 1820. After the stock came from the lathe the groove for the barrel and the cavity for the lock were hollowed out by special machinery. Measured by the standards of to-day all this work was crude; but the gun of that day was itself crude, and these roughly interchangeable parts served their purpose. Machine-tools were then both inaccurate and limited in variety, so that they could not be expected to turn out the various parts with mathematical accuracy. Further, at that time there were no such delicate measuring instruments as we have to-day. The most refined measuring instrument known then was the vernier caliper; and the smallest deviation from the standard that could be detected with this contrivance was, at best, perhaps the thousandth part of an inch. In 1848 the interchangeable system was applied to watch-making at the Waltham factory, and in 1850–51 it was adopted for sewing-machines. The profiling machine was developed between 1848 and 1852 by F. W. Howe and E. K. Root. Since then have come great developments in the quality of machine-tools and in their wonderful adaptability to changing needs. Measuring instruments have now been so highly developed that a variation of the twenty thousandth part of an inch can be detected immediately and with perfect accuracy.

Foreign countries did not remain indifferent to the success of the United States in the employment of the principle of interchangeability of parts. Various commissions were appointed to investigate the system; and, as remarked above, the economic success of the United States in producing interchangeable parts led to the adoption of this method in Europe. In 1854 the Colt factory was established at Hartford, and shortly afterward a British commission bought from them a full outfit of machinery for making the Enfield rifle on the interchangeable system. Between 1870 and 1880 our large machinery manufacturers were kept busy filling foreign orders, especially for gun machinery. Large orders for such machinery were received from the German government; and it was even stipulated in the contract that the manufacturers should send over men to set up the machinery and instruct native workmen how to run it. Other governments began to look to us for their machinery; and thus our system for the manufacture of interchangeable parts was gradually established in England and continental Europe. This principle of interchangeability, first applied to the manufacture of fire-arms, then to pistols, has now been extended to practically every kind of machine. The sewing-machine, the typewriter, the bicycle, the watch, the various kinds of agricultural machinery, the gasoline engine, and notably in the automobile, may be mentioned as types showing the economic value of the principle of interchangeability. All our large machinery manufacturers are represented in foreign countries, and certain types of American typewriters, sewing-machines, cash registers, mowing-machines, reapers, etc., are just as well known there as they are here. American textile machinery and shoe-making machinery play an equally important part.

The giving of detailed information of the entire machinery-manufacturing industry of the United States is well nigh impossible, due to its many ramifications, but the following facts and figures are both interesting and instructive. The machinery manufacturing industry includes many categories, chief of which in value of products is the automotive industry. Following

in order are motor vehicle bodies and parts; electrical machinery; agricultural implements; mechanical refrigerators; machine tools and foundry and machine shop products and forgings. Other classifications, as given in the census of manufactures, are gas machines and gas and water metres; pumps and pumping machinery; sewing machines; textile machinery; typewriters and supplies; washing machines and ironers; locomotives and railway cars; ships, and engines and water wheels. The total value of motor vehicles and of automobile bodies and parts in 1938 was $5,176,235,000. The 1,067 establishments engaged in these industries in that year employed 478,341 workers and paid out $756,080,000 in wages. The number of plants engaged in the making of carriages, wagons and sleighs showed a steady decline during 24 years from 1914 to 1938. In 1914 there were 4,662 establishments. In 1927, the number had declined to 117 and in 1938 the total number of plants was 43 with a total output of products valued at $9,138,453. Heavy transportation machinery such as locomotives and railroad cars also declined materially in number of plants and in value of output, the total value of locomotives being only $72,123,000.

In 1938 the number of establishments producing machinery, exclusive of those making transportation products, was 6,876. These plants employed 816,948 workers who earned $1,180,429,000 in wages and produced output valued at $4,790,151,000. In 1927 the number of establishments was 12,037; the number of workers was 886,427; the wages paid amounted to $1,287,778,000 and the value of the product was $5,368,015,000.

The number of establishments making transportation equipment in 1938 was 1,870. These employed 615,064 workers and the total of wages paid amounted to $957,098,000. The value of the output of the plants was $5,910,699,000. In 1927 the number of plants was 2,537 and in these 494,905 workers were employed and earned wages totaling $803,298,000. The output of finished product was valued at $4,693,972,000. In 1914 there were 7,818 plants; 312,562 employees who earned $230,615,000 and the output totaled $1,137,423,000 in value.

The value of machinery manufactured in 1938, exclusive of transportation equipment, totaled $4,790,151,000. Agricultural implements, including tractors, made in that year were valued at $554,778,000. Electrical machinery was valued at $1,622,098,000. Electrical refrigerators had a value of $363,178,000. Foundry and machine shop products and forgings had a value of $520,138,000. Engines and water wheels produced were valued at $194,695,000; pumps and pumping equipment, $198,721,000; machine tools, $260,242,000; sewing machines, $34,835,000; washing machines, $69,888,000. Aircraft production in 1938 was valued at $106,568,000 against $21,162,000 in 1927.

See HARDWARE INDUSTRY; FARM MACHINERY; and articles on special types of machinery.

MACHPELAH, măk-pē'lą, **Cave of,** Hebron, Palestine; in Old Testament history the burial place of the patriarchs. Upon the traditional site stands a superb mosque which only Mohammedans are permitted to enter, although by a special firman of the sultan the Prince of Wales visited it in 1862, the Marquis of Bute in 1866 and the Crown Prince of Prussia in 1869.

MACHRAY, mą-krā', **Robert,** Canadian Anglican archbishop: b. Aberdeen, Scotland, 17 May 1831; d. Winnipeg, Canada, 9 March 1904. He was graduated at King's College, Aberdeen, in 1851, and from the Sidney Sussex College, Cambridge, in 1855. He was of Presbyterian stock, but joined the Church of England and was ordained deacon in 1855 and priest in 1856. He was appointed vicar of Madingley, near Cambridge, in 1862, and in 1865 he was Ramsden preacher at Cambridge. He was appointed bishop of Rupert's Land, Canada, in 1865, and was consecrated in May of that year. His diocese covered 2,000,000 square miles of territory with headquarters at the then hamlet of Winnipeg, and but 18 clergymen to assist him. He was active in the promotion of education, renewed and reorganized the defunct Saint John's College at Winnipeg, and himself lectured in ecclesiastical history, liturgiology and mathematics. He was one of the founders of Saint John's Ladies' College, and upon the establishment of the University of Manitoba in 1877 he became chancellor, retaining the office until his death. He had meantime organized his diocese with a view to serving the fast-increasing population. He became metropolitan of Canada under the primacy of the archbishop of Canterbury in 1875, and upon the union of the Canadian Anglican churches in 1893, he became archbishop of Rupert's Land and primate of all Canada. Consult Machray, Robert, 'Life of Archbishop Machray' (1909).

MACHUELO, mą-chwā'lō, Spanish name current in the West Indies for the thread herring (q.v.), an inedible, shad-like fish (*Opisthonema oglinum*) of the Atlantic coasts of the United States and the waters of the West Indies.

McILHENNEY, Charles Morgan, American landscape painter: b. Philadelphia, 4 April 1858; d. 1904. Having studied under Frank Briscoe, he continued his training at the Academy of Fine Arts in Philadelphia, and soon began to win recognition in his chosen field. Among his best-known works are 'A Gray Summer Noon' (1884), and 'The Passing Storm' (1887); 'Old Friends' (1891); 'On the Beach' (1891); 'Gray Morning' (1892); 'September in the Marshes' (1893). In 1893 he was awarded medals at the Columbian Exposition and won the first Hallgarten prize.

McILVAINE, măk'īl-vān', **Charles Pettit,** American Protestant Episcopal bishop: b. Burlington, N. J., 18 Jan. 1799; d. Florence, Italy, 13 March 1873. He was graduated at the College of New Jersey (now Princeton University), in 1816; entered the Princeton Theological Seminary in the same year, and was ordained deacon in 1820 and priest in 1821. His first pastoral charge was at Georgetown, D. C., which he left in 1825 to become professor of ethics at the United States Military Academy, West Point. He became rector of Saint Ann's Church, Brooklyn, in 1830, and in 1831 undertook the duties of the professorship of the evidences of religion and sacred antiquities in the New York University. He did not long hold the chair, however, as he was the next year elected bishop of Ohio, to succeed Bishop Chase, who had resigned the see. The question of the legality of such a resignation excited considerable interest in the General Convention of that year, but in the interest of the

diocese both houses agreed in approving Dr. McIlvaine's testimonials, and he was accordingly consecrated in Saint Paul's Chapel, New York. Upon his removal to Ohio he was elected president of Kenyon College, Gambier, founded by Bishop Chase, and held the position until 1840, acting also for some years as president of the theological seminary in the same place. During his long episcopate he came to be recognized as one of the most influential leaders of the Evangelical or Low Church party in America, and his ability and courtesy were cordially recognized by those who differed from him most widely. During the Civil War he was one of the four ambassadors informally appointed by President Lincoln to set before the English people what was considered in the North the real significance of the War. He published various sermons, addresses and more important theological works, mainly directed to defending the positions of his party in the Church.

McILWRAITH, mäk"l-räth, **Jean Newton,** (JEAN FORSYTH), Canadian author, daughter of Thomas McIlwraith (q.v.): b. Hamilton, Ontario, 1871. She was educated at Ladies' College, Hamilton, and studied English literature in the correspondence classes of Queen Margaret College, Glasgow, for 10 years, engaging in editorial work in New York in 1902. She is a frequent contributor to magazines and is author of 'History of Canada' in 'Children's Study Series' (1899); (joint author with William McLennan) 'The Span o' Life' (1899); 'The Curious Career of Roderick Campbell' (1901); 'The Little Admiral' (1924); 'Kinsmen at War' (1927).

McILWRAITH, Thomas, Canadian ornithologist: b. Ayreshire, Scotland, 1824; d. 1903. He was educated in Scotland and emigrated to Hamilton, Ontario, in 1853, where he spent the remainder of his life. He became known through his classification of the birds of Canada and his study of their habits, which subject he pursued as a recreation. He was a member of the conference of American ornithologists held in New York in 1883, out of which came the American Ornithologists' Union. He served for many years as superintendent of the district of Ontario for the Migration Committee of the American Ornithologists' Union. His first report of Canadian birds was published in the *Canada Journal* in 1861, and his 'Birds of Ontario' was published by the Hamilton Association (1886; author's ed., 1887; 2d ed., 1894).

McINTIRE, Samuel, American wood carver and architect: b. Salem, Mass.. Jan. 1757; d. there 6 Feb. 1811. His influence upon architecture is exampled principally in his native town, where houses of his design, construction and ornamentation are preserved and give to one of the streets such distinction that it has been termed the most beautiful of our colonial streets. McIntire had carved figureheads for sailing vessels, which made Salem foremost of seaports in the colonies and known to the Indies and China, and then he began building houses for the great merchant ship owners. They were most substantial structures, the house itself one of a group of buildings, four-square and three stories in height, the whole surrounded by a massive fence. They differed from other homes of this general plan in their details, in their heavily ornamented entrance ways, hallways, staircases and room decorations, wherein the wood carver displayed his art in a manner that remains unsurpassed in this country.

His design entered into the Peirce house of 1779, and in 1780 he began the Derby house near the Derby wharf, and later the Boardman house on the Common, and the Forrester house. Meantime he was called upon to design other buildings such as the Assembly house and the court house in Salem, and in 1792 he submitted a design for the national Capitol. New influences were coming into American architecture in favor of more graceful forms, and McIntire did not hesitate to embody the new style in his plans, following after Bullfinch, and Adam in England, so that many of his later houses show less of massiveness and more of elegance. In the Read house he used carvings such as baskets of fruit and sprays of grapes which typify his methods of decoration. He displayed the new fashion in redesigning one of the Derby houses, the "Mansion," and carved many pieces for it from capitals to beading. As richly decorated was "Oak Hill" at Peabody, the home of a Derby daughter, the carvings here added to by McIntire's son Samuel after his death. Three of the rooms of this house have been transferred to the Boston Museum of Fine Arts and are described in a publication of the Museum. Decorations were also removed which are in the Pennsylvania Museum of Art.

His later houses were all built of brick, and included the Woodbridge and Tucker houses, and many carvings of his are found in other houses, not only as interior woodwork but in pieces of furniture bearing his characteristic ornaments of baskets, rosettes, eagles, the grape and laurel, and others used by him. Eagles he worked in on gateways, homes and large buildings, and some of these may be seen in the Essex Museum of Salem.

After his death it was said of him that all the improvements in Salem for thirty years had been under his eye. His son carried on carving, but died in 1819; and a brother, Joseph, and his son followed the art until the middle of the century. Consult Cousins and Riley, 'The Wood Carver of Salem' (1916); Swan, M. M. 'Samuel McIntire, Carver, etc.' (1934).

McINTOSH, Lachlan, American soldier: b. near Inverness, Scotland, 17 March 1725; d. Savannah, Ga., 20 Feb. 1806. He came with his father to Georgia in 1736, received there an ordinary English education, became a clerk in the mercantile establishment of Henry Laurens at Charleston, S. C., and was later employed as a land surveyor. At the opening of the Revolution he was made colonel of the 1st Georgia battalion, and became a brigadier-general in 1776. In 1777 he fought a duel with Button Gwinnett (q.v.), who was fatally wounded. In 1778 McIntosh was selected by Washington to lead a small force against the Western Indians, whom he subdued. In the siege of Savannah, 1779, he bore an active part. When Charleston surrendered to Sir Henry Clinton 12 May 1780, McIntosh was taken prisoner, and he never resumed his command. He was a member of the Continental Congress in 1784, and the next year as commissioner to the Indians he finished his public services.

MacINTOSH, William, a half-breed Creek chieftain, son of a Scottish trader: b. about 1780; d. 1 May 1825. In 1802 the United States undertook to extinguish the Indian titles to

lands within the borders of Georgia and in 1805 millions of acres of Creek lands were transferred to Georgia. The Creeks becoming alarmed at the prospect of being deprived of all their lands, on the motion of MacIntosh, now a chief, made a law in general council in 1811 forbidding the sale of any of the remaining land under penalty of death. MacIntosh led the Creek allies of the Americans in the War of 1812 with the rank of major and took the chief part in the massacre of 200 hostile Creeks at Atasi on 29 Nov. 1813. He also took part in the battle at Horseshoe Bend, Ala., 27 March 1814. More lands were acquired by treaty in 1818 and in 1821 another treaty was negotiated by the Georgians with MacIntosh, who was in the pay of the whites, and other chiefs controlled by him, while 36 chiefs refused to sign and demanded a general council. In 1824 about 10,000,000 acres still remained in the hands of the Creeks and in that year they re-enacted the law punishing with death any Creek who ceded land. In 1825 the whites, with bribes, induced MacIntosh and the chiefs under his control to sign a treaty ceding the remaining Creek lands. The treaty was approved by President Adams, but the Creeks did not rise in rebellion; they passed formal sentence of death on MacIntosh, which a party of warriors carried out.

MACK, Norman Edward, American politician and newspaper publisher: b. Buffalo, N. Y., 24 July 1858. He received a public school education, engaged in business and in 1879 established the *Buffalo Sunday Times.* In 1883 he began the publication of the *Daily Times,* of which he continued owner and editor. He was a delegate to the Democratic National Conventions from 1892, served as a member of the Democratic National Committee from 1900 and became its chairman in 1908. Died 26 Dec. 1932.

MACK VON LEIBERICH, Karl, Baron, Austrian military officer: b. Nennslingen, Bavaria, 24 Aug. 1752; d. Saint Polten, Austria, 22 Oct. 1828. He entered the army of Austria in 1770, and was in 1797 created field-marshal. After the peace of Campo Formio, he was appointed by the king of Naples to the command of his troops, and took the field against the French and occupied Rome; but a riot in Naples, caused by his having concluded an armistice with the French, forced him to take refuge in the French camp (1798). He was carried prisoner to Paris, but escaped in 1800 and in 1805 was sent to check the French advance alone the line of the Iller. But the enemy shut him up in Ulm, and on 17 October Mack capitulated with his army. He was tried by court-martial, but the sentence of death was commuted by the Austrian emperor to expulsion from the army and 20 years' imprisonment. In 1808 Mack was liberated, and in 1819 fully pardoned.

McKAY, măk-ī', **Alexander Charles,** Canadian educator: b. Beamsville, Ontario, 2 June 1861. He was educated at the universities of Toronto and Cambridge, England. He became professor of mathematics and physics at McMaster University in 1890, later holding the offices of dean of arts and registrar, and in 1905 he was elected chancellor of the university. After 1911 he was the principal of the New Technical School, Toronto. He collaborated in the preparation of mathematical textbooks.

MACKAY, mą-kā' or mą-kī, **Charles,** English poet, journalist and miscellaneous writer: b. Perth, Scotland, 27 March 1814; d. London, 24 Dec. 1889. He was editor of the *Illustrated London News,* 1852–59, lectured in the United States, 1857–58, and was a special correspondent of the London *Times* in New York during the Civil War (1862–65). He was famous for his songs, many of which he set to music of his own. 'Cheer, Boys, Cheer,' is the best known of these.

MACKAY, Clarence Hungerford, American capitalist: b. San Francisco, 17 April 1874; d. New York, 12 Nov. 1938. The son of J. W. Mackay (q.v.), he succeeded on the death of his father to his vast business interests. Much of his boyhood was spent in France, and he was educated in Vaugirard College, afterward studying at Beaumont College, Windsor, England. He was chairman of the Commercial Cable Company, the Postal Telegraph-Cable Company, the Commercial Pacific Cable Company, the Mackay Companies, the Commercial Cable Building Company, the Postal Telegraph Building Company and the Commercial Cable Company of Cuba. He was also a director of the North American Telegraph Company and the Metropolitan Opera Company. He was one of the prime movers to raise funds for the purchase of the log cabin in which Abraham Lincoln was born.

McKAY, Donald, American shipbuilder: b. Nova Scotia, 1810; d. 1880. He went to New York and learned shipbuilding, and began the business at Newburyport, Mass. At East Boston, in 1845, he established a shipyard where he built many large trading ships of the clipper model, in which he made great improvements. The *Great Republic,* which he built in 1853, a ship of 4,500 tonnage, was a larger vessel than had ever before been seen.

MACKAY, George Eric, English poet, son of Charles Mackay (q.v.): b. London, 25 Jan. 1851; d. 2 June 1898. Among his works are 'Songs of Love and Death' (1865); 'Ad Reginam' (1881); the popular 'Love Letters of a Violinist' (1886); 'A Lover's Litanies' (1888); 'Nero and Actæa,' a tragedy (1891); 'My Lady of Dreams' (1895); 'Arrows of Song' (3d ed., 1896); 'A Lover's Missal' (1898).

McKAY, Gordon, American inventor and manufacturer: b. Pittsfield, Mass., 1821; d. Newport, R. I., 19 Oct. 1903. He was the son of a cotton manufacturer, and at 12, on the death of his father, learned civil engineering, at which he worked for some time. Before he was 21 he built a machine-shop in Pittsfield which employed 100 men, and later became treasurer and manager of the Lawrence Machine Company. He was the first successful inventor of machinery for making boots and shoes; he perfected a shoe sewing-machine, invented, but not made practicable, by L. R. Blake, of Abington, Mass.; afterward invented the heeler, lasting-machine, nailing-machine, etc., which came into general use; and by these inventions revolutionized the boot and shoe industry of the world. At the outbreak of the Civil War he offered to make the shoes for the Union army, and within three years had leased his

machines to more than 60 firms, and shortly became a millionaire. In 1878 he formed the McKay Sewing-Machine Association, a strict monopoly which exacted commissions on all shoes made in the United States by the aid of his inventions, and also brought profit through European royalties. In 1893 he placed $4,000,000 in a trust fund for Harvard University. He made many other liberal donations for benevolent and educational objects, and established near Kingston, R. I., the McKay Institute for the manual training of colored youth. By his will the greater part of his estate was left to Harvard.

MacKAY, Jessie, Australian poet and prose writer: b. Cambridge, New Zealand, 15 Dec. 1864. She combined teaching with literary work and has been a voluminous contributor to the Australian press, with the readers of which she is a favorite. Among her published works are 'The Spirit of the Rangatira and Other Ballads' (1810); 'The Sitter on the Rail and Other Poems' (1891); 'The Bride of the Rivers.'

MACKAY, John William, American capitalist: b. Dublin, Ireland, 28 Nov. 1831; d. London, 20 July 1902. His parents brought him to New York in 1840, and he learned shipbuilding. He went to California as a miner in 1851, and afterward to Nevada, where he continued mining with great perseverance in the face of many disappointments. In 1872 he was one of the discoverers of the Bonanza mines of the Comstock Lode (q.v.), in which mines he obtained a two-fifths share and became very wealthy. He and his partners, Fair, Flood and O'Brien, founded the Bank of Nevada, of which Mackay was president for years. His relations with Jay Gould being unfriendly, in a spirit of opposition to him, and to the Western Union Telegraph Company, Mackay in 1884 joined with James Gordon Bennett in forming the Commercial Cable Company and the Postal Telegraph Company. He succeeded in laying two cables, overcoming great obstacles, and afterward won in a long rate-war with the old lines. The Roman Catholic Orphan Asylum at Virginia City, Nev., founded by him, is noteworthy among his many public benefactions.

MACKAYE, mą-kī', **James Steele,** American playwright: b. Buffalo, N. Y., 1844; d. Timpas, Colo., 25 Feb. 1894. In 1868 he went to Paris to study painting; but having there met Delsarte (q.v.) became interested in the latter's theories, and studied dramatic expression. In 1870–71 he gave in New York and Boston lectures on the art of expression. He opened the Saint James Theatre at New York in 1872, and appeared there in 'Monaldi,' adapted by himself from the French. In 1873–75 he was studying the drama in Paris and England, and at the Crystal Palace, London, he played the title-rôle in 'Hamlet.' His adaptation of Blum's 'Rose Michel' in 1872 ran for 122 nights at the Union Square Theatre, New York. He established in New York the Lyceum School of Acting, which later became the American Academy of Dramatic Arts. For several years he was manager of the Madison Square Theatre, and in 1885 built the Lyceum. Among his further plays were 'Won at Last'; 'Through the Dark'; 'Hazel Kirke'; 'A Fool's Errand'; 'In Spite of All'; 'Paul Kauvar.' Consult Mackaye, Percy, 'Steele Mackaye: A Memoir' (New York 1911).

MACKAYE, Percy, American dramatist and poet: b. New York, 16 March 1875. He was graduated from Harvard in 1897 and studied at the University of Leipzig in 1899–1900. He engaged in European travel in 1898–1900, residing in Rome, Switzerland, Leipzig and London. He was an instructor in a private school in New York in 1900–04, after which time he joined the Cornish Colony in New Hampshire and devoted his time entirely to dramatic work. He has lectured on the theatre at Harvard, Yale, Columbia and other American universities, and is a member of the National Institute of Arts and Letters. He is a leading exponent of poetic dramatic art in America and handles both tragedy and comedy with grace and surety of touch. Author of 'The Canterbury Pilgrims,' a comedy, produced by the Coburn Players in the open air at Harvard, Yale and other universities in 1909–13, and given as a civic pageant in honor of President Taft at Gloucester, Mass., 4 Aug. 1909 (1903); 'A Modern Rendering into Prose of Chaucer's Tales' (1904); 'Fenris the Wolf,' a tragedy (1905); 'Jeanne d'Arc,' a tragedy, produced by Julia Marlowe and E. H. Sothern in America and England in 1906–07 (1906); 'Sappho and Phaon,' a tragedy (1907); 'The Scarecrow' (1908); 'Lincoln Centenary Ode' (1909); 'Mater,' an American comedy (1908); 'The Playhouse and the Play,' essays (1909); 'A Garland to Sylvia' (1910); 'Anti-Matrimony,' a satirical comedy produced and acted by Henrietta Crossman (1910); 'The Civic Theatre' (1912); 'Uriel and Other Poems' (1912); 'Beauty and the Beast,' a lyric drama (1912); 'Sanctuary, A Bird Masque,' produced for President Wilson at Meriden Bird Club Sanctuary, New Hampshire (1913); 'The Immigrants,' a lyric drama (1915); 'The Evergreen Masque' (1917); 'This Fine Pretty World'; 'The Sphinx' (1929).

McKEAN, mą-kēn', **Thomas,** American patriot and jurist, signer of the Declaration of Independence: b. New London, Chester County, Pa., 19 March 1734; d. Philadelphia, 24 June 1817. He was privately educated at Newcastle, Del.; having settled there, he studied law and was admitted to the bar in 1755, at once became register of probate and was soon made assistant attorney for Sussex County. With Cæsar Rodney (q.v.), in 1762, he entered upon a revision of Delaware laws up to 1752, and was chosen in the same year to the Delaware assembly, in which his membership continued till 1779. Elected in 1765 to the Stamp Act Congress, he took a strong position in defense of colonial rights and as judge of the Common Pleas in the same year permitted no stamped paper to be used in his court. About 1771 he began to practise law in Philadelphia, although retaining a Delaware residence, and from Delaware, in 1774, he was elected to the Continental Congress, in which he served nine years, including the entire period of the Revolution, and took a prominent part in its proceedings, being president of the Congress in 1781. He was not present at the signing of the Declaration of Independence, which he had advocated, but added his signature some years afterward. The

Articles of Confederation were also signed by him. From September to November 1777, he served as acting president of Delaware, and from 1777 to 1799 as chief justice of Pennsylvania. As a member of the state convention in 1787, he played an active part in securing Pennsylvania's ratification of the Constitution. McKean became a strong supporter of Thomas Jefferson and a leader of the Republican Party of that day. From 1799 to 1808 he served as governor of Pennsylvania. With James Wilson he wrote *Commentaries on the Constitution of the United States of America* (1792).

McKEES ROCKS, borough, Pennsylvania, situated in Allegheny County, on the Ohio River at the mouth of Chartiers Creek, 4 miles northwest of the center of Pittsburgh, of which it is an industrial suburb. It is served by the Pittsburgh & Lake Erie, the Pittsburgh, Chartiers & Youghiogheny, and the Pittsburgh, Allegheny McKees Rocks railroads. There are bituminous coal mines nearby. The borough has railroad shops and industrial establishments producing iron and steel, locomotive parts, chemicals, paint, and enamelware.

McKees Rocks is on the site of a trading post established in 1743, and of a fort built by Christopher Gist (q.v.) in 1753. It was named for Alexander McKee, who acquired the land and settled here about 1764. It was incorporated as a borough in 1892. Government is by mayor and council. Pop. (1950) 16,241.

McKEESPORT, city, Pennsylvania, situated in Allegheny County, at an altitude of 750 feet, at the confluence of the Monongahela and Youghiogheny rivers and on their east banks, 10 miles southeast of Pittsburgh. It is served by the Pennsylvania, the Baltimore & Ohio, the Pittsburgh & Lake Erie, and the McKeesport Connecting railroads. The city is laid out on ground rising fairly steeply from the riverbanks, with the newer residential section on heights overlooking the business and industrial districts. McKeesport is the retail center of a thickly settled area, its neighboring towns including Clairton, East McKeesport, Glassport, Duquesne, Elizabeth, Wilmerding, Port Vue, and East Pittsburgh. The city's industrial history is closely associated with the development of the surrounding bituminous coal and natural gas region. McKeesport is one of the world's largest producers of steel pipe and tubing, and is sometimes called the Tube City. It also has important sheet steel and tin plate industries, and is the home of the first United States producers of stainless steel. Among the other products of the city's industrial establishments are shell and tool steel, steel castings, fabricated steel, structural steel products, chromium sheets, automobile wheels and bodies, tools and dies, cans, candy, meat products, and lumber. The city's public school system includes two high schools, and there is a Carnegie free library.

McKeesport was settled in 1755 by David McKee, a native of Ireland, who purchased a tract of 844 acres and from 1769 operated a ferry for which official authority was granted in 1775. The area was the center of the Whiskey Rebellion (q.v.) in 1794. The town was laid out in 1795 by John McKee, son of the original settler, 200 city lots being platted and sold. Growth was slow until about 1830, when the rich coalfields nearby were opened. Until the 1850's barge building was a thriving industry. The first ironworks was established in 1851, and industrial expansion was steady thereafter. McKeesport was incorporated as a borough in 1842, and chartered as a city in 1890. Government is of the commission type. Pop. (1950) 51,502.

McKEEVER, William Arch, American educator and author: b. Jackson County, Kans., April 12, 1868; d. July 8, 1940. He was graduated from the University of Kansas in 1898, and later studied at the University of Chicago and Harvard University. From 1900 to 1913 he taught philosophy at Kansas State Agricultural College, and from 1913 to 1920 was head of the department of child welfare at the University of Kansas. He then became director of the School of Psychology, Oklahoma City. He was the author of *Psychology and the Higher Life* (1908); *Psychologic Method in Teaching* (1909); *Farm Boys and Girls* (1912); *Training the Boy* (1913); *Training the Girl* (1914); *Outlines of Child Study* (1915); *The Child and the Home* (1923); *The Creative Mind* (1925); *You and Your Life* (1930); and *Living a Century* (1935).

McKELL, Sir William John, Australian statesman: b. Pambula, New South Wales, Sept. 26, 1891. From 1917 to 1947 he was a Labour member of the Legislative Assembly of New South Wales. He served as minister of justice of the state from 1920 to 1922 and again from 1925 to 1927, minister for local government from 1930 to 1931, minister of justice from 1931 to 1932, and prime minister from 1941 to 1947, when he was appointed governor general of Australia. He was knighted in 1951. Field Marshal Sir William Slim succeeded him in the governor generalship early in 1953.

MacKELLAR, Thomas, American printer, type founder, and poet: b. New York City, Aug. 12, 1812; d. Dec. 29, 1899. He went to work as a compositor at the age of 14, and in the following year was employed by the publishing house of John and James Harper, where he learned the printer's trade. Shortly before he was 21, he went to Philadelphia and became a proofreader in the type foundry of Lawrence Johnson and George F. Smith. In 1845 he became a partner in the firm, and in 1860 the head of its successor, MacKellar, Smiths & Jordan, which he developed into the leading type foundry in the United States. From 1855 to 1884 he edited the *Typographic Advertiser*. He was the author of a popular work on typography, *The American Printer* (1866), as well as of a number of volumes of poetry. Among the latter are *Droppings from the Heart* (1844); *Tam's Fortnight Ramble* (1847); *Rhymes Atween-Times* (1873).

McKELWAY, Saint Clair, American journalist: b. Columbia, Mo., March 15, 1845; d. July 16, 1915. In 1853 his family moved to New Jersey, where he was privately educated. He studied law and was admitted to the New York bar in 1866, but never practiced. In that year he joined the staff of the New York *World,* and from 1868 to 1870 was Washington correspondent of that paper and the Brooklyn *Daily Eagle.* He was a member of the editorial staff of the *Eagle* until 1878, when he became editor of the Albany *Argus.* In 1884 he became editor in chief of the *Eagle,*

which under his editorship maintained a high standard of excellence. He was a regent of the University of the State of New York since 1883, becoming vice-chancellor in 1900 and chancellor in 1913, a member of the historical societies of Long Island and Suffolk County, was director of the American Social Science Association and has lectured frequently on educational and political subjects.

McKENDREE, mą-kĕn'drĭ, **William,** American Methodist bishop: b. King William County, Va., 6 July 1757; d. near Nashville, Tenn., 5 March 1835. He served in the Continental army during the American Revolution, entered the Methodist ministry in 1787 and became a presiding elder nine years later. In 1801 he made a missionary tour beyond the Alleghanies and was an important factor in the evangelizing of that region. In 1808 he was elected bishop, being the first American-born person to hold that office in the Methodist Church. McKendree College (q.v.) was named in his honor. Consult 'Life' by Paine (1869).

McKENDREE COLLEGE, in Lebanon, Ill., founded in 1828 under the auspices of the Methodist Episcopal Church and first called Lebanon Seminary. In 1830 the name was changed, in honor of William McKendree, who gave his estate to the college. In 1839 a new charter was obtained whereby the school was granted university privileges. Abraham Lincoln rendered valuable services in securing the new charter. Students are admitted on certificates from approved schools or on examinations. It has classical, scientific, music, pre-law and pre-medical courses. Two main degrees are given: A.B. and B.S. In normal enrolment years it has approximately about 180 men and women in the regular session.

McKENNA, mă-kĕn'ą, **James Andrew Joseph,** Canadian public service commissioner: b. Charlottetown, Prince Edward Island, 1 Jan. 1862. He was educated at Saint Dunstan's College, Charlottetown, was associated for a time with the Prince Edward Island Railway and afterward engaged in journalism. In 1886 he entered the Indian Department of the Dominion Civil Service; and for a brief period was private secretary to Sir John A. Macdonald. With T. G. Rothwell he effected a settlement with British Columbia concerning the administration of the railway belt lands in 1897, and in 1899 he was a royal commissioner for the negotiation of a treaty with the Indians whereby the Peace River and Athabaska Country were surrendered to the Crown. He likewise secured the surrender by the Indians of the country around Buffalo Lake, Churchill River and Reindeer Lake in 1906. He was chairman of the royal commission which was appointed to adjust the claims of the half-breeds of the Northwest, and in 1901 was the sole commissioner. After 1909 he served as inspector of Indian Catholic schools in Manitoba, Keewatin and the Northwest provinces and territories. Author of 'Sir John Thompson' (1895), and 'The Hudson Bay Route' (1907). Died 30 May 1919.

McKENNA, Joseph, American jurist: b. Philadelphia, 10 Aug. 1843. In 1855 he went to California and was graduated from the Benicia Collegiate Institute in 1865, and admitted to the bar the same year. He was district attorney of Solano County in 1866–68, and in the sessions of 1875 and 1876 served as a Republican in the lower house of the California legislature. In 1885–93 he was a California representative in the 49th, 50th, 51st and 52d Congresses, resigning from the House in 1893 to accept the appointment to the office of United States circuit judge in the Ninth Federal judicial district. This post he resigned to become Attorney-General in the cabinet of President McKinley in 1897. On 16 Dec. 1897 he was made an associate justice of the United States Supreme Court; took his seat, 26 Jan. 1898; retired, 5 Jan. 1925. He died 21 Nov. 1926.

McKENNA, Reginald, English statesman: b. London, 6 July 1863. He was educated at King's College, London, and at Trinity Hall, Cambridge, and became a barrister in 1887. He engaged in law practice until his election to Parliament for North Monmouthshire by the Liberal party in 1895. He soon acquired a reputation as one of the hardest workers on the Liberal benches as well as for a sound knowledge of national finance and of parliamentary procedure. In the cabinet of Sir Henry Campbell-Bannerman, formed in 1905, McKenna was appointed Financial Secretary under Chancellor of the Exchequer Asquith. In 1907 he received cabinet place as president of the Board of Education. He instituted medical inspection of the children in the schools, and reorganized the secondary school system. When the Asquith cabinet was organized in 1908 he was appointed First Lord of the Admiralty, and in 1911 he was transferred to the office of Home Secretary, where the problems incident to the crusades of the militant suffragettes caused him considerable difficulty. The so-called "Cat-and-Mouse Act" brought severe criticism from the supporters of the suffrage movement and from the Opposition. He was also prominently connected with the Welsh Church Bill, the Mental Deficiency Act and the affairs of the Administration of Criminal Justice. Upon the formation of the coalition cabinet under Asquith, in May 1915, McKenna became Chancellor of the Exchequer, succeeding Lloyd George, who was appointed to the new post of Minister of Munitions. McKenna introduced the first heavy war-tax measure and elicited high praise upon its brevity and lucidity as well as its careful distribution of the burdens of taxation. When the new coalition cabinet was organized under the premiership of Lloyd George, December 1916, McKenna was succeeded by Bonar Law. In the elections of 1918 he lost his re-election from North Monmouthshire, interrupting a continuous Parliamentary career of 23 years. In 1919 he abandoned politics and devoted the remainder of his life to banking, becoming chairman of the Midland Bank, one of the strongest financial institutions in England. In 1924 he served as a member of the so-called Dawes Plan Commission. He died at London, 6 Sept. 1943.

MACKENSEN, August von, German field-marshal: b. Hausleipnitz, Saxony, 1849. Entering the army in 1869 he served as lieutenant of reserves in the Franco-Prussian War. In 1876 he became adjutant of the first cavalry brigade and two years later was made lieutenant-colonel. He was appointed to the general staff in 1882 and in 1894 became commander of the Life Hussars

Regiment and the following year was made aide-de-camp to the emperor. In 1914 he was made chief-of-staff under von Hindenburg on the Eastern Front and in 1915 he directed the German drive in the Balkans and was made field-marshal. He commanded the German right in the drive on Warsaw and forced the Russian evacuation of that city. In 1916 he subjugated Rumania in conjunction with von Falkenhayn. After the Armistice, he was interned by the French at Neusatz, where, over the protests of the Germans, he was kept until 1919.

MACKENZIE, ma-kĕn'zĭ, Sir **Alexander,** Canadian explorer: b. Stornoway, Scotland, 1763; d. Mulnain, Perth, 12 March 1820. He went to Canada and in 1789 explored the great river named after him from the western end of Great Slave Lake to the Arctic Ocean, made another expedition to the western coast (1792), and was the first white man to cross the Rocky Mountains and reach the Pacific Coast. He returned to Britain in 1801, and was knighted in 1802. He published 'Voyages from Montreal through the Continent of North America to the Frozen and Pacific Oceans in 1789 and 1793' (1801).

MACKENZIE, Alexander, Canadian statesman: b. Logierait, Perthshire, Scotland, 28 Jan. 1822; d. Toronto, Ontario, 17 April 1892. He emigrated to Canada in 1842. For five years he worked at the trade of a stonemason at Kingston, but then removed to Sarnia, where he became a contractor. But his chief interests were political, not commercial. In 1852 he began the publication of the Lambton *Shield,* and soon became conspicuous as one of the Liberal leaders. He entered the Canadian Parliament in 1861, and after the Confederation of Canada, in 1867, sat both in the Ontario legislature at Toronto and in the Dominion Parliament at Ottawa. When Edward Blake (q.v.) became Prime Minister of Ontario in 1871 Mackenzie joined his cabinet and became Provincial Treasurer, but in consequence of the passing of a law forbidding membership of more than one legislature, he elected in 1872 to sit in the Dominion Parliament. In 1873, when the government of Sir John Macdonald was overthrown, Mackenzie, now the leader of the Liberal party, became Prime Minister of Canada and held office for five years. His too great devotion to the details of his office broke down his health. In 1878 his government was defeated by the advocates of protection, and in 1880 he was obliged by ill-health to hand over the leadership of the Liberal party to Mr. Blake.

MACKENZIE, Sir **Alexander Campbell,** Scottish composer: b. Edinburgh, 22 Aug. 1847. He received his musical education at Sondershausen, Germany, and at the Royal Academy of Music, London, where he won the King's Scholarship in 1862. He established himself as a teacher in Edinburgh in 1865 and soon became known as a violinist of merit. He became precentor of Saint George's Church in 1870 and was appointed conductor of the Scottish Vocal Music Association in 1873. He was a member of the orchestra at the Birmingham Festivals in 1864–73. He had composed several notable pieces for the piano at this time, and at the solicitation of friends he abandoned his work as a teacher and settled in Florence where he spent the greater share of his time from 1875 to 1885 engaged in composition. From 1888 he was principal of the Royal Academy of Music. He conducted the Philharmonic concerts in 1892–99, and was knighted in 1894. Author of 'Overture, Cervantes'; the cantatas 'The Bride' (1881) and 'Jason' (1882); the operas 'Colombo' (1883); 'The Troubadour' (1886); the oratorios 'The Rose of Sharon' (1884); 'Bethlehem' (1894); incidental music for several plays among them 'The Little Minister,' 'Coriolanus' and 'Ravenswood,' and many concertos, songs, violin pieces and works for violin and orchestra. Died 28 April 1935.

MACKENZIE, Alexander Slidell (originally Slidell), American naval officer: b. New York, 6 April 1803; d. Tarrytown, N. Y., 13 Sept. 1848. He was a brother of John Slidell (q.v.) and assumed the name "Mackenzie" for an uncle in 1837. He entered the navy in 1815 and became a commander in 1841. While in command of the *Somers* the next year a mutiny among the naval apprentices on board was supposed to have been detected, and three of them, including a son of the Secretary of War, were hung from the yardarm on 1 Dec. 1842. He was a popular writer and among his works are 'A Year in Spain by a Young American' (1829–31; enlarged ed., 1836), which attained great popularity in England and the United States; 'Popular Essays on Naval Subjects' (1833); 'The American in England' (1835); 'Life of John Paul Jones' (1841), etc. Consult 'The Case of the Somers: Defense of A. S. Mackenzie' (New York 1843); Cooper, 'The Cruise of the Somers' (ib. 1844).

MACKENZIE, Arthur Stanley, Canadian educator: b. Pictou, Nova Scotia, 26 Sept. 1865. He was graduated at Dalhousie University in 1885, and in 1885–87 was assistant master at the Yarmouth Academy, Nova Scotia. He was scholar in physics at Johns Hopkins University in 1889–90 and Fellow there in 1890–91. He was connected with the staff of physics at Bryn Mawr College in 1891–1905, was professor of physics at Dalhousie University in 1905–10 and at Stevens Institute of Technology in 1910–11, after which he was president of Dalhousie University. Author of 'The Laws of Gravitation' (1900). Died Halifax, 2 Oct. 1938.

MACKENZIE, Charles Frederick, Anglican bishop: b. Portmore, Peebleshire, Scotland, 10 April 1825; d. Malo, in the Manganja country, Africa, 31 Jan. 1862. He was graduated at Cambridge in 1848, was elected a Fellow there and was ordained a deacon in 1851. He was appointed to a curacy at Haslingfield, Cambridgeshire, in 1851, which office he filled without discontinuing his work as Fellow and tutor at Cambridge. In December 1854 he accompanied Bishop Colenzo to Natal as his archdeacon, and returned to England after a severe illness in 1859. He became the head of the Universities' Mission to Central Africa in 1860 and in 1861 was consecrated bishop of Central Africa. He was assisted by Livingstone in penetrating certain remote districts in his diocese. He died of a fever while on his way to a conference with the explorer. Consult Goodwin, 'Memoir of Bishop Mackenzie' (2d ed., 1865); Livingstone, 'Narrative of an Expedition to the Zambeezi' (pp. 348–364, 400, 410–412, 1865).

MACKENZIE, Compton, English novelist and playwright: b. West Hartlepool, 17 Jan. 1883. He was educated at Saint Paul's School and Magdalen College, Oxford, where he took the second class in modern history in 1904. He was one of the founders of the Oxford *Point of View,* and was its editor from 1902 to 1904. He has since occupied himself in writing novels and plays. He holds a commission as a lieutenant in Royal Marines. His chief publications are 'The Passionate Elopement' (1911); 'Carnival' (1912); 'Guy and Pauline' (1915); 'Poor Relations' (1919); 'The Seven Ages of Woman' (1922); 'The Heavenly Ladder' (1924); 'The Old Men of the Sea' (1924); 'Coral' (1925); 'Fairy Gold' (1926); 'Rogues and Vagabonds' (1926); 'Dreams to Sell' (1930).

MACKENZIE, Sir George, Scottish lawyer: b. Dundee, 1636; d. Westminster, 8 May 1691. He was a grandson of Kenneth, 1st Lord Mackenzie of Kintail, and a nephew of the 1st and 2d Earls of Seaforth. He was educated at the universities of Saint Andrew's and Aberdeen and later studied civil law at the University of Bourges, France. He was called to the bar in Scotland in 1659 and speedily rose to distinction. In 1661 he conducted the defense for the Marquis of Argyll in his trial for high treason, and soon afterward was appointed a justice-depute, or judge of the Criminal Court. In 1669 he sat for Ross-shire and rendered himself conspicuous by his opposition to Lauderdale and by his support of popular measures. He was knighted in 1674 and in 1677 succeeded Sir John Nisbet as King's Advocate. From this time Mackenzie's principles seemed wholly subverted, and in his endeavor to force submission to the king he earned for himself the appellations «Bloody Mackenzie» and «the bloodthirsty advocate.» He opposed the abrogation of the penal laws against Catholics in 1686 and was removed from office until 1688, when for a year he was again King's Advocate, relinquishing the office at the outbreak of the Revolution. He founded the Advocate's Library at Edinburgh in 1689, and in 1690 he retired to Oxford where he was admitted as a student and spent the remainder of his life engaged in literary pursuits. Author of 'A Vindication of the Government of Charles II' (1691); 'The Moral History of Frugality' (1691); 'Methods of Proceeding against Criminals and Fanatical Covenanters' (1691); 'Vindication of the Presbyterians of Scotland from the Malicious Aspersions Cast upon Them' (1692), and many other works of earlier date. His collected works were published (2 vols., Edinburgh 1716–22).

MACKENZIE, George Henry, American chess player: b. near Aberdeen, Scotland, 24 March 1837; d. New York, 13 or 14 April 1891. He was appointed an ensign in the 60th Rifles in 1856, served at the Cape of Good Hope and in India and was promoted lieutenant. He returned to England and in 1861 sold his commission. He came to the United States in 1863, joined the Federal army and rose to the rank of captain. He thereafter devoted himself to chess as a professional, already having won first prize in the London Tournament of 1862, defeating the Prussian champion, Anderson. Settling in New York in 1865 he became a member of its chess club and won first prize in the tournaments of 1865, 1866, 1867, 1868. He won first prize at the Second American Chess Congress in Cleveland in 1871; fourth prize at the International Congress at Paris in 1878, and in 1887 he won the championship of the world at Frankfort. He was found dead in bed.

MACKENZIE, Henry, Scottish novelist and essayist: b. Edinburgh, 25 Aug. 1745; d. there, 14 Jan. 1831. He was a lawyer at Edinburgh, and in 1771 published anonymously 'The Man of Feeling,' which the booksellers had declined as a gratuitous offering, and which gained him a conspicuous place among 18th century writers. Other novels of his are 'Man of the World' (1773), and 'Julia de Roubigné' (1777). He edited *The Mirror,* 1779–80 (the first Scottish paper founded on the plan of *The Spectator*), and *The Lounger,* 1785–87.

MACKENZIE, James Cameron, American educator: b. Aberdeen, Scotland, 15 Aug. 1852. He was graduated at Princeton Theological Seminary in 1882 and was ordained in the Presbyterian ministry in 1885. He founded the Harry Hillman Academy, Wilkes-Barre, Pa., in 1882, and also organized the Lawrenceville (N. J.) School in that year, acting as its head master in 1882–99. In 1899 he reorganized the Jacob Tome Institute, Fort Deposit, Md., and was its director until 1901. In 1901–26 he was director of the Mackenzie School, Monroe, N. Y., and after that engaged in literary work. D. 10 May 1931.

MACKENZIE, John Joseph, Canadian pathologist and bacteriologist: b. Saint Thomas, province of Quebec, 1865; d. 1 Aug. 1922. He was educated at the universities of Toronto, Leipzig and Berlin. He was a Fellow in biology at Toronto and later was bacteriologist to the Ontario Provincial Board of Health. After 1900 he was professor of pathology and bacteriology at the University of Toronto. He contributed to various scientific magazines. He was a Fellow of the Royal Society of Canada, and member of the American Public Health Association, the Society of American Bacteriologists and of the American Association of Pathologists and Bacteriologists. He was secretary of the Canadian Institute. During the European War he was attached to No. 4 Canadian General Hospital. Author of 'Recent Theories in Regard to the Causes of Immunity to Infectious Disease' (1907).

MACKENZIE, John Stuart, British educator: b. near Glasgow, 21 Feb. 1860. He was educated at Glasgow and Cambridge universities and later studied at the University of Berlin. He was a Fellow at the University of Glasgow in 1882–84, at the University of Edinburgh in 1884–89 and at Trinity College, Cambridge, 1890–96. He was professor of logic and philosophy at the University College of South Wales and Monmouthshire in 1895–1915, then becoming professor emeritus. He was a vice-president of the Institut International de Socialogie in 1911 and president of the Moral Education League in 1908–16. Besides magazine articles and contributions to the 'Encyclopedia of Religion and Ethics' he is author of 'An Introduction to Social Philosophy' (1890; 2d ed., 1895); 'A Manual of Ethics' (1893; 8th ed., 1915); 'Outlines of Metaphysics' (1902; 2d ed.,1906); 'Elements of Constructive Philosophy' (1917); 'Ultimate Values' (1924).

MACKENZIE, Sir **Morell,** English laryngologist: b. Leytonstone, Essex, 7 July 1837; d. London, 3 Feb. 1892. He was educated at the London Hospital, Paris and Vienna. In 1859 he met Czermak in Budapest and learning from him the use of the laryngoscope he introduced its use into London. Later he became physician to the London Hospital and lecturer on diseases of the throat. In 1863 he founded the Throat Hospital in London. In 1887–88 he was associated with specialists of Berlin and Vienna in the treatment of the larynx disease of the Crown Prince, subsequently Emperor Frederick of Germany, and for these services was knighted by Queen Victoria and received the Grand Cross and Star of the Hohenzollern Order of Germany. He was the author of 'The Use of the Laryngoscope' (1866); 'Diseases of the Throat and Nose' (1880), etc.

MACKENZIE, Ranald Slidell, American soldier: b. New York City, 27 July 1840; d. Staten Island, N. Y., 19 Jan. 1889. He was son of Alexander S. Mackenzie (q.v.). Graduated from West Point in 1862, he was assigned to the engineer corps, was wounded at Manassas and brevetted 1st lieutenant for services in that action. He was engineer of Sumner's division at Fredericksburg (13 Dec. 1862), and received the successive brevets of captain and major for his conduct at Chancellorsville and Gettysburg. Promoted captain of engineers 6 Nov. 1863, he took part in the Richmond campaign as commander of 2d Connecticut Artillery. On 18 June 1864 was brevetted lieutenant-coloned and commanded the 2d Connecticut Heavy Artillery in the Shenandoah campaign. Present at Appomattox (9 April 1865), mustered out of the volunteer service 15 Jan. 1866. After the Civil War he commanded important army posts in the Southwest, and was notably successful in settling Indian troubles on the Rio Grande. Made brigadier-general 1882, retired for disabilities 1884.

McKENZIE, Robert Tait, American sculptor, educator and physician: b. Almonte, Ont., Canada, 1867; d. Philadelphia, Pa., 28 April 1938. He was graduated at McGill University in 1889 and took his M.D. there in 1892. He engaged in the practice of medicine; was connected with the medical faculty of McGill in 1895–1904, and in 1904 was appointed professor and director of the department of physical education at the University of Pennsylvania. He was appointed temporary major in the R. A. M. C. in 1915, and in 1916 was inspector of physical training of Kitchener's armies, and medical officer in charge of Heaton Park Command Depot. He was a fellow of the College of Physicians at Philadelphia, and in 1912–15 he was president of the American Physical Education Association. His fame as a sculptor was achieved without artistic training, his guide being his thorough knowledge of anatomy and his unusual ability in interpretation. He exhibited at the Society of American Artists, New York; the Royal Academy, London, and the Paris Salon. Among his works as a sculptor are 'The Sprinter' (Fitzwilliam Museum, Cambridge); 'The Athlete' (Ashmolean Museum, Oxford); the statuettes, 'The Competitor' and the 'Juggler' (Metropolitan Museum, New York); 'The Youth Benjamin Franklin' (University of Pennsylvania). Author of 'The Barnjum Barbell Drill,' 'Exercise in Education and Medicine,' 'Reclaiming the Maimed.'

MACKENZIE, Sir **William,** Canadian financier: b. Kirksfield, Ontario, 30 Oct. 1849; d. Toronto, 5 Dec. 1923. He was educated at the local schools and became a public school teacher. Giving up this occupation he contracted for the construction of a portion of the Victoria Railway — now the Midland division of the Grand Trunk Railway — and later executed contracts for the Coboconk, the Credit Valley, the Canadian Pacific, the Fort McLeod and Edmonton, the Regina, the Hudson Bay and Dauphin railways and other roads. He controlled and was president of the Toronto Street Railway, was also interested in the Montreal and Winnipeg street railways, and with others controlled the Birmingham Street Railway and other European lines. His great achievement was the construction of the Canadian Northern Railway. He was knighted in 1911.

MACKENZIE, William Douglas, American Congregational clergyman: b. Fauresmith, Orange River Colony, South Africa, 16 July 1859. He graduated from Edinburgh University in 1881, studied divinity in Edinburgh and Göttingen, was professor of theology in the Chicago Theological Seminary, 1895–1903, and since 1903 has been president of Hartford Theological Seminary. He published 'The Revelation of the Christ' (1896); 'Christianity and the Progress of Man' (1897); 'South Africa: its History, Heroes and Wars' (1900); 'John Mackenzie, South African Missionary and Statesman' (1902); 'The Final Faith' (1910); 'Galatians and Romans' (1912); 'Christian Ethics in the World War' (1918).

MACKENZIE, William Lyon, Canadian journalist and political reformer: b. Dundee, Scotland, 12 March 1795; d. Toronto, Ontario, 28 Aug. 1861. In 1820 he came to Canada and conducted a drug and book store at Little York (now Toronto), and later at Queenstown, where in 1824–26 he published the *Colonial Advocate.* He transferred the *Advocate* office to Toronto in 1826, and there continued the paper until 1833, attacking the office-holding class and demanding governmental reforms. In 1828 he entered the provincial Parliament; and having been expelled for alleged libel against that assembly, was five times re-elected and as often re-expelled, until the government refused to issue another writ of election. In 1832 he went to England, and having presented to the home government a petition of grievances from the Canadian reformers, was successful in obtaining the dismissal of the attorney-general and the solicitor-general of Upper Canada and the veto of the Upper Canadian bank bill. In 1834 he was elected first mayor of Toronto, in 1836 began the publication of *The Constitution,* and, in 1837 published in that journal a bold manifesto which was practically a declaration of independence of the provincial government. Soon afterward he was the moving spirit in armed rebellion. An encounter took place between his followers and the government forces at Montgomery's Tavern, in the vicinity of Toronto (7 Dec. 1837), and the insurgents fled to Navy Island in the Niagara, where they were joined by about 500 Americans. The island was bombarded by Canadian troops, and as a result of this and the strong opposition of General Scott of the United States army, the insurgents broke camp and Mackenzie was im-

prisoned for a year in Rochester jail. Later he was a journalist in the United States, in 1849 took advantage of amnesty to return to Canada, was there a member of Parliament from 1850–58, and at Toronto published the weekly *Mackenzie's Messenger* from 1858 until shortly before his death. The reforms for which he so persistently contended were in the main achieved in his lifetime. He wrote 'Sketches of Canada and the United States' (1833). Consult the 'Life' by Lindsey (1862); Lindsey's "Life" in 'The Makers of Canada' (1910); Dent, 'Story of the Upper Canada Rebellion' (1885); Read, 'The Canadian Rebellion of 1837)' (1896).

MACKENZIE, Canada, a district in the Northwest Territories, bounded north by the Arctic Ocean, east by Keewatin, south by Athabasca, and separated on the west from Yukon by the northernmost spur of the Rocky Mountains. The district created in 1895 and administered by the government of the Northwest Territories, is the largest in Canada, having an estimated area of 527,490 square miles, of which 34,265 squares miles are water. The surface generally is diversified; in the northwest it is a sterile waste; along the river valleys and on the western mountain slopes it is well forested with fir, pine, spruce and other northern trees, while coal and other minerals, although unexploited, are found. The principal lakes are Great Slave, Great Bear, Pelly and Clinton Colden. The chief rivers are the Mackenzie, the Coppermine and the Great Fish or Back River. The soil is comparatively unproductive, the climate being arctic and inhospitable except for the few summer months. The population, about 5,400, inhabit the trading settlements of the Hudson's Bay Company's along the Mackenzie and its tributaries. The pelts of the fur-bearing animals of the region are practically the only developed item of commerce.

MACKENZIE RIVER, Canada, a large river in the Northwest Territories, which flows from the Great Slave Lake, and after a northwesterly course of about 1,000 miles enters the Arctic Ocean by numerous mouths at the island-studded Mackenzie Bay. Its ultimate source is in Thutage Lake, the headwaters of the Finlay in northern British Columbia; its total length from Thutage Lake to the sea is 2,525 miles. Its tributary head-streams are the Great Peace River, which rises in British Columbia beyond the Rocky Mountains, and the Athabasca or Elk River, which has its source in the Rockies; these two rivers flowing into Lake Athabasca are discharged by the Great Slave River into Great Slave Lake whence issues the Mackenzie. The principal affluent of the Mackenzie is the Laird or Mountain River. With the exception of a slight obstruction in the rapids near Fort Good Hope, in lat. 66° N., the Mackenzie and its tributaries are navigable for a distance of over 1,800 miles, and from June to October steamboats of the Hudson's Bay Company ply from Great Slave Lake almost to the Arctic Ocean. Forts Providence, Norman and Good Hope are trading stations along its banks, while Forts McPherson, Franklin, Enterprise, Reliance, Resolution, Chippewyan, Nelson and Graham are along its tributaries. The valley is well-wooded with spruce, pine, poplar and birch, while coal, salt and other minerals abound in the region. The river is named after Alexander Mackenzie (q.v.), who first explored it in 1789.

MACKEREL, măk'ĕ-rĕl. The common mackerel (*Scomber scombrus*) is the best-known and most important member of the family *Scombridæ* and one of the most valuable of food-fishes, ranking in this respect behind the cod and herrings only. The mackerel is a compactly built fish of smooth and regular outline, the fusiform figure tapering accurately to the pointed snout, so that it cleaves the water easily. The large, deeply-forked tail is supported on a slender peduncle, provided with two small keels on each side, and preceded by a dorsal and a ventral series of finlets of five each. A soft dorsal and a counterpart anal fin are placed exactly opposite each other and behind the level of the vent, and the anterior dorsal fin is supported by usually 11 delicate spines. Very numerous and small scales cover the body nearly uniformly, but are absent from the head. The large mouth is provided with numerous small sharp teeth. The gill-rakers are long and the air-bladder is wanting. The color of the back is deep blue, marked by about 35 nearly vertical wavy black lines; below, the fish is silvery white. A recent close study of the species on the European side of the Atlantic establishes the existence there of local races, as in the herring, but it appears that the American representatives, while constituting a race distinct from the European, are more homogeneous.

The mackerel is an abundant fish on both sides of the north Atlantic, on the American side ranging from Cape Hatteras to the Straits of Belle Isle, and on the European from northern Norway to the Canary Islands and throughout the Mediterranean. While a true pelagic fish of wandering and migratory habits and, like most such, capricious in its movements, the great body of mackerel approaches the American coast and moves along it northward as the temperature of the water rises to about 45° F. On the approach of winter they retire to a greater distance from the land, but a few remain throughout the year near the coast. Mackerel swim in great schools at or near the surface; one such covering an area of 10 square miles, and another estimated as containing 1,000,000 barrels, have been observed. The local movements of the schools are largely regulated by the food-supply, which consists of small pelagic fishes, various kinds of small crustaceans, etc., which are pursued with great eagerness. On the other hand, the bluefish and other carnivorous fishes, porpoises, squids and fish-eating birds, are relentless enemies. Spawning takes place in the open sea, not far from the coast from Vineyard Sound to the Gulf of Saint Lawrence, and during the months of May, June and early July. The eggs are about one millimeter in diameter, contain an oil-drop and float at the surface, where the young fish develop and live. They grow rapidly and are about five inches long by the end of the first half year, when they are known as "spikes"; "blinkers" are about one year old and six or seven inches long; "tinkers" are seven to nine inches long and are supposed to be two years old. At the age of three or four

years the mackerel is mature and from 12 to 18 inches long. The very largest specimens weigh about four pounds and have a length of 22 to 23 inches.

The mackerel fishery is of the greatest importance in the New England States and Nova Scotia, and in Norway, Ireland and Great Britain. In Europe the fishery is prosecuted almost exclusively by means of small boats and hand lines, but in America is chiefly carried on in staunch sea-going schooners, most of which hail from Gloucester, Mass., and which are equipped with purse seines, by means of which entire schools are surrounded and captured. The fishing begins off Cape Hatteras in March or April and the schools are followed northward as they appear successively on the New Jersey, New England and Canadian coasts. In addition to the operations of this mackerel fleet, local fisheries are carried on along much of the coast, with pound-nets, gill-nets and hand-lines. The spring and local catches are generally sold fresh, the summer catch being split and salted. The product of the fishery has been peculiarly subject to fluctuations, due in large part to alternating periods of abundance and scarcity of the fish. Colonial writers refer to its great plenty, and statistics of the catch inspected in Massachusetts show a somewhat regular recurrence of such periods at intervals of about 20 years. From 350,000 barrels in 1880 and 395,000 in 1881, the catch steadily declined to 75,000 in 1886, and 18,000 in 1891, since which time it has greatly fluctuated.

The total weight of the mackerel landed in Boston and Gloucester in 1929 was 35,744,000 pounds a great increase over the catch of 1928 which was 23,517,000 pounds. Of the 1929 total, 21,264,000 pounds were landed at Boston, and 14,480,000 pounds at Gloucester. In addition there were landed at Portland, Me., in the same year 2,000,000 pounds. The total value of the mackerel landed at all three ports in 1929 was $1,382,400, compared with a value of $1,353,900 for the catch of 1928. The output of mackerel fry in 1929 was 2,778,000. The mackerel production of the Canadian provinces in 1928 was 123,768 hundredweight as compared with 158,797 hundredweight in 1927; and 251,478 hundredweight in 1922. The catch of 1928 was valued at $528,267; that of 1922 at $1,500,357.

An elaborate account of the American mackerel fishery will be found in Brown-Goode's 'Materials for a History of the Mackerel Fishery' (Report of the United States Fish Commission, 1884); for some recent views see Moore, 'Report National Fishery Congress' (Washington 1898); and for methods of preservation, Stevenson, 'The Preservation of Fishery Products for Food' (Bulletin of United States Fish Commission, 1898).

MACKEREL SHARK, or **PORBEAGLE,** a shark of the family *Lamnidæ,* allied to the man-eater (q.v.), and like it sometimes called blue shark, on account of its color, which is frequently seen on both sides of the northern Atlantic Ocean; it is the *Lamna cornubica* of ichthyologists. The ordinary length is about 10 feet, and they become very abundant in summer, when the mackerel are running, along the New England coast, and also about Great Britain, where they are called porbeagles. They are a nuisance to fishermen by destroying their nets, through which several will often tear their way (for they roam about in bands) in pursuit of captured fish. Formerly considerable quantities of oil were saved from their livers, but at present the value of this commodity does not pay for the trouble of taking them.

MACKEY, Albert Gallatin, American writer on Freemasonry: b. Charleston, S. C., 12 March 1807; d. Fortress Monroe, Va., 20 June 1881. He was graduated from the Medical College of South Carolina in 1832 and was demonstrator of anatomy there in 1838, but after 1844 devoted himself to studies of Freemasonry and became a standard authority on the subject. Among his works are 'A Lexicon of Freemasonry' (1845); 'The Mystic Tie' (1849); 'Book of the Chapter' (1858); 'A Manual of the Lodge' (1862); 'A Textbook of Masonic Jurisprudence' (1869); 'Encyclopædia of Freemasonry' (1874).

McKIBBEN, Chambers, American soldier: b. Pittsburgh, Pa., 2 Nov. 1841; d. May 1919. He enlisted as a private in the volunteer service 22 Sept. 1862, was brevetted captain for gallant services in the battle of North Anna River (Va.) and in the operations on the Weldon Railway, and on 1 May 1896 attained the rank of lieutenant-colonel of the 21st United States Infantry. At the beginning of the war with Spain he went to Cuba with Shafter's army, fought at Santiago (1 July 1898), and was made brigadier-general of volunteers and appointed military governor of Santiago. On 12 May 1899 he was mustered out of the volunteer service. Retiring in the same year, he was put in command of the Department of Texas, and two years later was transferred to the command of an infantry regiment. In 1902 he retired with the rank of brigadier-general.

McKIM, Charles Follen, American architect: b. Chester County, Pa., 24 Aug. 1847; d. 14 Sept. 1909. He was son of James Miller McKim, a Presbyterian minister who was an abolitionist. He studied at the Lawrence Scientific School in 1866, at the Beaux-Arts of Paris in 1867–70, and shortly afterward entered into partnership with Stanford White and William R. Meade. This firm achieved some of the finest triumphs of recent American architecture. Among notable examples of its work are the buildings of Columbia University, and the Public Library of Boston. In 1903 McKim received the royal gold medal from the Royal Institute of British Architects in recognition of his services to architecture. He was the second American to obtain this honor, R. M. Hunt (q.v.) having been the first. On the occasion of the presentation he made an able speech reviewing the progress of his profession in the United States. He was elected president of the American Institute of Architects.

McKIM, James Miller, American abolitionist: b. near Carlisle, Pa., 14 Nov. 1810; d. Llewellyn Park, West Orange, N. J., 13 June 1874. He was graduated from Dickinson College (Carlisle, Pa.) in 1828, studied medicine at the University of Pennsylvania and theology at Princeton (1831) and Andover (1832), and in 1835 was ordained a Presbyterian pastor in Womelsdorf, Pa. An original member of the American Anti-Slavery Society, he became its

lecturing agent in October 1836, and spoke throughout Pennsylvania, often at great personal danger. In 1840 he removed to Philadelphia, where he was publishing agent of the Pennsylvania Anti-Slavery Society and later corresponding secretary until 1862. In November 1862 he called a public meeting in Philadelphia to provide for 10,000 slaves suddenly liberated by the capture of Port Royal, S. C. As a result, the Philadelphia Port Royal Relief Committee was formed. This committee was expanded in November 1863 into the Pennsylvania Freedman's Relief Association, of which McKim became the corresponding secretary, in which capacity he was active in the establishment of Negro schools in the South. In 1865 he assisted in founding and became a proprietor of the New York weekly *Nation*. During the Civil War he was an advocate of the enlistment of Negro troops, and as a member of the Union League of Philadelphia assisted in the recruiting of 11 colored regiments.

MACKINAC ISLAND, măk'ĭ-nô, island, Michigan, in Mackinac County, at an altitude of 596 feet, at the entrance to the Straits of Mackinac in Lake Huron. It lies 255 miles northwest of Detroit. The island is 3 miles long and 2 miles wide. It is coextensive with Mackinac Island city and has been a state park since 1895. It came into prominence when the early missionaries and explorers realized its strategic value. It has steamboat connections with lake ports. It has a Daughters of the American Revolution library, a historical museum and an emergency hospital. Among local points of interest are the John Jacob Astor house, old forts, and a "most historical spot of Michigan" monument. The name is a shortened form of the Indian *Michilimackinak* meaning "great turtle." Pop. (1950) 572.

MACKINDER, mă-kĭn'dĕr, RIGHT HONORABLE SIR **Halford John,** English author and educator: b. Gainsborough, England, Feb. 15, 1861; d. England, March 6, 1947. He was educated at Christ Church, Oxford; in 1883 was president of the Oxford Union; barrister, Inner Temple, 1886; 1903–1908 director of the London School of Economics and Political Science. He was leader of the Mount Kenya expedition, 1899; member (Unionist) for the Camlachie division of Glasgow, 1910–1922. He was made privy councillor, 1926; vice president of the Royal Geographic Society, 1933–1936; Gold Medallist, American Geographical Society, 1943. He was author of *The Rhine* (1908); *Elementary Studies in Geography* (18th edition, 1930); *Democratic Ideals and Reality* (1919). See also GEOPOLITICS.

McKINLEY, mă-kĭn'lĭ, **William,** American statesman, 24th president of the United States: b. Niles, Trumbull County, Ohio, Jan. 29, 1843; d. Buffalo, N. Y., Sept. 14, 1901. He was educated at Union Seminary, Poland, Ohio, and Allegheny College, Meadville, Pa., 1860–1861. Forced by illness to discontinue his college course, he taught in the public schools, was a clerk in the Poland post office, and on June 11 enlisted for the Civil War as a private in Company E of the 23d Ohio Volunteer Infantry. His first battle was that of Carnifex Ferry, Sept. 10, 1861, and on April 15, 1862, while in camp at Fayetteville, western Virginia, he was promoted commissary sergeant. For conspicuous service at Antietam, Sept. 17, 1862, he was made second lieutenant of Company D. His subsequent appointments were, first lieutenant, Company E (Feb. 7, 1863); captain, Company G (July 25, 1864); and brevet major (March 14, 1865). When mustered out on July 26, 1865, he was acting assistant adjutant general on the staff of Gen. S. C. Carroll, commanding the veteran reserve corps stationed at Washington. Among other actions in which he participated were those of South Mountain, Sept. 14, 1862, Lexington, June 10, 1864, Kernstown, July 24, 1864, Opequan Creek (Winchester, Sept. 19, 1864), Fisher's Hill (Sept. 22, 1864), and Cedar Creek (Oct. 19, 1864). During his subsequent political career he was generally known, especially in Ohio, as Major McKinley. At the close of the war he began the study of law at Youngstown, Ohio (1865–1866), continued it at the Albany (N. Y.) Law School (1866–1867), in March 1867 was admitted to the bar at Warren, Trumbull County, Ohio, and at once entered practice at Canton. In 1870–1871 he was prosecuting attorney of Stark County, and during the campaign between R. B. Hayes and William Allen for the governorship of the state, spoke effectively against the "greenback" craze. He was elected to Congress as Republican representative from the 17th Ohio district in 1877, and served continually in the 45th, 46th and 47th Congresses (1877–1883). It was asserted by the Republicans that he was elected in 1882 to the 48th Congress by a majority of eight ballots; but, although he had received the certificate of election, his seat was successfully contested by J. H. Wallace, who was not, however, seated until June 1884. He represented the 20th district in the 49th Congress (1885–1887), and the 18th in the 50th and 51st Congresses; but in 1890 was defeated in the 16th for the 52d Congress by 300 ballots by J. G. Warwick, Democrat, lieutenant governor of the state a short time previously. His defeat was attributed to the gerrymandering of the district by a Democratic legislature. His service in Congress was notable. In 1877 he was appointed a member of the Judiciary Committee, and in December 1880 of the Ways and Means Committee to succeed James A. Garfield; and in 1881 was chairman of the committee in charge of the Garfield memorial exercises in the House. In 1889–1890 he was chairman of the Ways and Means Committee. He was a candidate for speaker of the 51st Congress, but was defeated by T. B. Reed on the third ballot in the Republican caucus. He was known among the foremost orators of the House; and his speeches on arbitration as a solution of labor troubles (April 2, 1886) and in support of the civil service laws (April 24, 1890) were most favorably received. But his principal efforts were made in connection with the tariff, which, from his first appearance in the House, was the chief object of his study. On April 6, 1882, he spoke in advocacy of protection; on April 30, 1884, in opposition to the Morrison tariff bill, making what was esteemed the ablest argument against that measure; and on May 7, 1890, in support of the general tariff bill, now known by his name, which, as chairman of the Ways and Means Committee, he had introduced before the House on April 16. The bill was passed by the House on May 21, by the Senate on September 11, and on October 6 became a law. His bill obtained for him an international reputation, and

eventually the Presidency. In 1884 he was delegate at large from Ohio to the Republican National Convention at Chicago, where he supported James Blaine's candidacy, and where, as chairman of the committee on resolutions, he helped to determine the platform of his party, which he read before the convention. In the Republican National Convention at Chicago in 1888, he was again a delegate and chairman of the committee on resolutions. He supported the candidacy of John Sherman, although, when it was finally learned that Blaine would decline the nomination, he was himself the choice of many delegates and was strongly urged to permit the use of his name. At the Minneapolis convention of 1892 he was once more a delegate and was elected permanent chairman of the assembly. He supported the renomination of President Harrison, and though refusing the use of his own name, received the ballots of 182 delegates. He then left the chair and moved to make Harrison's nomination unanimous, which was accordingly done. In the ensuing campaign he took a very active part, traveling, it was estimated, more than 16,000 miles and speaking to more than 2,000,000 voters.

In 1892–1896 McKinley was governor of Ohio, having been elected in 1891 by 21,500 plurality, and in 1893 by the unusual plurality of 80,995. Labor riots occurred during his administration, necessitating the placing of 3,000 militia troops in active service, but the difficulties were successfully adjusted. He also personally directed the relief work for the starving miners of the Hocking Valley district.

McKinley was nominated for the presidency by the Republican National Convention which met at Saint Louis, June 16, 1896, and was elected by a plurality of 601,854 over W. J. Bryan, receiving a popular vote of 7,104,779, and in the electoral college a vote of 271 to 176 for Bryan. Throughout the campaign he remained in Canton, where he made over 300 speeches to more than 750,000 visitors. Under his administration decided increase in business prosperity followed the passage of the Dingley tariff measure. The most important event of his term was the Spanish-American War (q.v.), which he had believed might be prevented and had done all in his power to avert. When hostilities broke out on the part of certain inhabitants of the Philippine Islands, the President appointed a commission to study the situation and report on the most suitable mode of government for the new territory. On July 7, 1898 he approved the joint resolution of Congress for the annexation of the Hawaiian Islands, and in 1898 he also selected a delegation to represent the United States in The Hague Peace Conference which convened in May 1899. The original Philippine Commission having rendered a report (Jan. 31, 1900), the President appointed a new commission, known from its head, Judge W. H. Taft, as the Taft Commission, under whose direction civil government was instituted in the islands on Sept. 1, 1900. (See PHILIPPINES—*History.*)

In 1900 the President stood conspicuously for justice in the settlement of the difficulties in China which marked that summer. He was renominated for the Presidency by the Republican National Convention which met at Philadelphia on June 25, 1900, receiving the entire vote of the 930 delegates. He was elected by a popular vote of 7,206,677 to the 6,374,397 for W. J. Bryan, receiving the largest popular majority ever given a candidate for the Presidency up to that time. He obtained 292 electoral votes and carried 28 States. On Sept. 5, 1901 he delivered at the Pan-American Exposition, Buffalo, N. Y., an important address, summarizing at once the problems then before the nation and his policy for their solution.

On September 6, while holding a reception in the Music Hall of the Exposition, McKinley was twice shot by Leon Czolgosz, an anarchist. He died on September 14, and four days afterward a day of mourning and prayer was called throughout the country by his successor, President Theodore Roosevelt. Unprecedented honors were paid to McKinley's memory in foreign capitals, notably in London, where memorial services were held in Westminster Abbey and Saint Paul's Cathedral. A statue was erected in his honor at Columbus, Ohio, and unveiled in 1906. See also UNITED STATES—*History.*

Bibliography.—The official biography of McKinley is Olcott, Charles Sumner, *The Life of William McKinley* (Boston 1916). Other useful biographical sources are the campaign biography by Porter, Robert Percival, *Life of William McKinley, Soldier, Lawyer, Statesman* (Cleveland 1896) and Kohlsaat, Herman Henry, *From McKinley to Harding* (New York 1923).

McKINLEY, Mount (Russian BOLSHAYA, bŭl-y'-skà'yà), a peak of the Rocky Mountains, the highest in North America (20,300 feet above sea level) south of the central part of Alaska, about 155 miles north of Cook Inlet. The Indian name for this peak is Traleyka. The fact that this is the highest land on the continent was not known till 1896 when W. A. Dickey explored the Sushitna River and the land near its source, naming the peak in honor of president William McKinley. In 1903 it was visited by members of the United States Geological Survey and in 1917 the Mt. McKinley National Park was created.

Attempts to climb the peak began in 1903 but no expedition was successful until the Hudson Stuck expedition reached the top on June 7, 1913. It has been climbed several times since then and the mountain was used to test U.S. Army Air Force equipment in 1942.

McKINLEY ACT, a name popularly given to a tariff bill reported to Congress, May 21, 1890, by the Ways and Means Committee of the House of Representatives, of which William McKinley was chairman. It became a law in October 1890 and was repealed in 1894. It increased the duties on wool, woolen manufactures, on tin-plate, barley and some other agricultural products and remitted the duty on raw sugar. The reciprocity feature was an important part of the bill, providing for the remission of duty on certain products from those countries which should remove duties on American imported products. See TARIFF.

McKINNEY, Mrs. Glen Ford. See WEBSTER, JEAN.

McKINNEY, mà-kĭn'ĭ, city, Texas, seat of Collin County, 30 miles north of Dallas on the Southern Pacific Railroad and state and federal highways. Altitude 612 feet. In a rich agricultural area, McKinney has dairy and stock farms, poultry dressing and pecan shelling plants, and manufactures dairy products, textile products, clothing, feeds, beverages, confectionery, and mattresses. Among the public services of the com-

munity are a city library, a city-county hospital as well as a 1,000-bed veterans hospital, and a municipal pool and playground. About 10 miles to the south-southeast the Lavon Reservoir (capacity 423,300 acre-feet) on the East Fork of the Trinity River is surrounded by game preserves and a recreational area.

The city was named for, and has a monument to, Collin McKinney, a signer of the Texas declaration of independence. The Collin McKinney home was built in 1836 and is now located in the city park. McKinney was founded in 1842 and has a commission form of government. Pop. (1950) 10,560.

MACKINTOSH, Charles Rennie, Scottish architect and painter: b. Dennistoun, Glasgow, Jan. 7, 1868; d. London, Dec. 10, 1928. A student at the Glasgow School of Art and a member of the firm of Honeyman and Keppie, he traveled abroad on the Alexander Thomson scholarship in 1890, and in 1894 submitted the prize-winning designs for the new building of the Glasgow School of Art. This building, completed in 1909, was representative of the originality and freedom from tradition characteristic of all his work. In 1897 he undertook, in collaboration with George Walton, the decoration and furnishing of Miss Cranston's Tea-Rooms in Glasgow, which embodied the features of what was later termed in Germany the "Glasgow School style."

Gaining considerably more renown on the Continent than in his own country, Mackintosh had commissions and exhibitions in many European cities, and, although he had no followers in Great Britain, he founded the so-called *Jugendstil* in Germany. After World War I he devoted his time to water colors and became one of the first British masters of abstract design.

MACKINTOSH, măk'ĭn-tŏsh, Sir **James,** Scottish historian and philosophical writer: b. Aldourie, Inverness-shire, Oct. 24, 1765; d. London, May 30, 1832. He was educated at Aberdeen and Edinburgh; studied medicine and took the M.D. degree in 1787; published his *Vindiciae Gallicae* in answer to Burke's *Reflections on the French Revolution;* quitted the medical profession and was called to the English bar in 1795. By reason of his brilliant lectures on the *Laws of Nature and Nations,* and his defense of Jean Gabriel Peltier, who was prosecuted for a libel on Napoleon Bonaparte, he acquired fame at the bar, and in 1804 was appointed recorder of Bombay and received the honor of knighthood.

After an honorable career in India, Mackintosh returned to England, entered Parliament for Nairn and afterward for Knaresborough, was professor of law at Haileybury College (1818–1824), a member of Privy Council, and in 1830 commissioner of the Board of Control. Among his writings may be mentioned his *History of England,* a fragment extending only to the reign of Elizabeth; *Dissertation on the Progress of Ethical Philosophy* in the *Encyclopaedia Britannica;* a *Life of Sir Thomas More* in Lardner's *Cabinet Cyclopaedia,* and nine chapters of an unfinished work on the revolution of 1688.

MACKINTOSH, a water-proof overcoat, or outer garment, one of the products of modern rubber manufacture. It derives its name from the inventor, Charles Mackintosh of Manchester (1766–1843). See Rubber.

MACKLIN, măk'lĭn, **Charles,** Irish actor and dramatist: b. Ireland, May 1, 1697; d. London, July 11, 1797. He was the son of an Irish gentleman named McLaughlin and in 1733 appeared in minor parts at Drury Lane, London. He steadily rose in public favor, until in 1741 he appeared in his greatest role, Shylock. He was accounted from this period among the best actors of the time. His last performance was at Covent Garden in May 1789, at past the age of 90. In 1735 he accidentally killed a brother actor in a quarrel and was tried for murder, and was frequently afterward engaged in disputes and actions at law. Of his own plays only *The Trueborn Irishman; Love a-la-Mode* (1759), and *The Man of the World* (1781) have been printed.

MACKUBIN, mă-kŭb'ĭn, **Florence,** American artist: b. Florence, Italy, May 19, 1861; d. Baltimore, Md., Feb. 2, 1918. She was of American parentage, and studied under Louis Deschamps and Julius Rolshoven in Paris and Herterrich in Munich, also miniature painting under Mlle. J. Devina in Paris. She specialized in portrait and miniature painting, and was officially commissioned to execute various portraits for the Executive Mansion and State House, Maryland, among them a copy of Van Dyck's portrait of Queen Henrietta Maria, and portraits of Governors Calvert and Eden of Maryland. Other portraits are those of Sir Charles Drury at the Admiralty House, Chatham, England, and Sir William Van Horne, Canada. Her miniatures won a medal at the Tennessee Exposition.

McLACHLAN, măk-lăk'lăn, **Alexander,** Scottish Canadian poet: b. Johnstone, Renfrewshire, Scotland, Aug. 12, 1818; d. Orangeville, Ontario, March 30, 1896. He went to Canada in 1841, was Canadian immigration agent to Scotland in 1862, and in 1874 delivered in Scotland a series of lectures on Canadian life. He lectured also in Canada and the United States.

McLachlan was a man of broad and democratic sympathies and was deeply interested in the betterment of conditions among the working classes. Among his publications were *Poems, Chiefly in the Scottish Dialect* (1855); *Lyrics* (1858); *The Emigrant and Other Poems* (1861); *Poems and Songs* (1874).

McLANE, măk-lān', **Allan,** American soldier and jurist: b. Philadelphia, Aug. 8, 1746; d. Wilmington, Del., May 22, 1829. In 1774 he settled in Kent County, Del., and in the revolution he took a prominent part. He became a lieutenant in Thomas Rodney's regiment of Delaware militia, where he rendered important service at Long Island and White Plains and also in the New Jersey campaign. In 1777 he was made captain and was in command of the American guard about Philadelphia, taking active part in the battle of Monmouth. With the rank of major under Gen. Henry Lee he participated in the capture of Stony Point and Paulus Hook and attained colonel's rank.

At the close of the war McLane was appointed judge of the Delaware Court of Appeals. From 1790 to 1798 he was United States marshal of Delaware under Washington's appointment, and from 1808 until his death collector of Wilmington (Del.) port. He also served in the Delaware legislature, being for a time speaker of the lower house.

McLANE, Louis, American statesman: b. Smyrna, Kent County, Del., 28 May 1786; d. Baltimore, 7 Oct. 1857. He was the son of Allan McLane (q.v.), and entering the navy at an early age, served as a midshipman under the elder Decatur. Quitting the navy in 1801 he studied law, was admitted to the bar in 1808 and rose to eminence in the profession. He represented Delaware in Congress, 1816–27, when he was chosen United States senator. In 1829–31 he was Minister to Great Britain, and on his return home was made Secretary of the Treasury. In 1833 he declined to sanction the removal of the deposits from the United States Bank, and was consequently transferred by the President to the State Department. He held the office of Secretary of State till June 1834, when he resigned and retired from political life. In 1837 he accepted the presidency of the Baltimore and Ohio Railroad, which he held till 1847. In June 1845 he was appointed by President Polk ambassador to London during the Oregon negotiations, after the settlement of which he resigned. In 1850 he was a member of the convention to reform the constitution of Maryland.

McLANE, Robert Milligan, American politician and diplomat: b. Wilmington, Del., 23 June 1815; d. Paris, France, 16 April 1898. He studied at the Collège Bourbon of Paris (1829–31), was graduated from West Point in 1837, took active part in the Seminole War in Florida (1837), and served under General Scott in the Cherokee country (Georgia). He resigned from the army in 1843, and having already been admitted to the bar in the District of Columbia, began practice at Baltimore, Md. In 1847–51 he was a Democratic member of the House of Representatives in the 30th and 31st Congresses. In 1853 he was appointed commissioner, with powers of minister plenipotentiary, to China, Japan, Siam, Korea and Cochin China; and from this mission he returned in 1856, having with Commodore Perry concluded important treaties. In 1859–61 he was Minister to Mexico, in which capacity he signed the treaty of 1860. In 1861 he returned to Baltimore and there took a prominent part in the discussions attending the secession of the Cotton States. He was one of the committee appointed by the Maryland legislature (May 1861) to confer with Lincoln in regard to alleged unconstitutional proceedings on the part of the Federal government within the State of Maryland. Upon the decision of the State legislature, based on the committee's report, that it was inexpedient for Maryland to secede, McLane retired from public affairs for a time. In 1877–78 he was State senator; in 1879–83 a representative in the 46th and 47th Congresses; and in 1883–85 governor of Maryland. He was Minister to France in 1885–89 by appointment of President Cleveland. After tendering his resignation in 1889, he spent his remaining years at Paris.

MACLAREN, mą-klär'ĕn, **Ian.** See WATSON, JOHN.

McLAREN, William Edward, American bishop: b. Geneva, Ontario County, N. Y., 15 Dec. 1831; d. New York, 19 Feb. 1905. He was graduated at Jefferson College, 1851, ordained to the Presbyterian ministry, 1860, and entered that of the Protestant Episcopal Church in 1872. Three years later he was appointed bishop of Illinois; after the subsequent division of the diocese became bishop of Chicago. He founded the Western Theological Seminary at Chicago (1883) and the Waterman Hall for Girls at Sycamore, Ill. Among his writings may be mentioned 'Catholic Dogma the Antidote of Doubt' (1884); 'Analysis of Pantheism' (1885); 'The Holy Priest' (1889); 'The Essence of Prayer' (1901).

McLAUGHLIN, măk-lâk'lĭn, **Andrew Cunningham,** American historical writer: b. Beardstown, Ill., 14 Feb. 1861. He was graduated from the University of Michigan in 1882, from its law school in 1885, was professor of history there 1891–1906 and since 1906 at the University of Chicago. He was director of the bureau of historical research of Carnegie Institution, Washington, D. C., 1903–05, and managing editor of the *American Historical Review*, 1901–05. He has written 'Lewis Cass' (in 'American Statesman' series 1891); 'History of Higher Education in Michigan'; 'History of the American Nation' (1899); 'The Confederation and the Constitution' (1905); (with Van Tyne) 'History of United States for Schools' (1911); 'The Courts, The Constitution and Parties' (1912); 'Steps in the Development of American Democracy'; and edited 'The Cyclopædia of American Government' (1914).

McLAUGHLIN, Mary Louise, American artist: b. Cincinnati. She began to decorate pottery in 1877 and made Losanti porcelain (1898), exhibiting for the first time in the Paris Exposition of 1900. She has been awarded several public honors for her work. Among her published writings are 'China Painting'; 'Pottery Decoration'; 'Painting in Oil'; 'The Second Madame'; 'An Epitome of History' (1923).

MACLAURIN, măk-lâ'rĭn, **Colin,** Scottish mathematician and philosopher: b. Kilmodan, Argyleshire, February 1698; d. 14 June 1746. He was educated at Glasgow University, and in 1717 became professor of mathematics in Marischal College, Aberdeen, and two years after was chosen Fellow of the Royal Society. In 1720 he published 'Geometrica Organica,' a work on curves. In 1725 he was elected professor of mathematics at Edinburgh, where his lectures contributed much to raise the character of that university as a school of science. A controversy with Bishop Berkeley led to the publication of Maclaurin's great 'Treatise on Fluxions' (1742). He also wrote a 'Treatise on Algebra'; 'Account of Sir Isaac Newton's Philosophical Discoveries,' etc.

MACLAURIN, Richard Cockburn, American educator: b. Lindean, Scotland, 5 June 1870; d. Boston, Mass., 15 Jan. 1920. He took his M.A. at the University of Cambridge in 1897, was elected a Fellow at Saint John's College, Cambridge, in 1897 and was professor of mathematics there in 1898–1905. He was dean of the faculty of law at the New Zealand University in 1905–07; and in 1907–09 he was professor of mathematics at Columbia University, New York. After 1909 he was president of the Massachusetts Institute of Technology. He wrote 'Title to Realty'; 'Theory of Light'; 'Lectures on Light.'

McLAWS, măk-lâz', **Lafayette,** American military officer: b. Augusta, Ga., 15 Jan. 1821; d. Savannah, Ga., 24 July 1897. He was grad-

uated at West Point in 1842; served in the Mexican War till the surrender of Vera Cruz; and at the beginning of the Civil War was commissioned a brigadier-general in the Confederate army. He was promoted major-general 23 May 1862, and during the march of Sherman to the sea commanded the defenses of Savannah and had charge of the military district of Georgia. He was appointed collector of internal revenue at Savannah in 1875 and postmaster there in 1876.

MACLAY, mą-klā', **Edgar Stanton,** American author: b. Foochow, China, 18 April 1863. He was graduated at Syracuse University in 1885; was reporter on the Brooklyn *Times,* 1886–90, and on the New York *Tribune* 1891–93; served on the editorial staff of the *Tribune,* 1893–95, and on that of the New York *Sun,* 1895–96. In 1896 he was appointed lighthouse-keeper at Old Field Point, and in 1901 received an appointment at the New York navy yard. He edited the 'Journal' of William Maclay (q.v.), and was the author of a 'History of the United States Navy,' which occasioned much controversy and brought about his dismissal from government employ, by order of President Roosevelt, in 1901. The ground of this action, following Maclay's refusal of an official request for his resignation, was a passage in the 'History' stigmatizing Read-Admiral Schley as a "caitiff, poltroon and coward" for his conduct in the naval fight off Santiago, Cuba, 3 July 1898. Maclay also wrote 'Reminiscences of the Old Navy' and 'The History of American Privateers.' He died 2 Jan. 1919.

MACLAY, Robert Samuel, American Methodist Episcopal clergyman: b. Concord, Franklin County, Pa., 7 Feb. 1824; d. 1907. He was graduated at Dickinson College in 1845 and entered the Methodist ministry in 1846. He sailed as a missionary to Foochow, China, 13 Oct. 1847. He was a member of the committee which translated the New Testament into the Foochow dialect; and in 1852–72 he was superintendent and treasurer of the Foochow Mission. He was transferred to Japan in 1872, becoming secretary and treasurer of the mission there; and assisted in translating the New Testament into Japanese. He was a delegate from Japan to the Ecumenical Methodist Conference at London in 1881. He was one of the founders of the Anglo-Chinese College at Foochow in 1881; and in 1884 he secured from the king of Korea permission to establish Christian missions in that country. He was instrumental in founding at Tokio in 1883 the Anglo-Japanese College, of which he was president in 1883–87; and the Philander Smith Biblical Institute in 1884, serving as dean in 1884–87. He was dean of the Maclay College of Theology at San Fernando, Cal., from 1888 until his retirement in 1893. Author of 'Life Among the Chinese' (1861); coauthor with Rev. C. C. Baldwin 'Dictionary of the Chinese Language in the Dialect of Foochow' (1871).

MACLAY, William, American soldier and politician: b. New Garden, Chester County, Pa., 1737; d. 1804. He was educated in his native place; was a lieutenant in the French and Indian War, taking part in the expedition against Fort Duquesne in 1758 and afterward serving under General Bouquet. He studied law, was admitted to the bar, went to England on behalf of militia officers serving in the French and Indian War, to confer upon their claims for land-grants with the proprietors of Pennsylvania, and on his return became attorney to the Penn family. In the Revolution he raised troops and equipped them, was assistant commissary of purchase and performed some field service. In 1781 he was elected to the Pennsylvania assembly, afterward held other offices in the State, and with Robert Morris (q.v.) was elected to the United States Senate, Pennsylvania's first representatives in that body. His service there ended in 1791, but in the Senate he had shown deep-seated hostility to Washington and his administration, which was the chief distinction of Maclay's senatorial career. In his later years he was a member of the Pennsylvania legislature and his last public office was that of a county judge. Consult his 'Journal,' edited by Edgar Stanton Maclay (q.v.).

MACLE, măk'l, in mineralogy, a variety of andalusite, occurring in long, tapering crystals in clay-slate. They have the axes and angles of a different color from the rest of the crystals, owing to a regular arrangement of impurities in the interior.

MacLEAN, George Edwin, American educator: b. Rockville, Conn., 31 Aug. 1850; d. 3 May 1938. He was graduated at Williams College in 1871 and at Yale Theological Seminary in 1874; from 1877 to 1881 was pastor at Troy, N. Y.; studied in Germany; and in 1883 became professor of English language and literature at the University of Minnesota. He was chancellor of the University of Nebraska, 1895–99, and from 1899 to 1911 was president of the University of Iowa. In 1913 he was sent by the United States Bureau of Education to make a study of the English universities and colleges. His writings include 'A Chart of English Literature' (1892); 'Old and Middle English Reader' (1893); and 'A Decade of Development in American State Universities' (1898); 'Present Standards of Higher Education in the United States' (1913); 'Studies in Higher Education in England and Scotland, with Suggestions for Universities and Colleges in the United States' (1916); 'The New International Era' (1923). He edited 'Ælfric's Anglo-Saxon Version of Alcuini Interrogationes Sigewulfi Presbyteri in Genesin' (1883); 'An Introductory Course in Old English,' by Wilkin and Babcock (1888) and 'An Old and Middle English Reader,' by Zupitza (1889).

McLEAN, George Payne, American lawyer and politician: b. Simsbury, Conn., 7 Oct. 1857. He was for a time a reporter on the Hartford *Evening Post,* then studied law, and was admitted to the bar in 1881, and immediately commenced practice in Hartford. In 1883–84 he was a member of the general assembly, where he soon became distinguished for facility in debate and was considered one of the leaders of the Republican party. In 1888 he was elected State senator and in 1900 nominated by his party as governor of Connecticut and elected. Though he was not widely known at the time of his election, his independent position in regard to constitutional reform soon made him prominent; both in his first governor's message and before the constitutional convention, he advocated representation in the

legislature according to population instead of by towns. Though in this he opposed certain elements in his own party, he gained support from a considerable number of Democrats and great personal popularity in the cities. In 1902 he was offered renomination, but declined; in 1903–04 he was a prominent candidate for United States senator. He was elected to the United States Senate in January 1911 and took office on March 4 following. He was re-elected in 1917 and 1923. He was the author of the "Federal Migratory Bird Bill," which became a law on March 4, 1913. He died June 6, 1932.

MacLEAN, James Alexander, Canadian educator: b. Mayfair, Ontario, Aug. 2, 1868. He was graduated at the University of Toronto in 1892 and took his A.M. at Columbia in 1893. He was professor of political science at the University of Colorado in 1894–1900; president of the University of Idaho in 1900–13; and from 1913 to 1934 was president of the University of Manitoba, Canada. Author of essays in *The Financial History of Canada* (1894). He died in London, Eng. Jan. 18, 1945.

MacLEAN, John, American jurist and statesman: b. Morris County, N.J., March 11, 1785; d. April 4, 1861. He removed with his parents to Warren County, Ohio, in 1799, later went to Cincinnati, where he studied law, and was admitted to the bar in 1807, and commenced practice at Lebanon, Warren County, Ohio. He was a member of Congress 1812–16, and from 1816–22 judge of the supreme court of Ohio. In July 1823 he was appointed postmaster general, the Post Office Department being then in a very disordered and inefficient condition. Under his administration this branch of the public service was restored to order, and managed with a vigor, method and economy that soon secured an almost unexampled degree of applause and public confidence. In 1829 he became associate justice of the Supreme Court of the United States. In this capacity his charges to grand juries while on circuit are distinguished for ability and eloquence. In the Dred Scott case he dissented from the decision of the court as given by Chief Justice Taney, and expressed the opinion that slavery has its origin merely in power, and is against right and in this country is sustained only by local law.

McLEAN, John, American educator: b. Princeton, N.J., 1800; d. there, 1886. His whole life was spent in Princeton. He was graduated from the college there in 1816, became tutor in the institution in 1818 and was a member of the faculty till 1868, when he resigned the presidency, which he had held from 1854. He published *Lecture on a Common School System for New Jersey* (1829), which in later years had much influence in the establishment of such a system; *History of the College of New Jersey* (1877), and *The True Relations of the Church and the State to Schools and Colleges* (1853).

MACLEAN, John, Canadian Methodist clergyman and author: b. Kilmarnock, Scotland, Oct. 2, 1851. He was educated at Victoria University, Cobourg, Ontario, and at the Wesleyan University, Bloomington, Ill. He served as a missionary among the Blood Indians near Macleod, Alberta, in 1880–89, and was pastor at Moose Jaw, Saskatchewan, in 1889–92; later filling pastorates at Port Arthur; and at Neepawa and Carman, Manitoba. In 1902–06 he edited *The Wesleyan,* and thereafter was stationed at Morden, Manitoba. In 1888 he was appointed a member of the Northwestern Board of Education. Author of *The Indians of Canada* (1892); *The Destiny of the Human Race; The Hero of the Saskatchewan; Better Lives for Common People; Science and the Bible.* D. March 27, 1928.

McLEAN, Norman, British Orientalist: b. Lanark, Scotland, Oct. 2, 1865. He was educated at the University of Edinburgh and at Christ College, Cambridge. He was examiner in classics at Edinburgh University in 1891–94; examiner for Oriental Languages Tripos in 1895–96, 1899–1900, 1909–11, and for theological Tripos in 1896–97, 1901–02, 1908–09, 1911–12. He was Fellow, senior tutor, Hebrew lecturer and Master at Christ College, Cambridge, and university lecturer in Aramaic. He edited with Rev. A. E. Brooke, a larger Cambridge edition of the Septuagint. He was an editor of *Ecclesiastical History of Eusebius in Syria* (1896).

McLEAN, Sarah Pratt. See GREENE, SARAH PRATT McLEAN.

MacLEISH, Archibald, American poet, librarian, and public official: b. Glencoe, Ill. May 7, 1892. He received his preliminary education at The Hotchkiss School, Lakeville, Conn., and was graduated from Yale University in 1915. He served in the First World War as a captain of field artillery, and in 1919 was graduated from Harvard Law School. In 1923 he abandoned the law to devote his time to the writing of poetry, developing into one of America's foremost poets. His published works include *The Happy Marriage* (1924); *The Pot of Earth* (1925); *Nobodaddy* (a play, 1925); *Streets in the Moon* (1926); *The Hamlet of A. MacLeish* (1928); *New Found Land* (1930); *Conquistador,* which won the Pulitzer prize for poetry (1932); *Frescoes for Mr. Rockefeller's City* (1933); *Union Pacific—a Ballet* (1934); and *Panic* (a play, 1935). He also wrote two radio verse dramas, *The Fall of the City* and *Air Raid.* On June 7, 1939 he was nominated by President Roosevelt to succeed Dr. Herbert Putnam, retiring Librarian of Congress, and the Senate confirmed his nomination June 29. In December 1944 at the instance of Secretary of State Stettinius he was appointed assistant secretary of state in charge of public and cultural relations. He resigned the post August 1945.

McLEMORE'S COVE, Ga., Military Operations at. While there was little fighting in the cove, the operations there in September 1863 were vital to the success of General Rosecrans' campaign for Chattanooga. The failure of General Bragg's excellent combinations immediately increased the difficulty of interposing his army between the Union army and Chattanooga and, in the end, made it impossible.

Lookout Mountain bounds the cove on the west. Following its eastern base from Chattanooga southward, it is 24 miles to Stevens' Gap, over which the Fourteenth corps, General Thomas', which constituted the center of Rosecrans' army, crossed Lookout from the west into the cove. Eight miles beyond is Dougherty's Gap, from which point Pigeon Mountain, run-

ning northeastwardly, forms the eastern boundary of the cove. The triangular area thus enclosed is from five to eight miles wide, the mouth opening toward Chattanooga, and contains from 80 to 100 square miles. General Bragg, in evacuating Chattanooga, because of Rosecrans' flank movement, had conducted his army by way of Rossville and Lee and Gordon's Mill and established it behind Pigeon Mountain, from a point near Lee and Gordon's to Lafayette, 13 miles beyond. From this position of his army there were four gaps through which roads led into McLemore's Cove. Opposite Lafayette was Dug Gap, to the south of it Blue Bird and to the north Cattlett's and Wrothen's. Dug Gap was directly opposite Stevens' Gap. The Chickamauga Creek rises near Dougherty's Gap and runs northward through the cove.

The right of the Union army, A. McD. McCook's Twentieth corps, with the cavalry corps, Gen. D. S. Stanley, crossed Lookout at Valley Head, 42 miles south of Chattanooga, and descended south of Dougherty's Gap. The left of this army, Crittenden's Twenty-first corps, had crossed the north point of Lookout near Chattanooga and, leaving one brigade in that city, had advanced to the vicinity of Lee and Gordon's Mill. It there formed the left of the Union army. The centre corps was at Stevens' Gap, 15 miles distant, the right corps about 25 miles beyond that point, with the cavalry still farther south. This separation of Rosecrans' army was made necessary by the fact that there were no roads practicable for wheels crossing Lookout Mountain in closer proximity.

General Bragg was fully informed of the movements, and the isolation of the several Union corps. These movements, which placed each corps beyond supporting distance from either of the others, were immediately rendered still more precarious by reports received from General Sheridan on the extreme right that the enemy was retreating toward Rome, which led General Rosecrans to order pursuit. General Thomas urged active concentrations instead, but was overruled.

General Bragg, from his position behind Pigeon Mountain, commanding the four gaps opening directly upon the advance of the centre across the cove, was in most favorable position for first striking General Thomas with effect, and then turning upon either of the wings before they could attain supporting distance. Had Bragg's orders been promptly and vigorously executed the situation of the Union army would have been critical.

The night of the 9th, Negley's division, forming the Union advance from Stevens' Gap along the road leading through Dug Gap to Lafayette, encountered the enemy in the gap, and later in the night it was ascertained that a strong force was concentrating there.

General Bragg, in developing his plan, had advanced Hindman's division from the Lafayette side of the mountain, and ordered General Hill to send Cleburne to co-operate. Late at night Hill sent word that Cleburne was sick, the gaps blocked with felled trees and that the movement was, therefore, impracticable.

Early the next morning General Buckner from the extreme right was ordered to advance into the cove to support Hindman. This junction was not effected until the afternoon of the 10th. Meantime, Negley had withdrawn his division from Dug Gap and was manœuvering in defense. Hindman, instead of attacking as ordered, sent a staff-officer to Bragg at Lafayette to suggest a change of plan. This officer reached Bragg at midnight and was at once directed to return and notify Hindman to carry out the orders he had received. Cleburne was then in Dug Gap, and had promptly cleared away obstructions. Walker's reserve corps was ordered forward to join Cleburne in the attack, and all impatiently waited for Hindman's guns. Bragg had ordered seven divisions to co-operate in this movement against Thomas' three which composed the Union centre. Hindman did not attack until afternoon. At that time Baird's division had arrived from Stevens' Gap to support Negley, and by brilliant movements in retreat, with some sharp fighting by T. R. Stanley's and Starkweather's brigades, the two divisions with their trains were withdrawn in perfect order to Bailey's crossroads, a strong strategic position in front of Stevens' Gap, where Brannan's division, which had completed the crossing of Lookout, was within easy supporting distance. Thus Bragg's attempt to crush the Union centre failed. For this failure he held Hill and Hindman responsible.

Bragg then withdrew the forces operating against the Union centre to Lafayette, and at once dispatched Polk's and Walker's corps with orders to attack Crittenden's corps in the vicinity of Lee and Gordon's Mill. This corps at the time was known to Bragg to be divided, with one of its three divisions near Ringgold. Polk was urged to attack with the greatest promptness. He, however, was led to believe that a general attack on his column was about to be delivered. Instead of carrying out Bragg's orders, he therefore awaited attack and sent for the whole of Buckner's corps as reinforcements. This delay enabled Crittenden to unite his forces, cross the Chickamauga, and take a strong position on the bluffs overlooking that stream at Lee and Gordon's. Thus Bragg's attempt to crush the Union left failed, as his movement on the centre had miscarried. For this Polk was held responsible.

Meantime the Union right was withdrawing under orders to join the centre at Stevens' Gap. Rosecrans had early discovered that Bragg, instead of retreating, was concentrated for battle, and that Johnston from Mississippi and Longstreet from Virginia were about to join him. General Rosecrans in his report says: "It then became a matter of life and death to effect the concentration of the army." The flanks of the army were 40 miles apart by the nearest practicable roads, and the centre was obliged to remain near Stevens' Gap until the right corps arrived.

General Bragg's third plan, for which orders were promptly given, was to move his army down the valley of the Chickamauga, cross at the bridges and fords below Lee and Gordon's Mill, sweep up the valley, attack Crittenden, the left of Rosecrans' army drive it back on the centre, and thus, interposing between the Union army and Chattanooga, push it back into the mountains and regain that most important city. Rosecrans, however, by an undiscovered night march moved his centre and right from the cove to the left of Crittenden, and at sunrise of 19 September had interposed between Bragg and Chattanooga on the field of Chickamauga.

These movements of the opposing armies brought on the battle of Chickamauga (q.v.).
H. V. BOYNTON.

McLENNAN, John Cunningham, Canadian physicist: b. Ingersoll, Ontario, 14 April 1867. He was educated at the universities of Toronto and Cambridge. From 1899 he was connected with the faculty in physics at Toronto, and after 1907 he served as professor of physics and director of the physical laboratory there. He was president of section III of the Royal Canadian Society in 1910; was elected to the Royal Society, London, in 1915; and in 1916–17 he was president of the Royal Canadian Institute. He was Dominion lecturer on the metric system in 1906; and was author of papers on radioactivity, electrical conduction of gases and spectroscopy. D. 9 Oct. 1935.

McLENNAN, măk-lĕn'ạn, **John Ferguson,** Scottish sociologist: b. Inverness, 14 Oct. 1827; d. Hayes Common, Kent, 16 June 1881. He was educated at King's College, Aberdeen, and Trinity College, Cambridge, and after two years spent in journalism in London returned to Edinburgh, and was called to the bar in 1857. His first important publication was the article on 'Law' in the eighth edition of the 'Encyclopædia Britannica' (1857), and in 1865 he elaborated some of its speculations in 'Primitive Marriage: an Inquiry into the Origin of the Form of Capture in Marriage Ceremonies.' In 1876 his 'Primitive Marriage' was republished with 'Kinship in Ancient Greece' and other matter under the title of 'Studies in Ancient History.' An unfinished work by him, directed against Sir H. S. Maine's patriarchal theory, was completed and published in 1885 by his brother under the title of 'The Patriarchal Theory.' In 1896 a second series of 'Studies in Ancient History,' treating of the origin of exogamy, was edited by his widow and Arthur Platt. Though his views are still and probably will remain matter of controversy, the study of primitive society received a powerful impetus from his important investigations.

McLEOD, măk-loud', **Alexander,** American Presbyterian clergyman: b. Island of Mull, Scotland, 12 June 1774; d. New York, 17 Feb. 1833. He came to the United States in 1792 and was graduated at Union College in 1798. He was licensed to preach in 1799 and was ordained in charge of the First Reformed Presbyterian Church of New York and of a church in Wallkill, N. Y. He soon resigned from the Wallkill charge, but retained his New York pastorate the remainder of his life. He was for a time an editor of the *Christian Magazine*. Author of 'Negro Slavery Unjustifiable' (1802); 'Ecclesiastical Catechism' (1807); 'View of the Late War' (1815); 'The American Christian Expositor' (2 vols., 1832–33), etc.

McLEOD, Archibald Angus, American railway official: b. Compton County, Quebec, Canada, 1848; d. 1902. Early in life he came to the United States, where he became a rodman on the docks of the Northern Pacific Railway at Duluth, and in 1885 manager of the Elmira, Cortland and Northern line. He then was successively acting general manager (1886), vice-president and general manager (1887) and president (1890) of the Reading system. His consolidation of the Lehigh Valley and Jersey Central with the Reading, under Reading control, for the purpose of controlling the carrying trade of the coal fields, resulted in the Reading passing into the hands of three receivers, of whom McLeod was one.

MacLEOD, Donald, Scottish Presbyterian clergyman and author: b. Campsie, Stirlingshire, 18 March 1831; d. 17 Dec. 1911. He was a brother of Norman MacLeod (q.v.), whom he succeeded as editor of *Good Words*, 1872–1905. He was educated at the University of Glasgow. He held pastorates at Lauder (1858), Linlithgow (1862) and Glasgow (1869–1909), and, like his brother, was chaplain to Queen Victoria. He published 'Sunday Home Service' (1885); 'Christ and Modern Society' (1893), etc.

MACLEOD, Fiona, pseudonym of William Sharp (q.v.), Scottish poet and novelist: b. Paisley, 12 Sept. 1856; d. Sicily, 13 Dec. 1905. A part of his youth was spent in the Hebrides and in the islands of Iona and Arran. His stories and poems attracted great attention by reason of their freshness of treatment and originality of conception. Under his own name he published a number of works, including poems, stories, and biography, beginning with a life of Rossetti in 1882. In 1893 he began writing mystical prose and verse under the pen name of 'Fiona Macleod,' and cleverly concealed his identity, going the length of supplying a fictitious biography of the lady, to 'Who's Who,' and corresponding, through his sister, with her admirers. He also wrote concurrently, under his own name. Among works published as Fiona Macleod are 'Pharais' (1895), a romance; 'The Mountain Lovers' (1895); 'The Sin-Eater and Other Tales' (1895); 'The Washer of the Ford' (1896); 'Green Fire' (1896); 'From the Hills of Dream' (1896); 'The Laughter of Peterkin' (1897); 'Through the Ivory Gate' (1901); 'The Silence of Amor' (1902).

McLEOD, Hugh, American soldier: b. New York, 1 Aug. 1814; d. Dumfries, Va., 2 Jan. 1862. He was graduated at West Point in 1835 and served on frontier duty at Fort Jesup, La., until June 1836, when he resigned. He then joined the Texans in their struggle against Mexico, and afterward practised law at Galveston, Tex. As brigadier-general of the Texas militia he was appointed by President Mirabeau B. Lamar of Texas to the command of an expedition planned to secure an establishment of trade between Texas and Mexico in 1841, but was taken prisoner by the Mexicans and not released until the following year, when the United States government intervened in his behalf. He served in the Texas Congress in 1842–43, fought through the Mexican War and was a member of the State legislature after the annexation to the United States. He joined the Confederate army in 1861 and served on the Rio Grande and in the first Virginia campaign.

McLEOD, John, Canadian pioneer: b. Stornaway, Island of Lewis, Scotland, 1788; d. Montreal, 24 July 1849. He was engaged in the service of the Hudson Bay Company in 1811, mustering men for the company's service in the Hebrides and conducting them to Canada. In 1812–16 he built the trading posts of the company for 500 miles westward of the Red River

establishment. He was the first man known to have traversed the continent from Hudson Bay to the Pacific coast. He was in charge of Norway House, the most important fur-trading establishment in that part of the country, in 1826–30. He was afterward in charge of the Saint Maurice district, extending from Hudson Bay to the Saint Lawrence. He was a man of wide influence among both the whites and the Indians and accomplished an important work in opening the northwest for settlement.

MACLEOD, John James Rickard, Canadian medical scientist: b. Dunkeld, Scotland, 6 Sept. 1876; d. 18 March 1935. He was educated at Aberdeen, Leipzig, and Cambridge universities and received his Ph.D. from the University of Toronto. Regius professor of physiology at the University of Aberdeen at his death, he was Anderson traveling fellow, University of Aberdeen in 1898–99; demonstrated in physiology at London Hospital in 1899–1903; MacKinnon scholar of the Royal Society, 1900–03; professor of physiology at Western University, Cleveland, Ohio, from 1903 to 1918, and professor at the University of Toronto from 1918 to 1935. In 1923 he was associate dean of the faculty of medical sciences. He was fellow of the Royal Society of Canada. His published works include: 'Diabetes: Its Physiological Pathology'; 'Fundamentals of Physiology and Biochemistry in Modern Medicine'; 'Carbohydrate Metabolism and Insulin'; 'Insulin'; and various articles in scientific journals.

McLEOD, Malcolm, Canadian lawyer, son of John McLeod (q.v.); b. Green Lake, Saskatchewan, 21 Oct. 1821; d. Ottawa, September 1898. He was educated at Edinburgh, Scotland, later studied law in Montreal and in 1845 was admitted to the bar. He engaged in practice, was district judge for the counties of Pontiac and Ottawa in 1873–76 and in 1887 he became Queen's counsel. He was prominently connected with the projects of annexation of the Northwest territory to Canada and the building of a railroad to the Pacific. He was instrumental in securing the revocation of the Hudson Bay Company's charter, taking the matter to the British Colonial Secretary when the Canadian Parliament refused to act. Author of 'The Peace River' (1872); five pamphlets on 'The Pacific Railway' (1874–80).

MACLEOD, Canada, town and capital of Macleod District, Alberta, on Old Man's River, about 100 miles south of Calgary, and on the Canadian Pacific Railway. It is situated in a rich agricultural and coal-mining region, has natural gas, stone quarries, and deposits furnishing materials for the manufacture of cement and of bricks. It has a considerable trade in grain. The village is growing rapidly and is a post of the Royal North West Mounted Police. Pop. (1936) 1,365.

MACLISE, mą-klēs', **Daniel,** English painter: b. Cork, 1806; d. Cheyne Walk, Chelsea, 25 April 1870. He became a student at the Royal Academy in 1828, and began to exhibit in 1829, but it was not until 1833 that he established his reputation with his picture of 'Snap Apple Night.' Three years after he was elected an associate, and in 1840 he became a full member of the Royal Academy. Maclise was commissioned to paint for the new Houses of Parliament, and produced 'The Spirit of Chivalry'; 'The Spirit of Religion,' and the two great paintings of the 'Meeting of Wellington and Blücher after Waterloo,' and the 'Death of Nelson' (1858–64), for which patriotic paintings he refused all remuneration. Among his best-known pictures are 'Merry Christmas in the Baron's Hall'; 'The Ordeal of Touch'; 'The Marriage of Strongbow and Eva'; the 'Play Scene in Hamlet'; the 'Banquet Scene in Macbeth,' etc. His sketches, book illustrations, humorous drawings and outline portraits were very numerous. He declined the presidency of the Academy in 1866. His works show great fertility of invention, skill in composition and excellence in drawing, but his color is coarse, and his pictures are sometimes disagreeable unless seen from a distance. His mural paintings are now recognized to be the greatest historical paintings of their kind ever produced in England. Consult O'Driscoll, 'Memoir of Daniel Maclise' (1871).

McLOUGHLIN, măk-lŏk'lĭn, **John,** Canadian pioneer and fur trader: b. Rivière du Loup, Lower Canada, 19 Oct. 1784; d. Oregon City, 3 Sept. 1857. He was educated in Canada and at Edinburgh, Scotland, studied medicine and in early manhood returned to Canada, where he entered the Northwest Company and was placed in charge of Fort William, the chief depot of the company, situated at the mouth of the Kaministiquia River on Lake Superior. Upon the consolidation of the Northwestern and the Hudson Bay companies, in 1821, Dr. McLoughlin was appointed chief factor of the company in the Oregon country. Arriving overland at Astoria in 1824 he founded Fort Vancouver, which, situated advantageously near the confluence of the Columbia and Willamette rivers, became the headquarters of the company beyond the Rockies. When Dr. McLoughlin established the fort the Indians were so hostile that it was unsafe for parties of less than 60 men to travel the Columbia River, but under his management of the company's affairs it became safe for two men to traverse the distance between Oregon City and Fort Hall. In the entire period of his administration, from 1824 to 1846, there were no Indian wars in the Oregon country, although they broke out in 1847, the year after his resignation. He made Fort Vancouver a haven of refuge to emigrants arriving after the perilous journey overland, furnishing goods and provisions on credit and caring for their sick in direct opposition of the company's policy, which was to keep the land wild for the wild fur-bearing animals. During McLoughlin's administration the Oregon country was in the condition of joint occupancy by the United States and Great Britain. His courageous and humanitarian method of dealing with the situation, recognizing the equal rights of the American settlers with those of the British Fur-trading Association, undoubtedly went far toward preventing war between the British and American nations. However, the strictures upon his methods by Sir George Simpson, governor-in-chief of the Hudson Bay Company, culminated in an order to render no further aid to immigrants, and McLoughlin resigned rather than obey, although it cost him his income of $12,000 a year. His resignation took effect in 1846, and he then retired to Oregon City where he had

extensive and partially improved land claims. Litigation over his claims embittered his last years, but after his death the land was restored to his heirs. He became an American citizen in 1848. The McLoughlin Institute was dedicated to his memory at Oregon City in 1907, and he is generally known as the "Father of Oregon." Consult the 'Reports' of the Washington Historical Society, the Oregon Historical Society and the Oregon Pioneer Association; Dye, E. E., 'McLoughlin and Old Oregon' (1900; 8th ed., 1913); Holman, F. V., 'Dr. John McLoughlin, the Father of Oregon' (1907).

McLOUGHLIN, Maurice Evans, American tennis champion: b. Carson City, Nev., 1890. He won the championship of the Pacific Coast, played in the East in 1908–09 and in 1909 and 1911 he competed for the Davis cup in Australia, but unsuccessfully. He won the national championship at Newport in 1912; and in 1913 was leader of the American team that captured the Davis cup from England. He was victor at Longwood and won the New York State championship in 1914. His defeat of Brookes and Wilding in singles made him world champion. Author of 'Tennis as I Play It' (1915).

McLOUTH, măk-lowth', **Lawrence Amos,** American educator and author: b. Ontonagon, Mich., 19 Jan. 1863; d. 1927. He was educated at the universities of Leipzig, Heidelberg and Munich. He was instructor in German at the University of Michigan in 1892–95; and after 1895 was professor of Germanic language and literature at New York University. He edited German texts, was author of numerous articles on literature, philology and pedagogy, and of 'Verses' (1910).

MACLURE, măk-lūr', **William,** American geologist: b. Ayr, Scotland, 1763; d. San Angel, near the city of Mexico, 23 March 1840. In 1796 he visited the United States, and in 1803 was in Europe as one of the commissioners to settle the claims of American citizens against France for spoliations during the revolution in that country. On returning to America he engaged with zeal in the extraordinary private undertaking of a geological survey of the whole country. Depending on his own resources and observations at a time when geology was unknown as a science, and few could appreciate his motives, he visited almost every State and Territory, crossing and recrossing the Alleghanies no fewer than 50 times. His first communication to the public was a memoir entitled 'Observations on the Geology of the United States, explanatory of a Geological Map,' read before the American Philosophical Society, 20 Jan. 1809, and published in Vol. VI of their 'Transactions.' He still continued his explorations, and on 16 May 1817 presented another memoir to the society, published in their 'Transactions,' and also in a separate volume. The former publication was six years prior to that of the geological map of England prepared by William Smith, a production which gave him the title of father of English geology. To Maclure is equally due the title of father of American geology. His publications attracted much attention to the science. He now settled in Philadelphia and gave his books and collections to the Academy of Natural Sciences of which he was president from 1817 till his death. He lived in Spain, 1819–24, where he attempted to found an agricultural college, and returning in 1824 to the United States attempted to carry out a similar scheme in the New Harmony settlement in Indiana. Several distinguished naturalists from Philadelphia joined him in this enterprise, but the scheme failed. After 1828 he lived in Mexico, always, however, with the intention of returning to the United States, and with his interest in the progress of scientific education there unabated. While in Mexico he wrote 'Opinions on Various Subjects,' devoted mainly to political economy (1837).

McMAHON, măk-mä'hŏn, **Sir Arthur Henry,** British soldier and administrator: b. 28 Nov. 1862. He was educated at the Royal Military College at Sandhurst, joined the 8th Regiment in 1883 and in 1885 entered the Indian Staff Corps and joined the 1st Sikhs, Punjab Frontier. He became affiliated with the Indian Political Department in 1890 and served as political agent on various missions until 1901, when he became Revenue and Judicial Commissioner at Beluchistan. He was an arbitrator on the boundary between Persia and Afghanistan in Seistan and also served as British Commissioner to the Seistan Mission in 1903–05. He was Foreign Secretary to the Government of India in 1911–14. In 1914–16 he was High Commissioner of Egypt. He was knighted in 1906.

McMAHON, James, American mathematician: b. County Armagh, Ireland, 22 April 1856; d. 1 June 1922. He was graduated at the University of Dublin in 1881. He was examiner in mathematics 1883–84, instructor 1884–90, assistant professor 1890–96, and professor after 1904 at Cornell University. In 1891–97 he was associate editor of *Annals of Mathematics.* Professor McMahon was joint author of 'Higher Mathematics' (1896); the 'Cornell Mathematical Series,' and 'Plane Geometry' (1903).

MacMAHON, Marie Edme Patrick Maurice de, Duke of Magenta and Marshal of France: b. Sully, Saône et Loire, 13 June 1808; d. near Montargis, 17 Oct. 1893. He was descended from an Irish family that went into exile with James II, and was educated at the military college of Saint Cyr; served with distinction in Algeria; became brigadier-general in 1848; received command of a division during the Crimean War, and assisted in storming the Malakoff; was appointed to the Senate in 1856; took part in the campaign of 1859 against Austria, and won the battle of Magenta by his prompt handling of the left wing and was rewarded by a marshal's baton and a dukedom; and in 1864 became governor-general of Algeria. At the outbreak of war between France and Germany (1870) MacMahon was placed in command of the First army corps, which was defeated at Weissenburg and Wörth, and finally fell back upon Châlons. Here he rallied his forces, and proceeded northeastward to relieve Bazaine, who was besieged in Metz, but he was pursued by the Germans, shut up by them in the town of Sedan and wounded in the battle before the final surrender with 81,000 men. After the armistice with Germany he was employed by the Versailles government in putting down the commune, and in 1873 was elected President of the republic, a position which he occupied until 1879. Consult Daudet, 'Souvenirs de la présidence du Maréchal de MacMahon' (Paris 1880); 'Le maréchal de MacMahon' (ib. 1883);

LaFarge, 'Histoire complète de MacMahon, maréchal de France, duc de Magenta' (ib. 1898).

MacMANUS, măk-măn'ŭs, **Seumas,** Irish novelist and writer of short fiction and verse: b. Donegal, 1868. He was educated at a mountain school in Donegal and engaged in teaching. He soon became known for his prose and verse contributions to periodicals, dealing with the traditions and folklore of Ireland. He visited America in 1899 and afterward his contributions appeared in many leading American periodicals. He has since made frequent lecture tours in America. Author of 'Through the Turf Smoke' (1899); 'Donegal Fairy Tales' (1900); 'Ballads of a Country Boy' (1905); 'The Leadin' Road of Donegal' (1900); 'Irish Nights'; 'Yourself and the Neighbors' (1914); 'Ireland's Case' (1917), etc. Among his plays are 'The Woman of Seven Sorrows'; 'Orange and Green'; 'Rory Wins'; 'Nabby Harren's Matching'; 'Top o' the Mornin',' etc.

McMASTER, John Bach, American historian: b. Brooklyn, 29 June 1852. He was graduated from the College of the City of New York in 1872, studied civil engineering, and 1877 became instructor of civil engineering at Princeton. In 1883 he published the first volume of his 'History of the People of the United States,' and the same year was appointed professor of American history in the University of Pennsylvania. His 'History,' of which eight volumes were published in 1913, has become a standard work. It covers a period reaching from the close of the Revolution (1783) to the outbreak of the Civil War,— less than 100 years, but a crucial time for the shaping of the country. The account of the formative time, the day of the pioneer and the settler, engaged his particular attention and received his most careful treatment. He strove to give a picture of social rather than constitutional and political growth; and tells the story of national evolution with admirable lucidity and simplicity of style, and always with an appeal to fact precluding the danger of the subjective writing of history to fit a theory. His other works are 'Benjamin Franklin as a Man of Letters' (1887); 'With the Fathers, Studies in American History' (1896); 'Origin, Meaning and Application of the Monroe Doctrine' (1897); 'A School History of the United States' (1897); 'A Primary School History of the United States' (1901); 'Daniel Webster' (1902); 'Brief History of the United States' (1903); chapters 9, 11 and 12, Vol. VII, 'Cambridge Modern History' (1903); 'Struggle for the Social, Political and Industrial Rights of Man in America' (1903); 'The United States in the World War' (1919); 'A History of the People of the United States' (1927). D. 24 May 1932.

McMASTER, William, Canadian senator and philanthropist: b. Tyrone, Ireland, 24 Dec. 1811; d. Toronto, Canada, 22 Sept. 1887. When 22 years of age he emigrated to Canada, and after several years' experience in a large wholesale firm in Toronto commenced business on his own account. He was elected a member of the legislative council for the Midland division of Canada in 1862, and held this seat until he was called to the Senate by royal proclamation in 1867. He was prominently identified with many public institutions, notably as president of the Canadian Bank of Commerce, member of the senate of the University of Toronto, chairman of the Canadian board of the Great Western Railway and became widely known by his liberal donations to educational and religious institutions, especially those of the Baptist denomination, of which sect he was a member. McMaster University, Hamilton, is named in his honor.

McMASTER UNIVERSITY, Hamilton, Canada, established in 1887 through the generosity of Senator William McMaster (q.v.) and by a charter from the Legislative Assembly of Ontario, is ultimately controlled through the Baptist Convention of Ontario and Quebec, which elects the members of the board of governors, 16 in number, exclusive of the Chancellor. It occupies a site of over 90 acres, surrounded by extensive parklands at the western limits of Hamilton, but prior to 1930 was situated in Toronto, where its Arts faculty was opened in 1890. At present it has an endowment of $2,250,000, owns five main buildings, and has a staff of 42 in two faculties, a library of 50,000 volumes, and an annual attendance of over 600, plus more than 350 part-time evening and summer students. A «Christian school of learning,» the university has no sectarian tests for students, and requires only that instructors be members of an evangelical Christian church. The present university grew directly out of the Canadian Literary Institute, established in 1857 by Baptists of central Canada, in Woodstock, Ont., under the principalship of Rev. R. A. Fyfe, D.D. This coeducational school was set up by act of Parliament, and provided literary and theological courses. Arts studies were partially developed through temporary affiliation with the University of Toronto in 1875, and in 1881 the theological work was transferred to Toronto, where the Toronto Baptist College was established through gifts of Senator McMaster, whose later bequest of $900,000 made possible the endowment of the new university in 1887. The college in Woodstock, changed into a boys' and young men's preparatory school, remained open until 1926, and a similar school for girls and young women, Moulton College, founded by Mrs. Susan Moulton McMaster in 1888, still operates in Toronto under the supervision of the McMaster Board of Governors. Matters of academic policy, including nominations to the faculty, are in charge of a Senate, which includes the governors and representatives of the faculty and alumni, while the board of governors makes appointments to the staff and deals with finances and all questions affecting the corporation. The removal to Hamilton, and consequent enlargement of the McMaster constituency and resources, were made possible through generous gifts from graduates, members of Baptist churches, and interested citizens of Hamilton.

HOWARD P. WHIDDEN,
Chancellor.

MacMECHAN, Archibald McKellar, Canadian scholar and author: b. Berlin (now Kitchener), Ontario, 21 June 1862; d. Halifax, N. S., 7 Aug. 1933. He was educated at the University of Toronto and at Johns Hopkins, and in 1889 was appointed professor of English language and literature at Dalhousie University, Halifax, N. S. He retained this position until shortly before his death. He published: 'The Relation of Hans Sachs to the Decameron';

The Porter of Bagdad (1901); *The Life of a Little College* (1914); *The Winning of Responsible Government* (1915); *Sagas of the Sea* (1923); *Headwaters of Canadian Literature* (1924); *The Book of Ultima Thule* (1927); *There Go the Ships* (1928); *Red Snow on Grand Pré* (1931); *Late Harvest,* poems (1934).

McMECHEN, măk-měk'ĕn, city, West Virginia; in Marshall County; altitude 710 feet. It is situated on the Ohio River, six miles south of Wheeling, and is served by the Baltimore and Ohio Railroad. McMechen is a residential community, with local industries. Nearby, at Moundsville, is the Grave Creek Mound, one of the best known Indian mounds in the country. McMechen was settled in 1823, incorporated in 1895, and has a mayor and council. Pop. (1950) 3,518.

MACMILLAN, măk-mĭl'ăn, **Daniel,** Scottish bookseller and publisher, founder of Macmillan & Co.; b. Upper Corrie, Isle of Arran, Sept. 13, 1813; d. Cambridge, Eng., June 27, 1857. He took service with a Cambridge bookseller in 1833, and with Messrs. Seeley, Fleet Street, London in 1837. He set up in business for himself in London in 1843, but soon moved to Cambridge, where in 1844 he became a publisher, quickly establishing a prosperous business. He published Charles Kingsley's *Westward Ho!* in 1855, and Thomas Hughes' *Tom Brown's School Days* in 1857, but he was established chiefly by educational publications and the works of Isaac Todhunter and F. D. Maurice.

Alexander Macmillan (b. Irvine, Ayrshire, Oct. 3, 1818; d. London, Jan. 25, 1896) became associated with his brother in 1843, and after the latter's death, opened a branch in London, which in 1863 became the headquarters of the firm. He was joined in the enterprise by his son George Macmillan (1855–1936), and two sons of Daniel, Sir Frederick Orridge Macmillan (1851–1936; knighted in 1909) and Maurice Crawford Macmillan (1853–1936); and through the establishment of numerous branches overseas the firm became one of the leading publishers of the English-speaking world. *Macmillan's Magazine,* the first of the shilling monthlies, made its appearance in 1859 and continued publication until 1907.

In 1893 Macmillan & Co. became a limited-liability company under the chairmanship of Sir Frederick. The branch opened in New York in 1869 became a separate concern, The Macmillan Company, in 1896, although the directors of the parent company retained control through stock ownership until Jan. 22, 1951, when it became wholly independent.

Consult Hughes, T., *Memoir of Daniel Macmillan* (London 1882); Graves, C. L., *Life and Letters of Alexander Macmillan* (London 1910); *The House of Macmillan (1843–1943)* (London and New York, 1944).

McMILLAN, Sir **Daniel Hunter,** Canadian administrator: b. Whitby, Ontario, January 1846; d. Winnipeg, April 14, 1933. He was educated in Canada and in 1864 served with the Canadian Volunteers on the Niagara frontier. He afterward took part in the military operations during the Fenian Raid in 1866; the Red River expedition of 1870; and in the Northwestern rebellion of 1885 he was awarded a medal. He represented Centre Winnipeg in the Manitoba Legislative Assembly, 1880–1900, and became a member of the Manitoba government in 1889. In 1900–1911 he was lieutenant governor of Manitoba. He was knighted in 1902.

MacMILLAN, Donald Baxter, American Arctic explorer: b. Provincetown, Mass., Nov. 10, 1874. He was graduated from Bowdoin College in 1898, and took postgraduate courses in anthropology at Harvard. In 1908 he joined the Peary Arctic Expedition, which culminated in 1909 in the discovery of the North Pole. He was a member of the Cabot Labrador Expedition in 1910, and in 1911–1912 did ethnological work in that region.

MacMillan organized his first independent expedition in 1913. This had for one of its purposes the solution of the problem of Crocker Land, which Peary believed he had seen on one of his earlier expeditions. MacMillan remained in the Arctic regions until 1917, proving the nonexistence of Crocker Land, and exploring a large part of the hitherto unvisited Grant Land on Ellesmere Island. MacMillan was appointed professor of anthropology at Bowdoin College in 1918. In 1920 he explored in the Hudson Bay region. In the next year he organized and commanded an expedition to Baffin Land (now called Baffin Island); followed in 1923–1924 by researches on the glaciers of Kane Basin, and in 1925 by an expedition whose chief purpose was to reach the North Pole by airplane. Commander Richard E. Byrd was in charge of the aeronautical part of the expedition. MacMillan visited Labrador, Baffin Island and Greenland in 1926 and 1927–1928; in 1944 commanded an expedition which made aerial surveys of Greenland, Baffin Island, and Labrador; and led expeditions to Ellesmere and Baffin islands in 1948 and 1949.

McMILLAN, Edwin Mattison, American physicist: b. Redondo Beach, Calif., Sept. 18, 1907. He was educated at the California Institute of Technology (B.S., 1928; M.Sc., 1929) and received his Ph.D. at Princeton University in 1932. He became a national research fellow at the University of California, 1932–1934; staff member of the Radiation Laboratory there from 1934; research associate, 1934–1935; instructor in physics, 1935–1936; and was assistant professor from 1936 until 1941, when he was called by the government to work on radar and, later in the same year, on sonar for the navy. McMillan also assisted in the development of the atomic bombs of the Hiroshima and Nagasaki types.

In 1940 McMillan was codiscoverer, with Philip Hauge Abelson, of element 93, which was named neptunium, obtained by bombarding the uranium isotope 238 with neutrons. His work on element 94, plutonium, was interrupted by World War II, but his experiments were continued by Glenn Theodore Seaborg, with whom he shared the Nobel Prize for chemistry in 1951.

Returning to the University of California as a full professor in 1946, McMillan developed the particle accelerator known as the synchrotron, a major advance over the cyclotron.

MacMILLAN, Sir **Ernest Campbell,** Canadian musician and composer: b. Mimico, near Toronto, Aug. 18, 1893. He was educated at the universities of Toronto and Oxford, and studied in Edinburgh and Paris. He was in Germany at the outbreak of World War I and was interned

at the Ruhleben Prison Camp. While there, he wrote a setting of Algernon Charles Swinburne's *England,* which Oxford later accepted for the degree of Mus.D. Returning to Canada, he was principal of the Toronto Conservatory of Music, 1926–1942; dean of the faculty of music at the University of Toronto from 1927, and conductor of the Toronto Symphony Orchestra from 1931. He was knighted in 1935.

MACMILLEN, măk-mĭl'ĕn, **Francis,** American violinist: b. Marietta, Ohio, Oct. 14, 1885. He entered the Chicago College of Music at the age of seven, afterward studying under Karl Markees and Joseph Joachim in Berlin, 1895–1899; under César Thomson in Brussels, 1900–1902; and later under Karl Flesch and Leopold Auer in St. Petersburg. He received first prize and the Val Hal cash prize at the Brussels Royal Conservatory in 1901, and made his debut in that city, March 30, 1903, afterward touring England, Belgium, France, and Germany. He made his American debut at Carnegie Hall, Dec. 7, 1906, and toured the United States. He toured Europe, 1911–1914; and played and taught there, 1929–1935; then returned to the United States.

McMINNVILLE, măk-mĭn'vĭl, city, Oregon; seat of Yamhill County; altitude 155 feet. It is situated on the Yamhill River, 21 miles north-northwest of Salem, and is served by the Southern Pacific Railroad. McMinnville is the trade center of an area producing livestock, dairy products, wheat, fruit, and nuts. Lumber, condensed milk, brick and tile, and gloves are manufactured. Linfield College (Baptist; coeducational), founded in 1857, is located here. W. T. Newby, a miller from McMinnville, Tenn., settled here in 1844 and named the town. It was incorporated as a town in 1876; as a city in 1882. Pop. (1950) 6,635.

McMINNVILLE, town, Tennessee; seat of Warren County; altitude 900 feet. It is situated 53 miles northwest of Chattanooga, and is served by the Nashville, Chattanooga and St. Louis Railway. The region is agricultural, with timber areas, and marble and granite quarries. The town manufactures wood products, textiles, shoes, hosiery, and overalls. Settled about 1800, it was incorporated as a village in 1808; as a town in 1872. Government is by mayor and council. Pop. (1940) 4,649; (1950) 7,577.

MacMONNIES, măk-mŏn'ĭz, **Frederick William,** American sculptor: b. Brooklyn, N. Y., Sept. 28, 1863; d. New York, N. Y., March 22, 1937. He was assistant and pupil to Augustus Saint-Gaudens, 1880–1884, and studied under Alexandre Falguière in Paris, where in 1886 and 1887 he won the Prix d'Atelier, the highest award for foreigners Opening his own studio in Paris in 1887, he won a second medal in the Salon of 1891 with his statues of Nathan Hale (now in City Hall Park, New York) and James Stranahan (Prospect Park, Brooklyn). Succeeding works were *Faun with Heron* (1892); *Sir Henry Vane* (1893; Boston Public Library); the *Columbian Fountain* for the World's Columbian Exposition at Chicago, 1893, once his most famous work; *Bacchante with Infant Faun* (1894; placed in the Metropolitan Museum of Art, New York, after being rejected on grounds of prudery by the Boston Public Library; replica in the Luxembourg, Paris); *Victory* (1895) for the battle monument at West Point, N. Y.; and a statue of Shakespeare (1898) in the Library of Congress.

The major works of his later sculptural period are *Washington at Princeton* (1918) for the battle monument at Princeton, N. J.; *Civic Virtue* (1919; City Hall Park, New York), a work criticized as lacking the idealism the subject seemed to demand, and later removed; and his massive, granite Marne Monument (1926). The latter work, 130 feet tall, was executed by Edmondo Quattrocchi from MacMonnies' designs, and was placed on a hill near Meaux, France, as a gift of the American people. It symbolizes France, as a woman, holding a fallen soldier, facing the enemy defiantly.

McMURRICH, măk-mûr'ĭk, **James Playfair,** Canadian scientist: b. Toronto, Ontario, Oct. 16, 1859; d. there, Feb. 9, 1939. Graduated from the University of Toronto in 1879, he received his Ph.D. from Johns Hopkins in 1885. From 1884–1886 he instructed at that institution in mammalian anatomy. He held a professorship in biology at Ontario Agricultural College (1882–1884); at Haverford (1886–1889); at Cincinnati (1892–1894). From 1889–1892 he was assistant professor of morphology at Clark University; professor of anatomy in the University of Michigan (1894–1907); and from 1907 until his retirement in 1930 was professor of anatomy at the University of Toronto. He published *A Textbook of Invertebrate Morphology* (1894); *The Development of the Human Body* (1902); *Leonardo da Vinci, the Anatomist (1452–1519)* (1930).

MacMURROUGH, măk-mûr'ô, **Dermot** (in Irish DIARMAID MACMURCHADA or MACMURCHADHA), king of Leinster: b. 1110?; d. Ferns, 1171. He succeeded his father, Enna, in 1126. After becoming infamous for his cruelty, in 1152 (according to *The Annals of the Four Masters*) he carried off Dervorgill, wife of Tiernan O'Ruark, lord of Breifne. Roderic O'Connor, recaptured Devorgill in 1153, and in 1166, after he had become high-king of Ireland, drove MacMurrough from the country. The latter applied for aid to Henry II of England, promising to hold his kingdom as Henry's vassal. Receiving permission to enlist adventurers among Henry's subjects, he was joined by Richard de Clare, to whom he promised his daughter, Eva, and succession to his kingdom. Returning to Ireland in 1167, MacMurrough maintained himself by guile until the arrival of de Clare in 1170, after which Wexford, Waterford, and Dublin were soon taken. Upon MacMurrough's death, de Clare, who had married Eva in 1170, claimed the kingdom. See also IRELAND—*History to 1601 A.D.*

McMURRY, Frank Morton, American educator: b. near Crawfordsville, Ind., July 2, 1862; d. Pawling, N. Y., Aug. 1, 1936. He studied at the universities of Michigan, Halle, Jena, Geneva, and Paris. He was professor of pedagogy at the Illinois State Normal School, 1891–1892; and at the University of Illinois, 1893–1894; dean of Teachers College, University of Buffalo, 1895–1898; and professor of elementary education at Teachers College, Columbia University, 1908–1926. He was the author of *Tarr and McMurry Common School Geographies,* with Ralph Stockman Tarr (1900; 1902); *Method of*

Recitation, with C. A. McMurry (1898); *How to Study and Teaching How to Study* (1909); McMurry and Benson, *Social Arithmetics* (1926). D. Aug. 1, 1936.

McMURTRY, Lewis S., American surgeon: b. Harrodsburg, Ky., Sept. 14, 1850; d. Feb. 1, 1924. He was educated at Centre College, Kentucky, and at Tulane University. He specialized in gynecology and abdominal surgery, becoming professor of those subjects in the medical department of the University of Louisville, where he afterward became president of the medical faculty. He was surgeon at the Louisville City Hospital, and was president of the American Medical Association in 1906–07. He contributed to the *International Text Book of Surgery*.

McNAB, Sir Allan Napier, Canadian statesman: b. Niagara, Ontario, Feb. 19, 1798; d. Aug. 8, 1862. He entered the navy as midshipman in 1813, but soon abandoned the navy for the army; was present at the capture of Fort Niagara, and commanded the advance guard at the battle of Plattsburg. At the close of the war he studied law and practiced in Hamilton, and in 1829 was elected a member of the assembly, and speaker 1837–41. During the insurrection of 1837–38 he commanded the militia on the Niagara frontier, routed the insurgents near Toronto Dec. 7, 1837; and a party of American sympathizers having occupied Navy Island in the Niagara River, whence they were cannonading the village of Chippewa on the Canadian side, he sent a party to seize the steamer *Caroline*, employed to convey them supplies, and having driven the crew ashore, set fire to it and sent it over the Falls. For his services to the crown during this insurrection McNab was knighted. In 1854 he was prime minister under the earl of Elgin, retaining office for a few months under his successor, Sir Edmund Head. On retiring in 1856 he was made a baronet.

McNAIR, măk-nâr', Frederick Vallette, American naval officer: b. Jenkintown, Pa., Jan. 13, 1839; d. 1900. He was educated at the United States Naval Academy and served in the *Minnesota* 1857–59. In 1861 he became lieutenant, and during the Civil War took part in the bombardment of Forts Jackson and Saint Philip, the capture of New Orleans and the destruction of the Confederate ram *Arkansas*. He was instructor at the naval academy 1867–68, in 1872 became commander and in 1887 was placed in command of the *Omaha* in the Asiatic squadron. In 1890 he became superintendent of the Naval Observatory. In 1895 he was made admiral, a member of the lighthouse board in 1898, and in July of the last-named year was appointed to take charge of Admiral Cervera and other Spanish prisoners of war. Upon their return to Spain he was appointed superintendent of the naval academy.

McNAIR, Leslie James, Lieutenant General of the United States Army; the Commanding General of the Army Ground Forces; according to General Marshall "the brains of the army"; killed in France in July 1944. Leslie McNair was born in Verndale, Minnesota, on May 25, 1883. He graduated from the United States Military Academy in 1904 and was commissioned a 2d lieutenant of artillery. On becoming a 1st lieutenant in 1905 he transferred to the Ordnance Department and was stationed at Sandy Hook Proving Ground, New Jersey, and later at Watertown (Mass.) Arsenal. In June 1908 he returned to field artillery and after four years went abroad to observe French artillery practice. From 1913 to 1916 he was at Fort Sill, Oklahoma, and then went to Mexico with General Pershing. In June 1917 he began a distinguished career in France on a staff with his friend George C. Marshall. He was promoted rapidly: lieutenant colonel 1917; colonel 1918; and at 35 years was the youngest brigadier general in the army. He earned the Distinguished Service Medal for skill in the use of artillery.

After the First World War he reverted to his permanent grade of major and during the next 15 years had various assignments: instructor, Fort Leavenworth; General Staff in Hawaii; professor of Military Science and Tactics at Purdue University; Artillery School, assistant commandant. He became a lieutenant colonel in 1928 and in 1935 as executive officer in the office of the Chief of Field Artillery was promoted to colonel. He was later commander of the 2d Field Artillery Brigade, Fort Sam Houston, and then commandant at the Command and General Staff School, Fort Leavenworth.

The big assignment came in July 1940 when as chief of staff, General Headquarters, he was charged with directing the gigantic training program. When the army was streamlined in 1942 he retained these duties becoming commanding general, Army Ground Forces, with rank of lieutenant general. His program included: factual training films; stiff obstacle courses; dangerous training under live ammunition maneuvers, realistic and tough. These he knew to be the only fit preparation for combat. Starting with about 1,000,000 men he finished with a trained army of nearly 8,000,000. In July 1944, satisfied that the job was done, he sought and received assignment to the field. Shortly afterward in France, while observing, he was killed by the unfortunate misdirection of one of his own army's bombs.

MACNAMARA, Thomas James, British statesman and author: b. Montreal, Canada, Aug. 23, 1861; d. Dec. 3, 1932. He went to England at an early age and was educated at Saint Thomas School, Exeter, and at the Borough Road Training College for Teachers. He was engaged in teaching in 1876–92 and was president of the National Union of Teachers in 1896. Elected to Parliament for North Camberwell in 1900, he served as parliamentary secretary of the Local Government Board in 1907–08 and to the Admiralty in 1908–15, in 1908–20 was financial secretary to the admiralty and minister of labor 1920–22. He was author of numerous textbooks.

McNAUGHTON, Andrew George Latta, Canadian soldier: b. 1887. Commander in chief of the Canadian Active Service Force from 1940. General McNaughton was educated at Lennoxville and at McGill University, the Royal Staff College, Camberley, and the Imperial Defense College, London. During the war of 1914–18 he served in France and Belgium; became chief of the Canadian General Staff in 1929 and was president of the National Research Council of Canada from 1935 to 1939. In 1930–40 he com-

manded the 1st Division of the Canadian Overseas Force.

MacNEIL, măk-nēl′, **Hermon Atkins,** American sculptor: b. Chelsea, Mass., 1866; d. New York City, Oct. 2, 1947. He was graduated at the Massachusetts State Normal School in 1886; and later spent two years in study under Henri M. A. Chapu at Julien Academy, and two years under Jean A. J. Falguière at the Ecole des Beaux Arts in Paris. He was engaged in important decorative work for the expositions at Chicago, Paris, Buffalo, and Panama. He executed the spandrels on the portico of the national pavilion at the Paris Exposition, where he exhibited the groups *The Sun Vow* and the *Last Act of the Moqui Snake Dance.* The main cascade fountain at the Saint Louis Exposition was his work, and he served on the jury of awards. Among his other work may be mentioned *The Coming of the White Man* (City Park, Portland, Oreg.); *McKinley Memorial* (Columbus, Ohio); *General Washington* (Washington Arch, New York). His work is represented at the Art Institute, Chicago; Peabody Institute, Baltimore; Cornell University; the Metropolitan Museum, New York; and Johns Hopkins University.

MacNEVIN, or **MACNEVEN, William James,** American physician: b. Ballynahowne, County Galway, Ireland, March 21, 1763; d. New York, July 12, 1841. When 12 years old he was placed in the care of his uncle, Baron O'Kelly MacNevin, court physician in Austria, and he received his education at the universities of Prague and Vienna, taking his medical degree at Vienna in 1784. He then returned to Ireland and engaged in practice at Dublin. He was arrested with Thomas Addis Emmet in 1798 and imprisoned for four years; joined the Irish Legion under Napoleon and after three years came to the United States and practiced medicine. In 1808 he was professor of obstetrics in the College of Physicians and Surgeons, New York City, and in 1811 professor of materia medica. He was author of *Rambles through Switzerland* (1803); *Chemical Examination of the Mineral Waters of Schooley's Mountain* (1815); *Exposition of the Atomic Theory of Chemistry* (1819).

McNICHOLAS, John T., Roman Catholic archbishop: b. Kiltamagh, County Mayo, Ireland, Dec. 15, 1877; d. Cincinnati, Ohio, April 22, 1950. He was brought to the United States in 1881, and educated at St. Joseph's College, Philadelphia; St. Rose Priory, Springfield, Ky., and St. Joseph's College, Somerset, Ohio. He was ordained priest in 1901; was lector of sacred theology, Minerva University, Rome, in 1904, and in 1904–1905 was a professor at the Dominican House of Studies, Somerset, Ohio; at Washington, D.C., 1905–1909; was pastor of the Church of St. Catherine of Siena, New York City, 1913–1916, and archbishop of Cincinnati in 1925. Of wide civic interests he was appointed chairman of the board of the National Catholic Welfare Conference in 1946. He was the first episcopal chairman of the Legion of Decency.

McNUTT, măk-nŭt′, **Paul Vories,** vō′rēz, American lawyer and public official: b. Franklin, Ind., July 19, 1891. He was graduated from Indiana University, 1913, and from Harvard Law School, 1916. He was assistant professor of law at Indiana University 1917–1919; became professor, 1919, and was dean of the law school, 1925–1933. He was governor of Indiana, 1933 to 1937; high commissioner to the Philippines, 1937–1939; federal security commissioner, 1939–1945; also director of Defense, Health and Welfare Services, 1941–1943; and chairman of the War Manpower Commission, 1942–1945. He then returned to the Philippines as high commissioner, and in 1946 was made ambassador to the islands, serving until 1948. He served in World War I as an artillery officer, and was national commander of the American Legion, 1928–1929. He has been decorated by Poland, France and the Philippines. He now practices law in New York and Washington.

MACOMB, mâ-kōm′, **Alexander,** American general: b. Detroit, Mich., April 3, 1782; d. Washington, D.C., June 25, 1841. He entered the United States Army in 1799 as a cornet of cavalry, and in 1812 held the rank of lieutenant colonel of engineers, and adjutant general of the army. In January 1814 he was promoted brigadier general and placed in command of that part of the northern frontier bordering on Lake Champlain. At Plattsburg, on Sept. 11, 1814, he sustained the attack of a greatly superior British force under Sir George Prevost, which, after the defeat of the British squadron on Lake Champlain on the same day, retreated to Canada. For his firmness and courage on this occasion he was commissioned a major general, and received the thanks of Congress and a gold medal. In 1835 he succeeded to the office of commander in chief of the army, which he held until his death. He wrote a *Treatise on Martial Law and Courts Martial, as Practised in the United States* (1809).

MACOMB, Ill., city and McDonough County seat, altitude 702 feet, 202 miles by rail southwest of Chicago, with a privately owned airport. Located in a farming region, it makes porcelain electrical insulation, poultry equipment, pottery and stoneware, milk products, and automobile license plates. The public library is well stocked. The city is the seat of the Western Illinois Teachers College, with nine buildings on a 290-acre campus. Settled in 1830, Macomb was named for Gen. Alexander Macomb (q.v.), who commanded the United States Army from 1835 to the time of his death. It was incorporated as a town in 1830, and as a city in 1856; has a mayor and council, and a city-owned water-supply system. Pop. (1930) 8,509; (1940) 8,764; (1950) 10,586.

MACON, mā′kŭn, **Nathaniel,** American statesman: b. Warren County, N. C., Dec. 17, 1758; d. there, June 29, 1837. He was educated at the College of New Jersey, now Princeton; in 1776 he left college and served in the New Jersey militia. During the following three years he studied law; from 1780 he served as a common soldier in the Continental Army till the provisional treaty of peace in 1782, refusing any pay or military distinction. When the Constitution of the United States was submitted to North Carolina, he opposed it, asserting it bestowed too much power on the government, and made it in effect independent of the state. He never lost this dislike of the Constitution, and had unlimited confidence in the capacity of the people for self-government;

he was a strong opponent of the Alien and Sedition Acts. He was a member of the United States House of Representatives from 1791 to 1815, serving as speaker from 1801 to 1807, and of the Senate from 1815 to 1828, when he resigned. In 1835 he was president of a convention called to revise the North Carolina constitution.

MACON, mä-kôN, city, France, capital of the Department of Saône-et-Loire, situated on the Saône River and the main railway line between Paris and Marseille, 38 miles north of Lyon. A bridge of 12 arches crosses the river to the suburb of St.-Laurent. The Cathedral of St.-Vincent, built in the 12th and 13th centuries, was destroyed during the French Revolution, but part of it is still used as a chapel, and the façade and towers remain. The modern church of St.-Pierre is a Romanesque structure with two fine spires and a three-naved basilica. The seat of the prefecture dates from the 17th century, and the city hall from the 18th century. There is in the city a statue of Alphonse de Lamartine, the poet, who was born here in 1790.

Mâcon was the Roman Matisco Aeduorum. It became part of the royal domains in 1238, but from 1435 to 1477 belonged to the Duchy of Burgundy. In the 16th century it was a stronghold of the Huguenots. It suffered severely in various invasions. It is the seat of a prefecture and has courts of the first instance and of commerce. The city has important commercial and manufacturing interests. It enjoys a large trade in Burgundy wines and manufactures supplies for the wine trade. Other products are bicycle parts, hardware, rennet, shirts, and grape juice. Pop. (1946) 18,221.

MACON, mā'kŭn, city, Georgia, seat of Bibb County, situated at an altitude of 335 feet, at the head of navigation of the Ocmulgee River, 92 miles by highway southeast of Atlanta. It is served by the Georgia, the Central of Georgia, the Georgia Southern & Florida, the Southern, and the Macon, Dublin & Savannah railroads, and by federal and state highways. The municipal airport, Cochran Field, 9 miles southeast of the city, is served by the Eastern, Delta, and Southern airlines.

Industry and Trade.—The country surrounding Macon produces peaches, vegetables, corn, watermelons, livestock, and cotton, and there are pine forests and deposits of kaolin. (In colonial times, Georgia kaolin was shipped to England for use in the Wedgwood potteries.) On these resources, and on the power derived from the Ocmulgee's drop of 90 feet in the 7 miles above the city, Macon's industries are based. There are a dozen cotton mills, whose varied products include yarn, twine, duck, tire fabric, hosiery, and underwear, as well as several large cottonseed oil plants. In addition, there are flour mills, canneries, meat-packing plants, and factories producing paper, containers, acoustical and insulation materials, brick, tile, concrete, chemicals, fertilizers, and farm implements. Lumber, sash and doors, venetian blinds, crates and baskets, furniture, creosoted timber, and prefabricated houses are also produced locally. Sawmill equipment is a feature of the city's machine shops, and most of the railroads that enter Macon have shops here. A large circus and some racing stables make the city their winter quarters. Macon is a shipping point and has a large wholesale trade.

Government.—Macon is governed by a mayor and a council of 15 aldermen. In 1911 the state legislature authorized it to own and operate its waterworks and to introduce a civil service system for its police and fire departments.

Buildings, Cultural Facilities, and Other Points of Interest.—The City Hall, built in 1836 in the prevailing Greek Revival style of the city's older structures and remodeled in 1935, served as the state capitol for four months in the winter of 1864–1865. The 4,000-seat Municipal Auditorium, which has a copper-covered dome 156½ feet in diameter, was built in 1925. There are historical murals in the Washington Memorial Library building (1919; library, 1874) and in the Citizens and Southern National Bank (1933).

The city has a stadium and several parks: Baconsfield, along the left bank of the river; Central City, in the southeast, with the grounds of Luther Williams Baseball Park and the quarters of the Georgia State Exposition (held annually in October); and Tattnall Square (18 acres), in the southwest corner. South of this square is the campus of Mercer University (q.v.), a Southern Baptist institution which moved here from Penfield in 1871. On the same street (College Street) is Wesleyan Conservatory, the music and fine arts department of Wesleyan College (q.v.), chartered in 1836. The college opened in Macon in 1839, but in 1928 all departments but the conservatory were moved to Rivoli, 7 miles to the northwest, where a dozen Georgian colonial buildings were erected on a 170-acre campus. Georgia Baptist College for Negroes, a coeducational institution founded in 1889, is 5 miles northeast of the city on a 205-acre campus; 30 acres formerly belonging to the college are now a city recreation park. Georgia Academy for the Blind, two miles west of the city, was begun by private gifts in 1851 and taken over by the state in the following year; the present building was erected in 1906.

Macon was the birthplace of Sidney Lanier (q.v.), poet and musician, and Georgia's best-known man of letters. The Lanier home is marked by a marble tablet. Several residences in the city are good examples of the Greek Revival style: the Baber House, built before 1840 and used since 1920 as a clinic; the Cowles-Walker House (1830), now owned by the Scottish Rite Masons; the Cowles-Bond-O'Neal House (1836); the H-plan Coleman-Speer-Birdsey House (1840), similar to Stratford Hall, Virginia; and the particularly fine Ralph Small House (1846).

Macon's streets are planted with crape myrtles, palmettos, and roses. Annually in the spring the Bibb County Camellia Show and the Bibb Flower Show are held in the city. At Porterfield, 8 miles to the south, are fine test gardens of roses.

The Macon area contains numerous prehistoric remains representing several stages of Indian culture. Just outside the city on the southeast is the Ocmulgee National Monument. In the farther part of the monument is the Lamar Mounds and Village Site, consisting of a conical and pyramidal mound, both apparently temple sites, and of traces of houses 20 to 25 feet square which had thatched cane roofs covered with clay and puddled clay floors. The pottery found here is glossy, with paddle-marked designs. Nearer the city is the Macon Plateau, which has four

mounds, a council chamber 42 feet in diameter with 50 clay seats around the wall, and a well-preserved prehistoric cornfield. One of the plateau mounds was decorated on its sides and top with bright-colored clay bands.

There are other interesting Indian remains in Brown's Mount, which has a smaller council room with built-in seats, and Shell Rock Cave, where red flint and jasper implements and many marine fossils have been found.

History.—By 1805 the Indians had ceded to the state all the land between the Oconee and Ocmulgee rivers. A military post, Fort Hawkins, was built on the east side of the Ocmulgee in 1806. (The spot is marked by a blockhouse erected in 1938.) Here troops gathered for Andrew Jackson's southern campaign in the War of 1812, and here came the first settlers from North Carolina in 1818. They named their village Newtown. In 1821 the Indians ceded to the state the lands west of the Ocmulgee, and two years later a settlement was established across the river and named in honor of Nathaniel Macon (q.v.), the North Carolina patriot. The Macon *Telegraph* was founded in 1826. Three years later, Newtown became a part of Macon, and in 1832 the city was incorporated.

Macon became an important point for shipping cotton downstream to Darien by oared flatboats. In the 1840's a railroad was completed connecting Macon with Savannah, and another north to Atlanta, and soon railway bridges blocked river traffic above the city. In the 1850's, Macon grew rapidly and made bids for direct trade with Europe. In 1860 it held the Belgian Fair and Cotton Planters' Exposition. In the Civil War the city was a Confederate gold depository, a center for commissary supplies, and one of Georgia's four munition-making cities. In 1864 it was threatened, but not taken, by Union forces; it was finally occupied only after the armistice in April 1865. In that year the *Wesleyan Christian Advocate* was moved to Macon from Charleston, S. C. The first large-scale textile mills were built in the 1870's. The Macon *News* was established in 1884 (with a Sunday edition founded in 1930 it is now under the same management as the *Telegraph*). The city limits were extended in 1900. In 1906 the river levee was improved, and flood danger minimized. By 1910 the city had a population of 40,665. In the Spanish-American War one of Georgia's six training camps was at Macon, and in World War I Camps Harris and Wheeler were established here. By 1940 the population numbered 57,865. In World War II, Camp Macon, second largest in the state, was established. Warner Robins Air Technical Service Command (now Robins Air Force Base) was set up near the city. Pop. (1950) 70,252.

Consult *The Macon Guide and Ocmulgee National Monument* (Macon 1939).

MACON, mā'sˈn (originally MAÇON), bayou, Louisiana. It rises in southeastern Arkansas and flows south through Louisiana to its junction with the Tensas River in Franklin Parish. Its course of approximately 150 miles is partly navigable.

MACON, mā'kŭn, city, Mississippi, seat of Noxubee County, situated at an altitude of 180 feet, on the Noxubee River and the Gulf, Mobile and Ohio Railroad, 28 miles south-southwest of Columbus. In an agricultural area, the city has plants producing milk, cheese, cottonseed oil, and lumber. It has a public library, two high schools, and a hospital. Macon was incorporated in 1836 on land ceded by the Choctaw Indians in 1833. The city is governed by a mayor and a board of aldermen. Pop. (1950) 2,241.

MACON, city, Missouri, seat of Macon County, located at an altitude of 865 feet, on the Chicago, Burlington & Quincy and the Wabash railroads, 23 miles north of Moberly. It is the shipping center for the surrounding agricultural and coal-producing region. Pleasantly situated in a grove of maple trees, the city is the seat of an osteopathic sanatorium specializing in the treatment of nerve diseases, and has a public library and a municipal park. The town of Macon, which was named for Nathaniel Macon (q.v.), was founded in 1856. Three years later it merged with the adjoining town of Hudson to form Macon City, later called Macon. The city became the county seat in 1863. Pop. (1950) 4,152.

MACORIS, the short form of SAN PEDRO DE MACORÍS (q.v.).

MACOUN, John, Canadian botanist: b. Maralin, County Down, Ireland, April 17, 1832; d. Ottawa, July 18, 1920. He went to Canada in 1850 and became a farmer. From 1868 to 1879 he was professor of botany and geology at Albert College, Belleville, Ontario. He was appointed explorer for the Canadian government in the Northwest Territories in 1879, and botanist to the Geological Survey of Canada in 1882. Three years later he became assistant director and naturalist of the survey, a position he held until his death. Macoun was a charter member of the Royal Society of Canada. His published works include *Manitoba and the Great North West* (1882); *The Forests of Canada and Their Distribution* (1895); catalogues of Canadian plants and birds; and an *Autobiography,* published posthumously in 1922.

MacPHAIL, Agnes Campbell, Canadian politician: b. Proton Township, Grey County, Ontario, March 24, 1890. She was educated at the Collegiate Institute, Owen Sound, Ontario, and the Collegiate Institute and Normal School, Stratford, Ontario, and became a teacher. In 1921 she was elected as a member of the United Farmers of Ontario Party to the Canadian House of Commons, the first woman to achieve this distinction in Canada. Re-elected in 1925, 1926, 1930, and 1935, she later became a member of the Co-operative Commonwealth Federation of Canada. In 1948 she was elected to the legislature of Ontario.

MacPHAIL, SIR Andrew, Canadian physician and writer: b. Orwell, Prince Edward Island, Nov. 24, 1864; d. Montreal, Sept. 23, 1938. He was educated at Prince of Wales College, Charlottetown, and at McGill University, where he received his B.A. degree in 1888 and his M.D. and C.M. degrees in 1891. He was principal of Fanning Grammar School in 1882–1885, and engaged in journalism from 1889 to 1893. From 1895 to 1906 he was pathologist to the Western Hospital and Verdun Hospital for the Insane. From then until his retirement in 1937 he was professor of the history of medicine at McGill

University. He became a fellow of the Royal Society of Canada in 1910 and was knighted in 1918. During World War I he served as a medical officer. His published works include *Essays in Puritanism* (1905); *The Vine of Sibmah* (1906); *Essays in Politics* (1909); *Essays in Fallacy* (1910); *Official History of the Canadian Forces in the Great War; the Medical Services* (1925); *Three Persons* (1929); *The Bible in Scotland* (1931); and *The Master's Wife*. He also translated Louis Hémon's *Maria Chapdelaine* (1921).

MACPHEE, John Joseph, American neurologist: b. Prince Edward Island, Canada, July 8, 1860; d. New York, N. Y., Feb. 18, 1941. He was educated at Prince of Wales College, Charlottetown, and at the University of Vermont, receiving his M.D. degree in 1890. From 1891 to 1894 he was pathologist at the Post-Graduate Medical School in New York City, and then became professor of nervous and mental diseases at the New York Polyclinic Medical School and Hospital. He also served as consulting neurologist at St. John's Hospital, Brooklyn; Beth Israel Hospital, New York; and St. Francis Hospital, New York. He contributed numerous articles to medical periodicals.

MACPHERSON, Sir David Lewis, Canadian statesman: b. Castle Leathers, near Inverness, Scotland, Sept. 12, 1818; d. at sea, Aug. 16, 1896. He was educated at the Royal Academy in his native city, and moved to Canada in 1835. In 1842 he became a partner in a forwarding firm in Montreal, and in 1851 secured with others a charter for a railway from Montreal to Kingston, the beginning of the Grand Trunk Railway. In 1872 he became president of the Interoceanic Railway Company, the rival of the Canadian Pacific in competition for the transcontinental railway charter. He sat in the Legislative Council of Canada from 1864 to 1867, when he entered the Dominion Senate, becoming its speaker in 1880. From 1883 to 1885 he served as minister of the interior. He was knighted in 1884. He was the author of several pamphlets on finance.

McPHERSON, Edward, American journalist: b. Gettysburg, Pa., July 31, 1830; d. there, Dec. 14, 1895. After his graduation from Pennsylvania (now Gettysburg) College in 1848, he studied law but soon entered journalism, becoming editor of the Harrisburg *American* in 1851. For the next 44 years he was connected with various Pennsylvania newspapers, including the Philadelphia *Press* (1877–1880) and the Gettysburg *Star and Sentinel* (1880–1895). He served as a member of Congress for two terms and as clerk of the House for 16 years. He was also active in the Republican Party and was the author of several valuable political source books including *The Political History of the United States of America During the Great Rebellion* (1864); and *The Political History of the United States of America During the Period of Reconstruction* (1871). He published the *Political Manual* annually from 1866 to 1869, and the *Handbook of Politics* biennially from 1868 to 1894.

MACPHERSON, James, Scottish author and translator: b. Ruthven, Inverness, Oct. 27, 1736; d. Belville in Badenoch, Inverness, Feb. 17, 1796. He studied at King's College and Marischal College in Aberdeen, and at Edinburgh University. After he published *Fragments of Ancient Poetry, collected in the Highlands of Scotland, and translated from the Gaelic or Erse Language* (1760), a subscription was raised to enable him to collect additional specimens of national poetry. As the fruit of his research, he produced *Fingal, an Ancient Epic in Six Books* (1762), followed by *Temora* (1763), and a collected edition entitled *The Works of Ossian* (1765), all alleged translations from Gaelic originals ascribed to the 3d century bard Ossian (q.v.).

The question of the authenticity of the works provoked a violent controversy, Dr. Samuel Johnson being one of Macpherson's greatest opponents. It may be concluded that Macpherson's prose epics were founded on traditional narratives current in the Highlands; but the date of the oldest of the lays is comparatively modern, and it is now impossible to ascertain the precise extent of his obligations to Gaelic bards. Macpherson never made any serious attempt to vindicate himself against the charge of forgery. He had a life allowance from the government, was agent to Mohammed Ali, nabob of Arcot, and held a seat in the House of Commons from 1780 until his death. He was the author of several historical works and of an inadequate translation of Homer's *Iliad*. He was buried in Westminster Abbey.

McPHERSON, James Birdseye, United States army officer: b. Clyde, Ohio, Nov. 14, 1828; d. Atlanta, Ga., July 22, 1864. He was graduated from the United States Military Academy in 1853. Appointed brevet 2d lieutenant of engineers, he became assistant instructor of practical engineering at West Point (1853–1854). After working on the construction of defenses for New York Harbor and the improvement of the Hudson River, he was given charge of the construction of Fort Delaware and of the defenses of Alcatraz Island in San Francisco Bay.

At the opening of the Civil War, he applied for active employment in the field. In May 1862, he was appointed brigadier general of volunteers and was with Gen. Henry W. Halleck at the siege of Corinth. For his services on this occasion he was made major general of volunteers in the following October. He took an important part in the siege and capture of Vicksburg and in consequence was promoted to the rank of brigadier general in the regular army, Aug. 1, 1863. In March 1864, he was made commander of the Army of the Tennessee and performed distinguished services in the campaign of Georgia. The following July he commanded in the engagement around Atlanta and was killed during a reconnaissance.

McPHERSON, city, Kansas, seat of McPherson County; altitude 1,495 feet; 27 miles northeast of Hutchinson; served by the Chicago, Rock Island and Pacific; the Union Pacific; the Missouri Pacific; and the Atchison, Topeka and Santa Fe railroads. The surrounding area raises wheat and corn. The city is the central Kansas trade center for rich oil and gas fields, discovered in the region in 1929. Important industries include oil refinery plants, oilfield supply houses, flour and feed mills, and cement mills. Mc-

Pherson College (q.v.) and Central College are located in the city. Government is by commission. The city was incorporated in 1874. Pop. (1940) 7,194; (1950) 8,689.

McPHERSON COLLEGE, an accredited, coeducational institution, located in McPherson, Kans. It was chartered in 1887 and opened in 1888. The college is the property of the Church of the Brethren, sometimes known as the Dunkers. It offers courses leading to the bachelor of arts and bachelor of science degrees. The campus covers about 13 acres.

McQUAID, mȧ-kwād′, **Bernard John,** American Roman Catholic prelate: b. New York City, Dec. 15, 1823; d. Rochester, N. Y., Jan. 18, 1909. After studying in Canada, he completed his course at St. John's College, Fordham, N. Y., where he was graduated in 1843, and for the next three years held the position of tutor. He studied theology first with the Lazarists of New York City and later at St. John's College, Fordham, being ordained priest January 1848. Having built churches at Morristown and Springfield, N. J., he was engaged upon one at Mendham when summoned to the newly created diocese of Newark, N. J., 1853. In 1856, Father McQuaid founded Seton Hall College at Madison, N. J. (now Seton Hall University, located in South Orange, N. J.), and was its first president, retaining the office for 10 years. He was consecrated first bishop of the diocese of Rochester, N. Y., by Archbishop John McCloskey in New York City, July 12, 1868. With characteristic energy he discharged his episcopal duties, the cause of Catholic education ever appealing to him as one of paramount importance. With a view to advancing it, he invited the Sisters of St. Joseph to conduct new parochial schools in his diocese and likewise founded St. Andrew's Preparatory Seminary.

MACQUARIE ISLANDS, mȧ-kwŏr′ĭ, a group of small islands in the South Pacific Ocean, about 850 miles southeast of Tasmania, Australia, by which it is administered. The largest island, also called Macquarie, has an area of about 89 square miles. The crest of a submarine mountain, it rises to a height of about 1,400 feet. It is rocky and has some small glacial lakes. Formerly it was good seal-hunting ground, but the seals have been practically exterminated. Penguins and other sea fowl abound, and there are large herds of sea elephants.

The islands were discovered in 1810 and until the destruction of the seals were visited by the sealers. Its only inhabitants at the time it was made a base of the Mawson Australasian Antarctic Expedition (1911–1914) were a few men stationed there for the purpose of rendering sea elephant and penguin blubber. There is now a permanent weather and relief station on the island and there are also radio stations.

Consult Mawson, Sir Douglas, *The Home of the Blizzard,* 2 vols. (1914).

MacQUEARY, mȧ-kwē′rĭ, **Thomas Howard,** American educator: b. Charlottesville, Va., May 27, 1861; d. St. Louis, Mo., July 1930. He was graduated from the Episcopal Theological Seminary at Alexandria, Va., in 1886, took orders in the Protestant Episcopal Church, and in 1887 became rector at Canton, Ohio. His religious views having undergone a radical change, he was tried by an ecclesiastical council for denial of miracles and suspended from the ministry for six months. He accordingly resigned from it in September 1891, and was for some time in the Universalist ministry. He returned to college for special work and in 1898 took his M.A. degree at the University of Minnesota, later (1901) finishing the work for the Ph.D. degree in history and economics at the University of Chicago, although he did not publish his thesis and take the degree. He founded Unity House Social Settlement in Minneapolis; from 1900–1906 was superintendent of the Parental School in Chicago; and from 1906 was head of the department of history and head assistant in Soldan High School, St. Louis, Mo. He also lectured frequently for Chautauquas and other societies. He was the author of *The Evolution of Man and Christianity* (1889), and *Topics of the Times* (1891).

McQUILLEN, John Hugh, American dentist: b. Philadelphia, Pa., Feb. 12, 1826; d. there, March 3, 1879. He began the study of medicine and dentistry in 1847, engaged in the practice of dentistry in 1849, took his M.D. at Jefferson Medical College in 1852, and his D.D.S. at the Philadelphia College of Dental Surgery in 1853. He became professor of operative dentistry and dental pathology at the Pennsylvania College of Dental Surgery in 1857. In 1863 he was instrumental in securing a charter for the Philadelphia Dental College and he was from that time until his death its dean and professor of anatomy, physiology, and hygiene. He was president of the American Dental Association, the Pennsylvania Association of Dental Surgeons, and the Odontographic Society of Philadelphia. From 1865 to 1872 he was editor in chief of the publication *Dental Cosmos.*

MACRAUCHENIA, măk-rô-kē′nĭ-ȧ, a genius of three-toed, long-necked fossil ungulates, from the Pleistocene of South America. They form a connecting link between the palaeotherium and the camel family. In form they resemble the llama, but are as large as a hippopotamus. Their remains have been gathered from the pampas of Argentina and Bolivia.

MACREADY, măk-rē′dĭ, **William Charles,** English tragedian: b. London, March 3, 1793; d. Cheltenham, April 27, 1873. His father was the manager of several small theaters. William Charles received his education at Rugby, and originally had the intention of adopting one of the learned professions; but his father's failure in management changed his plans for a career, whereupon he joined his father's troupe then acting in Birmingham. He appeared there for the first time in 1810 in the character of Romeo, in which he was successful. On Sept. 16, 1816, he made his first appearance on the London stage at Covent Garden Theatre, acting the role of Orestes in *The Distressed Mother.* He did not achieve an immediate triumph in London, but gradually rose in popular favor. In 1819 his portrayal of Richard III established him as a leading tragedian, and the following year his Virginius gained him tremendous praise. In 1826 he made his first tour in the United States, making his debut in New York City on October 2 of that year as Virginius. From 1837 to 1839 he was manager of Covent Garden.

In 1841 he became a theatre manager of Drury Lane, but met with no success, so that he resigned at the end of the second season. His managership at Drury Lane had brought upon him considerable financial loss, to repair which he made his third visit to America (1848–49). There he was involved in an unfortunate quarrel with the American actor, Forrest, which in May 1849 culminated in a riot at the Astor Place Opera House, New York, at which Macready was appearing as Macbeth, and in consequence was obliged to leave the country. On his return to London he gave some farewell performances, and then retired from the stage in 1851.

McREYNOLDS, măk-rĕn'oldz, **James Clark,** American lawyer, cabinet officer and jurist: b. Elktown, Ky., 3 Feb. 1862. He was graduated at Vanderbilt University in 1882 and from the law department of the University of Virginia in 1884. He engaged in law practice at Nashville, Tenn., attaining a distinguished reputation; and in 1900–03, without relinquishing his practice, he was professor at the Law School of Vanderbilt University. While of Democratic party affiliations he was appointed Assistant Attorney-General under the Roosevelt administration in 1903–07, after which he engaged in law practice in New York. He was on several occasions retained as counsel by the United States in service connected with the application of the anti-trust laws, his part in dealing with the tobacco trust and with the anthracite coal dealers and the railroads being especially prominent. In 1913 he was appointed United States Attorney-General by President Wilson, succeeding Attorney-General Wickersham. While in office the cases of the Union and Southern Pacific Railroad merger, the International Harvester Company, the American Telephone and Telegraph Company, the Reading Company and the New York, New Haven and Hartford, under the Sherman Anti-Trust Law, came under his direction. He was appointed associate justice of the Supreme Court of the United States in August 1914 and took his seat in October.

MACROBIUS, mą-krō'bĭ-ŭs, **Ambrosius Aurelius Theodosius,** Latin author of the 5th century A.D. The country of his birth is uncertain, but it is inferred from the fact that he speaks of Latin as a foreign tongue to him that he was probably a Greek. He was the author of a miscellaneous work entitled 'Saturnalia,' curious for its criticisms, and valuable for the light it throws upon the manners and customs of antiquity; a commentary on Cicero's 'Somnium Scipionis,' in two books, valuable for the exposition it affords of the doctrines of Pythagoras with respect to the harmony of the spheres; and a treatise, 'De Differentiis et Societatibus Græci Latinique Verbi.' Consult Von Jan, 'Macrobius'; and Eyssenhardt, 'Macrobi Opera'; also Wissowa, G., 'De Macrobii Saturnaliorum Fontibus' (Breslau 1880).

MACROCOSM. See MICROCOSM.

MACROCYSTIS, măk'rō-sĭs'tĭs, a genus of brown seaweed of the family *Laminariaceæ,* generally known as giant kelp. It is common throughout the southern temperate zone and along the Pacific Coast of the United States. It has a much-branched root from which rises many filiform simple or branched stems without leaves below, but bearing numerous lance-like leaves above. The stems reach the greatest length known in the vegetable kingdom. Observations by Hooker near the Crozet Islands report specimens fully 700 feet long; and other authorities state that a length of 900 feet is sometimes attained.

MACROTHERIUM, a genus of extinct ungulate mammals, in some cases of gigantic size, found most completely in the Miocene deposits of Europe, but also known from China and western North America. It represents the primitive group *Ancylopoda,* which had a wide geographical range in the Miocene and Pliocene epochs when it became extinct. The structure of the curiously twisted feet so much resembles that of the ground-sloth that for a long time the macrotheres, as well as their companion, but more generalized, genus *Homalodontotherium,* were regarded as edentates. Consult Woodward, 'Vertebrate Palæontology' (1898).

MACRURA. See DECAPODA.

McTYEIRE, măk-tăr', **Holland Nimmons,** American Methodist Episcopal bishop: b. Barnwell County, S. C., 28 July 1824; d. Nashville, Tenn., 15 Feb. 1889. He was graduated at the Randolph-Macon College, Virginia, in 1844, and in 1845 entered the ministry, joining the Virginia Conference. In 1846 he was assigned to Saint Francis Street Church, Mobile, Ala., and after serving in the churches at Demopolis, Ala., and Columbus, Miss., he was transferred to the Louisiana Conference. He was editor of the New Orleans *Christian Advocate* in 1851–58, and from 1858 until its publication was interrupted by the Civil War he edited the Nashville *Christian Advocate.* During the war he served as pastor of the church at Montgomery, Ala. He was elected bishop in 1866, and in 1873 he became president of the board of the newly-founded Vanderbilt University. He was senior bishop for some time before his death. Author of 'Duties of Christian Masters' (1851); 'Catechism on Church Government' (1869); 'Manual of Discipline' (1870); 'History of Methodism' (1884); 'Passing Through the Gates' (1889), etc.

MACŪ, mă'koo, a nomadic Indian tribe of the Amazon region. They range through northwestern Brazil, more particularly along the Rio Negro. They are of the lowest type of savages of South America, provide neither shelter nor clothing and plant no crops. They live by hunting and fishing, are hostile and apparently have no connection with other tribes. A report of their condition was made by Theodor Koch-Grunberg in 'Anthropos' (Vol. I, pp. 877–906, 1906).

MacVEAGH, măk'vā, **Franklin,** American cabinet officer, brother of Wayne MacVeagh (q.v.): b. near Phœnixville, Pa., 1837; d. 6 July 1934. He was graduated at Yale in 1862 and took his LL.B. at Columbia University in 1864. He was admitted to the bar in 1864; and in 1864–66 was engaged in practice in New York. His health failing he went to Chicago in 1866 and there engaged in the wholesale grocery business. After the great fire in 1871 he established the firm of Franklin MacVeagh and Company, wholesale grocers, and he also became connected with various banking and

manufacturing interests. He became president of the Citizens' Association of Chicago in 1874 and was largely responsible for many important reforms. He was Democratic candidate for United States senator against Senator Cullom in 1894 but was defeated. From 1896 he was associated with the Republican party, and in 1909 he was appointed Secretary of the Treasury by President Taft, serving throughout the Taft administration. He was vice-president of the American Civic Association in 1905; served as president of the Chicago bureau of charities and of the Municipal Art League; and was a founder and member of the executive committee of the National Civic Federation.

MacVEAGH, Wayne, American lawyer and diplomat: b. Phœnixville, Pa., 19 April 1833; d. 11 Jan. 1917. He was graduated from Yale in 1853 and was admitted to the bar in 1856. He was district attorney of Chester County 1859–64, became prominent as a Republican leader, and conspicuous in his profession, and in 1870–71 was Minister to Turkey. He was an active opponent of «machine politics» and in 1872 led the Republican opposition to Simon Cameron, his father-in-law. He was chairman of the «MacVeagh Commission» sent by President Hayes to Louisiana in 1877 to act as the President's unofficial representative and aid in adjusting political differences there. He was Attorney-General of the United States, March to September 1881, and was Ambassador to Italy 1893–97. In 1903 he was chief counsel of the United States in the Venezuela arbitration before The Hague Tribunal.

McVICKAR, William Neilson, American Protestant Episcopal bishop: b. New York, 19 Oct. 1843; d. 28 June 1910. He was graduated at Columbia College (1865); and at the General Theological Seminary (1868). He was ordained deacon (1867) and priest (1868). Being elected coadjutor bishop of Rhode Island, 19 Oct. 1897, he was consecrated 27 Jan. 1898, and on the death of Bishop Clark, September 1903, succeeded to the see.

MACWHIRTER, măk-wĕr'tĕr, **John,** Scottish landscape painter: b. Slateford, near Edinburgh, 27 March 1839; d. London, 28 Jan. 1911. He entered the Trustees' Academy, conducted by Robert Scott Lauder at Edinburgh, when 13 years of age, and at 15 made his first exhibition, 'Old Cottage at Braid,' at the Royal Scottish Academy. At 16 he began his annual tours of Europe in search of material for his canvases, his travels eventually covering all parts of Europe and the United States as well. In 1867 he exhibited six pictures at Edinburgh and was elected to the Royal Scottish Academy. He made his first exhibition at the Royal Academy, London, in 1865, and in 1869 he settled permanently in London. He painted some effective landscapes in California in 1877; was elected associate of the Royal Academy in 1879 and Academician in 1893. His landscapes are naturalistic and their popularity doubtless was enhanced by the tinge of literary significance he succeeded in giving them, together with a certain felicity in the selection of their titles. Among his work are 'The Lady of the Woods' (1876); 'The Three Graces' (1878); 'The Lord of the Glen' (1880); 'The Three Witches' (1886); 'Crabbed Age and Youth' (1899); 'The Fallen Giant' (1901). His work is represented in the Royal Academy diploma gallery; the Walker Art Gallery, Liverpool; and in the municipal galleries at Manchester, Dundee, Aberdeen and Hull. Author of 'Landscape Painting in Water Colors' (1901). Consult Spielmann, H. M., 'The Art of John MacWhirter'; Sinclair, W. M., 'John MacWhirter, R.A.' (*Art Journal Annual,* Christmas, 1903).

MACY, Jesse, American historian: b. Henry County, Ind., 21 June 1842; d. 2 Nov. 1919. He was graduated from Iowa College in 1870. From 1871 to 1885 he was principal of the academy of Iowa College; in 1883–85 was acting professor of history and political science; in 1885–1912 professor of political science, and professor emeritus since 1912. In 1913 he was Harvard Foundation lecturer in French provincial universities. He received the degree of LL.D. from Brown University in 1898, from Grinnell in 1911 and from Oberlin in 1915. He has written 'Civil Government in Iowa' (1881); 'Institutional Beginnings in a Western State' (1883); 'Our Government' (1886); 'A Government Textbook for Iowa Schools' (1887); 'The English Constitution' (1897); 'Political Parties in the United States, 1846–61' (1900); 'Party Organization and Machinery' (1904); 'Comparative Free Government,' with J. W. Gannaway (1915).

MAD ANTHONY, a nickname given to the Revolutionary general, Anthony Wayne (q.v.), on account of the seeming recklessness of his brilliant military feats.

MAD APPLE, the fruit of an American nightshade, especially that called Sodom apple (*Solanum sodomiæ*), the eating of which produces poisonous intoxication.

MAD MULLAH, term applied to Mohammed Ali, the Mahdi, or Moslem Messiah: b. Somaliland, 1843; d. Omdurman, 22 June 1885. In his youth Mohammed was initiated into the mysteries of the occult sciences and sorcery. A study of the Koran and the Arab writings followed in the Marabout school. When quite young the future Mullah was taken with the idea of making the pilgrimage to Mecca, and not content with one journey made the sacred visit three or four times. After his last pilgrimage Mohammed returned to Berbera, but met with small success. Establishing himself in a powerful inland tribe, his ascetic practices and bold demeanor gained for him a reputation for sanctity and spiritual gifts. In 1880 he proclaimed himself Mahdi («the guide,» i.e., in the way of salvation), and in 1881 he proclaimed a Jehad or holy war against the infidel and speedily aroused all the latent fanaticism of the fierce Sudanese tribesmen. From 1881–83 he destroyed nearly every force sent against him; and so threatening did his power become that the evacuation of the Sudan was ordered by the Egyptian government, Wolseley's expedition for the relief of Khartum was too late to effect its purpose, the city was stormed in January 1885 and General Gordon murdered. His death is said to have occurred through poison administered at the hands of a woman he had outraged. His successor, Abd-Allah, carried on the struggle, until the power of Mahdism was finally broken at the battle of

Omdurman in 1898. Consult Darmesteter, *The Mahdi* (London 1885); Hoffmann, *Mahdithum* (Kiel 1899); Müller, E., *Beiträge zur Mahdilehre des Islams* (Heidelberg 1901); Wingate, *Mahdism and the Sudan* (London 1901).

MAD TOM, local name in eastern United States for any of several types of small catfish native to fresh waters. They are long and slender, with mottled skin entirely naked, and have sharp pectoral spines with which a wound about as painful as a bee-sting may be inflicted. There are several varieties, ranging from a few inches to nearly a foot in length. They are known also as stone-cat, owing to their resemblance to the rocky or pebbly bottoms they frequent.

MADACH, mŏ'däch, **Emerich,** or **Imre,** Hungarian poet: b. Also-Sztregova, Jan. 21, 1823; d. there, Oct. 5, 1864. He studied Law, was a notary in his native country and was also active as an orator and journalist. He wrote on archaeology and aesthetics; and both lyric and dramatic verse. His principal works are the two dramatic poems *Moses* (1860); and *The Tragedy of Man* (1860). The latter owes much to *Paradise Lost,* and to *Faust,* but is yet a remarkable performance. Though strongly contemplative in character, it was successfully presented. There is an excellent rendering in German by von der Lech (1888).

MADAGASCAR, măd-à-găs'kẽr, an island in the Indian Ocean, since 1896 a French colony. It is separated by the Mozambique Channel from the southeast coast of Africa, the nearest point being 240 miles distant. It is 980 miles long from Cape Sainte-Marie in the south to Cape Amber (Ambre) in the north, and has an average breadth of 250 miles; greatest breadth 360 miles; total area 228,500 square miles; population (1946 census) 4,058,281. Exclusive of Australia and Greenland, generally classed as continents, it is the third largest island in the world, only New Guinea and Borneo being larger. For administrative purposes, the Comoro Archipelago (q.v.) with several other islands lying adjacent to Madagascar, such as Nossi-Bé and Sainte-Marie, the islands of St. Paul and Amsterdam in the South Indian Ocean, and certain Antarctic islands, are considered dependencies of Madagascar.

The principal towns of Madagascar are the capital, Tananarive, or Antananarivo (pop. 170,000), in the interior; Tamatave (21,000), the largest port on the east coast; Majunga, Fianarantsoa, Diégo Suarez, and Antsirabe.

The Land.—Madagascar consists of an elevated region with an average height of from 3,000 to 5,000 feet overlooked by mountains rising in some cases to over 9,000 feet above sea level. This plateau occupies a much larger proportion of the surface in the north and east than in the west and south; the greater portion of the island south of latitude 23° belongs to a much lower region which does not consist entirely of plains, but is interrupted toward the west by three prominent chains of hills stretching from north to south, one of them apparently in a continuous line about 600 miles in length. The coast has a number of indentations, mostly small, but a few good harbors, being in great part rock, though in some places low and sandy.

The rivers are numerous, but few of them offer the advantages of internal navigation. The chief waterways are on the west and northwest side of the island. The Betsiboka with its affluent, the Ikopa, together measuring 300 miles, may be ascended by light steamers for 100 miles; the Tsiribihina has a somewhat shorter course, but drains by its numerous tributaries a much larger area. The eastern rivers descend from the high land through magnificent gorges, forming a succession of rapids and cascades, the falls in some instances having a descent of 500 feet. There are few lakes of any size as yet known to explorers; one of the largest is Lake Alaotra, measuring 25 miles in length; the others do not reach a length of 10 miles. A chain of lagoons linked by the Pangalane Canal, forms a waterway a short distance inland from the eastern seaboard, extending from Foulpointe to Farafangana (390 miles).

Geologically the elevated region consists almost entirely of granite and other igneous rocks, while the lower region is composed chiefly of secondary formations. The former region is traversed by a line of extinct volcanic craters, some of which show signs of comparatively recent activity. Among the more remarkable fossils are remains of a huge struthious bird, the Aepyornis, whose egg, measuring 12 by 9 inches, is larger than that of any other known bird. Minerals include copper, nickel, lead, iron, gold, large deposits of high carbon content graphite, mica, and numerous precious and semiprecious stones. Coal is found in the west both in the northern and southern parts of the island.

Climate.—The climate is varied; the heat on the coast is often very intense, but on the highlands of the interior the temperature is moderate. The coastal climate is tropical. In the interior the winter is dry and agreeable. The greatest amount of rainfall occurs on the east coast, and especially on the northeast, the part directly exposed to the summer monsoon. The elevated region of the interior and the districts on the west coast are more suitable for Europeans, but owing to the large extent of marsh and lagoon on the east, malarial fever prevails, and is frequently fatal to natives from the interior as well as to Europeans. On certain days in August or September, there may be freezing temperatures in high plateaus but snow is unknown.

The People.—The inhabitants, known by the name of Malagasy, belong to the Malayo-Polynesian stock and speak a Malayan languge. They appear to form substantially a single race, though they have received a considerable intermixture of African blood and a certain amount of Arab intermixture. They are divided into numerous tribes, each having a distinctive name and custom. The Antaimerina (commonly called Hovas) are the predominant tribe; their proper country is the elevated region of the interior, but they extended their sway over nearly the whole island. They were socially divided into three classes: Andriana or nobles; Hovas (in a special and restricted use of the word) or free commoners; and Mainty or slaves. The nobles and slave classes have been abolished by the French. Among the other chief tribes are the Betsimisaraka on the east coast, the Betsileo in the south central region, and the Sakalava on the west and north. In the coast districts the houses of the better class are built of framed

timber with lofty roofs covered with shingles or tiles; the dwellings of the lower classes are constructed of bamboo or rushes, even of clay. In former and more unsettled times the villages were almost always built on the tops of hills, but during the 19th century this precaution was not deemed so indispensable. The principal article of native dress with both sexes is the *lamba,* a piece of cloth about three yards long and two broad, which is folded around the body under the arms, one end being thrown over the shoulder.

Flora and Fauna.—The most striking feature in the vegetation was formerly a belt of dense forest on the east and west of Madagascar. But forest areas greatly decreased during the last century, the high plateaus in particular being almost denuded. There is some virgin forest in Maroansetra and conservation measures are enforced. The stands include many species of lofty palms, hardwooded exogens supplying a great variety of beautifully veined and durable timber, and a large number of trees remarkable for the splendid character of their blossoms. Of all the trees of Madagascar, the most striking is the *Ravenala* or traveler's tree (*R. madagascariensis*). It resembles a palm, its stem being crowned by a semicircle of oblong leaves spread out vertically in a fan shape. It owes its name to the fact that the traveler may supply himself with water by piercing or breaking the lower ends of the leaf stalks.

Madagascar has a singularly local fauna which, although upon the whole related to Africa, is so peculiar to itself that, with a few neighboring islets, it forms a very distinct subprovince of the African region. Its characteristics show plainly that the separation of the island from the continent occured at a very ancient time. Another singular feature is the presence of various forms of animal life represented elsewhere only in Oriental Australian regions; in a few animals, there is a marked resemblance to South American species (for example, the boas). From this fact it has been argued that in early Tertiary times there was a land connection between Madagascar and India and the region thence to Australia, now represented only by the islands of the Malayan Archipelago. (See LEMURIA.) In its mammals, Madagascar is singular in what it lacks, as well as in what it possesses. It has none of the cattle, equine animals, elephants, rhinoceroses, hogs, or even rodents of Africa, except a mouse or two; no lion or true cat or dog of any kind; and no monkeys. On the other hand, it has several small insectivora, closely allied to tropical American species; the great majority of all the lemurs, the few outsiders being in Africa and the Orient; and several viverrine quadrupeds, which take the place of the predatory cats. The modern birds are less striking in their peculiarities, but in the zoological era immediately preceding the present, the island possessed those huge ratite birds, the Aepyornis and its relatives, which gave rise to the story of the roc. Many forms of huge land tortoises were also members of this singular fauna. The fishes, amphibians, reptiles and lower forms are largely peculiar.

Crocodiles are numerous in the rivers and lakes, and many species of lizards, chameleons and tree frogs abound in the forests. Among the insects are numerous brilliantly colored beetles, butterflies, moths, flies, locusts, and spiders, venomous species of the latter as well as scorpions and centipedes being present. See also ZOOGEOGRAPHY.

Agriculture.—About 75 per cent of the 4,000,000 Malagasy inhabitants are farmers. Of the vegetable products grown for food, by far the most important is rice, the staple food of the country; next in importance come manioc or cassava, sweet potatoes, beans, tomatoes, groundnuts, and yams. Ginger, pepper, and indigo grow wild in the woods; cotton, sugarcane, coffee, tobacco, and hemp are cultivated. Humped cattle are found in immense herds, and form a large part of the wealth of the inhabitants; they appear to have been introduced from Africa at a remote period, as the fat-tailed sheep, goats, swine, and horses have been more recently. Under French administration agriculture and cattle raising have undergone considerable expansion. An important part has been played in the settlement of the island by colonists from France. Cattle breeding is especially important. About 1,500,000 hectares of land are under cultivation (1 hectare=2.471 acres).

Industry and Trade.—Graphite, raffia fiber, coffee, manioc, hides, sugar, cloves, vanilla, mica, and canned meats are exported. The chief imports are cotton goods, machinery, iron and steel, cement, fuel oil, and automobiles. Imports for 1946 were 1,352,000 tons valued at 2,121.6 million francs C.F.A. Exports: 132,900 tons valued at 2,777 millions. Mineral exports: 8,900 tons of graphite, also mica and quartz. Other exports included meat and manioc. Phosphate production ceased in 1939. Production of garnet and corundum for abrasives, and rock crystal used for optical supplies, has continued, but exports of precious and semiprecious stones were curtailed by World War II. In general, the Malagasy show much aptitude for the manual arts. As silversmiths, gunsmiths, carpenters, and shoemakers, they rapidly acquire the skill of Europeans. They also make hand-woven textiles, rabanna goods, fine lace, straw hats, and ceramics.

Transportation and Communication.—There are two main railroads on the island. One extends from Tamatave to Tananarive, 230 miles, with one branch line from Tananarive to Antsirabe, 98 miles, and another from Moramanga to Lake Alaotra, 105 miles. The second is the Fianarantsoa-East coast line, 100 miles in length, serving the Betsileo region. There are approximately 15,500 miles of roads on the island, and a network of local airlines, mail being carried by plane.

Government.—Madagascar is divided into five provinces and is administered by a high commissioner assisted by a government council. French decrees of October 1946 (modified in January and March 1947) instituted a Representative Assembly consisting of 36 members—15 comprising French citizens of the first electoral list, which includes some autochthonous voters; and 21, the second electoral list comprising Malagasy who do not have French citizenship status. Five provincial assemblies were established, elected on the basis of the double lists, with representatives of the second list in the majority. The provincial assemblies elect the members of the Representative Assembly. The elections of March 30, 1947, returned to the Assembly (for the second electoral list) 12 members of the Parti des Déshérites Malgaches (favoring close ties with the French), and 9 of the

Democratic Movement of the Malagasy Renovation (desiring a free and independent Madagascar within the French Union). A Court of Appeal and tribunals throughout the provinces provide for native justice, while there are special courts for the administration of French justice.

Education and Religion.—In 1944, there were more than 250,000 children attending public and private elementary schools where the curriculum comprises academic and technical courses. Education is free and compulsory, and instruction in French is obligatory. Instruction is also given in higher schools in practical agriculture, industries, and medicine. Numerous Catholic and Protestant missions and mission schools have long been established; in 1895 it was estimated that there were 450,000 Protestants and 50,000 Catholics in Madagascar. The religion of the great bulk of the people is a kind of fetishism or worship of charms.

History.—Madagascar was known to the traveler Marco Polo at the end of the 13th century and had already been visited for several centuries by the Arabs. In 1506 it was visited by the Portugese, who gave it the name of St. Lorenzo. A number of French settlements were formed, broken up, then re-established at various times, more particularly along the east coast at Sainte-Marie Island, Antongil Bay, Fort Dauphin, and Tamatave. British influence began to be felt after the Napoleonic wars.

Previous to 1810, Madagascar, which had no truly indigenous population, might be said to be divided among numerous tribes who remained almost constantly at war with one another. By the 19th century, the Hovas had gradually extended their supremacy over most of the island. While some of their rulers encouraged the infiltration of European ideas, others yielded to the pressure brought to bear by the Andriana nobles and gave proof of a fear and distrust of strangers which several times led to armed intervention by both the French and British. After several decades of rivalry, the British recognized France's larger interests and predominant rights in the island.

Radama I, a prince of remarkable intelligence, became king of the Hovas in 1810, and began to enforce by right of conquest a claim to the sovereignty of the whole island. He received arms and other assistance from the British, by which he was enabled to carry on his conquests. Christian missionaries began to teach in the capital in 1820. Many converts were made, the Bible was translated into the Malagasy tongue, the language was first reduced to a systematic written form, and printing was introduced. Great improvements had taken place in the manners of the people when Radama died in 1828, and was succeeded by his chief wife, Ranavalona I, a woman of cruel disposition, and opposed to all innovation. The native converts were persecuted, many of them being put to death, and the island was closed to Europeans. This reign of terror ended at last in 1861, when the queen died, and was succeeded by her son, Radama II, who, himself a Christian, reopened the island to European missionaries and traders, and proclaimed the emancipation of the African slaves. He appears, however, to have been a weak prince easily swayed by native and foreign favorites, and he made an unwise grant of extensive territories and privileges to an enterprising French company, an act which lost him the affection of his nobles, and led to his assassination in 1863. His wife Rasoherina was placed on the throne, and the government repudiated the concessions made to the French, offering 1,000,000 francs as compensation. After a quiet and prosperous reign of five years, this queen died, and was succeeded by Ranavalona II in 1868. After she had been elected queen, she and a great number of her courtiers became Christians, and many reforms favorable to enlightenment and humanity were perseveringly carried out. She was succeeded in 1883 by Ranavalona III. The Sakalavas, a large tribe inhabiting the northwest of Madagascar, had previously asked to be placed under France's protection. Queen Ranavalona refused to recognize French interests in that part of the island and this led to hostilities in 1883–1885. The war was terminated by a treaty, under which France acquired protectorate rights over Madagascar; but hostile feeling toward the French again led to war in 1895. Franch forces soon quelled the insurrections and Madagascar was proclaimed a French colony (Aug. 6, 1896). In 1897 the queen was deposed and exiled, first to the island of Réunion and thence to Algiers where she died in 1917. Gen. Joseph Simon Gallieni was named French resident general (1896-1905) with full military and civil powers. He removed Hova governors from all regions inhabited by other tribes and rapidly brought peace to the island.

In 1941, fears were aroused in Great Britain by Japanese official statements concerning the possible occupation of Madagascar by Axis forces. A British expeditionary force established a control zone in Diégo Suarez, May 1941. Five months later they took control of the whole island, the pro-Allied French officials continuing their functions. In December 1942, the French Committee of National Liberation appointed a high commissioner for Madagascar and French sovereignty was restored.

Consult Howe, S. E., *Drama of Madagascar* (London 1938); Griffith, G., and Ronca, J., *Madagascan Adventure* (London 1939); Chapman, O. M., *Across Madagascar* (London 1943).

JEAN DE LA ROCHE,
French Colonial Administrator.

MADAME BOVARY. The first and best-known novel of Flaubert, a type and model for the fiction of the next generation, was the first and is probably still the best of minute reproductions of the platitudes of modern life. *Madame Bovary* was published in 1856 when Flaubert was already 35, the fully matured and laboriously executed expression of his effort to make writing a means of emancipation from self. The French literary historian Gustave Lanson considered it "the masterpiece of contemporary fiction." Flaubert's own education had been out of key with his provincial surroundings, and he chose natures similarly out of tune with their environment for the first object of his study, with a painstaking accumulation of "significant little facts" quite in the spirit of Taine's psychology and literary criticism. Flaubert had worked on *Madame Bovary* at least since 1852, "eighteen hours out of the twenty-four," he tells George Sand, and adds, "I seek something better than success, I seek to please myself." The novel attracted immediate and wide attention, presently stimu-

lated by a prosecution of the author for alleged immorality, a celebrated case, ending in a curiously qualified acquittal. The court pleadings and judgment, printed at Flaubert's insistence with subsequent French editions of the novel, throw strange light on the moral ideas of the last decade of the Second Empire.

'Madame Bovary' marks the transition from the fiction of romantic fancy to that of close realistic observation, preferably of the petty, the puerile and the commonplace. The theme is the banality of provincial life, as Flaubert saw and felt it; the lesson is the futility and danger of a sentimental revolt from the commonplace when vulgar souls indulge in romantic aspirations. Briefly the story is this: Charles Bovary, a "medical man," though not an M.D., fatuously good, timidly banal, is shown us first as a dull pupil, then unsympathetically married, then a widower attracted to a farmer's daughter, Emma, the book's chief subject, whom he marries, apparently the less initiated of the two. Emma's convent education beyond her station had been supplemented by romantic poetry and fiction, in Flaubert's opinion a deliberate perversion, whose degrading and immoral results he proposes to show. Charles was happy; Emma ever restlessly reaching out toward a fulfilment of her romantic aspirations. Chance brought her to an aristocratic ball. Dormant emotions were awakened. "She desired at the same moment to die and to live in Paris." Léon, a law student, served her for a platonic attachment, presently to be succeeded by Rodolphe, after Emma had sought sentimental consolation in religion, quite in vain. Rodolphe's carnally-minded courtship, a bitterly ironically parody of romanticism, is successful; but from dreams of bliss Emma is relentlessly drawn down to and below the commonplace. Both weary, Emma again seeks refuge in religion, but meeting the now more sophisticated Léon yields once more, and plunges Charles into debt while still seeming to him more charming than ever, as she descends the last steps of dissimulated corruption. Abandoned by Léon, once more rejected by Rodolphe, she escapes life by poison, holding even beyond death the infatuated love of Charles, who, even though at last undeceived, dies with a lock of her hair in his hand.

Incidental to the story are some admirable character studies of provincial types, notably M. Homais, druggist-demagogue and materialist, incarnation for Flaubert of "triumphant democracy," a by-word for the narrow, provincial philistine, who has given his name to a social species. His counterfoil is the parish priest, Bourrisien, whose cure of souls is a perfunctory, well-meaning, uncomprehending fatuity. More subordinate but strongly individual are the sacristan Lestiboudois, the notary Guillaumin, and the merchant-money-lender Lhereux.

Apart from its subtle psychology 'Madame Bovary' won and holds admiration for its phrases of flashing irony, its vivid narration and fine descriptive passages, but no less for its linguistic euphony, a matter to which Flaubert gave untiring and at times almost morbid attention. Ethically it reflects its author's sombre pessimism. To Flaubert all spiritual aspiration seems foredoomed to failure. For himself he sought forgetfulness in the pursuit of art for art's sake. In this book he presents neither a character to imitate nor an act to admire. Yet 'Madame Bovary' is, in Bourget's phrase, "the very ideal of the literary artist." There are translations by W. Walton and others. Consult Whitehouse, H. R., 'The Life of Lamartine' (2 vols., New York 1919).

BENJAMIN W. WELLS,
Author of 'Modern French Literature.'

MADAME SANS-GENE. (1) The wife of Marshal Lefebvre, a laundress at the time of her marriage to the Marshal (then a sergeant), who was given the name, which means "carefree," because she retained the unconventional manners of her early life. (2) A play by Sardou and Moreau, first presented at Paris in 1893. The personages are Napoleon and the homely characters whom he made his courtiers. (3) An opera, first presented at the Metropolitan Opera House, New York City, 25 Jan. 1915.

MADDER, (1) *in botany,* the English name of the plants of the genus *Rubia,* especially *R. tinctorum.* It is a trailing or climbing annual, supporting itself by its leaves and prickles. It is supplied chiefly from Holland, France, Italy and Turkey. The roots are kiln-dried and then threshed; they are then dried a second time, and afterward pounded and stamped in a mill. Indian madder, called also madder of Bengal, is *R. cordifolia.* (2) *In chemistry,* the root of *R. tinctorum* is extensively used in dyeing for the production of a variety of colors, namely, red, pink, purple, black and chocolate. Other species of *Rubia* are also used. It would appear that madder contains a colorific principle — rubian — which, under the influence of a peculiar ferment, termed erythrozym, breaks up into alizarin, purpurin, etc. The colors produced from madder are very stable, the well-known Turkey-red being one of them. Madder also contains certain yellow coloring matters, but they are useless, if not injurious, in the process of dyeing. (See DYES; DYEING). (3) *In pharmacy,* madder is a tonic, diuretic and an emmenagogue. Brown madder, a rich red-brown pigment, prepared from the roots of *R. tinctorum.*

MADDOX, Richard Leach, English physician and chemist: b. Bath, England, 4 Aug. 1816; d. Portswood, Southampton, 11 May 1902. He studied medicine at University College, London, but was graduated M.D. at Edinburgh. In early life he settled and practised his profession in Constantinople, and here first took up the study of photography. He subsequently left the Bosphorus for Smyrna and was a civil surgeon in the military hospitals at Scutari during the Crimean War, and finally settled at Woolston, near Southampton, England. It was during his residence at Woolston, which lasted until 1874, that he worked out the process which has revolutionized the art of photography, by substituting the gelatino-bromide for the collodion plate. With him originated the gelatino-bromide dry plates to take the place of the wet collodion plates which, besides other inconveniences, sometimes produce an atmosphere which is dangerous to the operator's health. There have been more than one claimant to the credit of this discovery, but it has been decided by the *Scientific American* that Dr. Maddox is entitled to all the honor of the invention.

MADEIRA, village, Ohio, Hamilton County, is located 15 miles northeast of Cincinnati (3 miles from the corporate limits), of which it is a residential suburb, on the Baltimore and Ohio Railroad. It is incorporated and has a mayor-council government. Pop. (1950) 2,689.

MADEIRA, mȧ-dēr'ȧ (Port. mȧ-thā'ê-rȧ, mȧ-thā'ê-rȧ), a group of islands in the eastern Atlantic Ocean belonging to Portugal and forming the Portuguese administrative district of Funchal. They lie opposite to and about 360 miles distant from Morocco, off the west coast of Africa, about 535 miles southwest of Lisbon, north of the Canary Islands and southwest of the Azores. They include Madeira and Porto Santo islands and two groups of uninhabited islets, the Desertas and Salvages (or Selvagens), with a combined area of 315 square miles.

The main island, Madeira, is 35 miles long and up to 13 miles wide. It is made up of mountains of volcanic origin the highest of which is Pico Ruivo, 6,056 feet high. The east portion of the island is elevated, but less so than the west. From the central mass steep ridges extend to the coast where they form precipices from 1,000 to 2,000 feet high. These cliffs are indented by a few small bays where richly cultivated valleys approach the water between abrupt precipices or backed by rugged hills, and here are located the villages of Madeira. The most striking features of the mountain scenery are the jagged ridges and the deep gorges which cut through the highest mountains almost to their base.

Wine and sugar are the staple products; sugar cane, sweet potatoes, onions, some cereals, fruit, and cattle for dairying are raised. The chief industries are embroidery, wine making, sugar milling, the manufacture of wicker furniture and baskets, and fishing. The principal exports are Madeira wines and embroideries, wickerwork, bananas, pineapples, dairy products, and fish.

The mean annual temperature of Madeira is 65°F., and the climate from its constant and temperate warmth makes the island a favorite resort of invalids. Funchal, the capital, is a submarine cable station and port-of-call. It has been an Episcopal see since 1514, and has a late 15th century cathedral. Pop. (1950) 54,856.

The Madeiras were known to the Romans under the name of *Purpurariae Insulae*. They were rediscovered in 1418 by the Portuguese navigator, Joãs Gonçalves Zarco, who in 1421 founded Funchal. The name Madeira was given to the principal island because of the magnificent forests of building timber (in Portuguese *madeira*) which covered it. From 1580 to 1640 the islands, with Portugal itself, were under Spanish rule, and twice have been occupied by the British, in 1801 and again in 1807–1814. The British developed the wine industry, and are still the most numerous among foreign visitors to the islands. Pop. (1950) total, 269,179; Madeira Island, 266,245.

MADEIRA, river, Brazil, the most important affluent of the Amazon, formed by the united streams Beni and Mamoré on the frontiers of Brazil and Bolivia. The length from the source of the Mamoré is 2,100 miles.

MADELEINE, Marie Angélique de Sainte, French abbess, prioress of the convent of Port Royal, Paris. See under baptismal name, Arnauld, Jacqueline Marie.

MADELEINE, mȧ-dlĕn', **La**, France, a type station, or rock shelter, of late paleolithic culture in the valley of the Vézère, midway between Moustier and Les Eyzies. The Madelenian, or Magdalenian, epoch in archaeology was named from this cave.

MADELEINE, La, a church in Paris, in a square of the same name, begun in 1764. It was remodeled and changed after the Revolution, and was completed and consecrated in 1842. The church is built in the form of a Greek temple and is 100 feet high, 354 feet long and 141 feet wide. The bronze doors by Henri de Triqueti are 35 feet high and 16 feet in width. The building, which has no windows, is lighted from above.

MADEMOISELLE DE MAUPIN, mō-păn', a novel written by the French author, Théophile Gautier, when he was only 24 years of age (1835). It expresses the most salient features of romanticism. In the somewhat long preface is found the key to the interpretation of this highly imaginative work. Gautier cries out against the shammed respectability of that period and condemns the prudish stand of literary critics who according to him are merely hypocrites actuated by envy. Violently opposed to classical traditions and ideas, Gautier, who had been trained as a painter, keeps in this work the painter's vision, and emphasizes primarily form and color, while defending art for art's sake. Digressions on the supreme value of beauty are found frequently throughout the pages, and the vivid imagination of the author is fruitful to the point of exaggeration. The heroine, brought up according to tradition, rebels against it, and, disguised as a man, like the Amazons of old, resolves to study life at first hand. After many unusual adventures she becomes for one day the long-sought ideal of a romantic poet who had searched in vain until then for the "woman" of his dreams and who found her only to lose her immediately. As a novel the work is crude both in subject matter and in development, showing that it comes from a young man whose passions were not yet calm. It is, however, essentially artistic; the style is full of color and abounds in beautiful descriptions and lyric passages. While the novel did succeed in amazing placid citizens and is still classed as dangerous reading, it must not be considered as a study of any type of French character, but as a flight of imagination, a descriptive fantasy artistically worked out by a talented writer of the Romantic school.

Louis A. Loiseaux.

MADERA, mȧ-dâr'ȧ, city, California, Madera County seat, is located 22 miles northwest of Fresno, on the Santa Fe, and Southern Pacific railroads. It is in a lumber and vineyard area. Pop. (1950) 10,497.

MADERO, Francisco Indalecio, mȧ-thā'rō, president of Mexico: b. San Pedro, Coahuila, Oct. 4, 1873; d. Mexico City, Feb. 22, 1913. He came of a wealthy family and was a grandson of a former governor of Coahuila. He was educated at a Jesuit college in Mexico and at the University of California and spent the years

1889–1895 in France. He returned to Mexico, engaged in cotton planting and in banking and materially increased his fortune. He took up his residence in Mexico City in 1900 and became keenly interested in political reform. Of a naturally retiring disposition, he displayed an initiative that surprised his most intimate friends, and by 1905 he was the unquestioned leader of the reform element. He actively opposed the rule of Porfiro Díaz, and in 1908 he published his *La Sucesión Presidencial en 1910*, a strikingly well-balanced attack on the evils existing in the political and social life of Mexico. He advocated suffrage reforms, a single term for the presidency and opposed the absolutism which characterized the rule of Díaz, while crediting him with the many achievements of his administration. The book caused a sensation and was promptly suppressed by the government. However, Madero was nominated for the presidency in 1910, running against Díaz on a platform advocating a single term for the presidency. He was arrested on a fabricated charge in July 1910 and imprisoned until it was too late for him to interfere with the re-election of Díaz. Madero then headed a plot for a revolution against the government, advocating reforms in suffrage, land distribution, freedom of the press and the single presidential term among other measures. The uprising began at Puebla, Nov. 20, 1910, spread through Sonora and Sinaloa, and upon capturing Juárez, Madero set up his government and appointed a cabinet, May 11, 1911. The Díaz government then entered into a conference with the revolutionists and peace was declared May 21. Madero was elected president October 1. Temperamentally a dreamer and idealist, Madero found himself checked upon every hand in his attempts to carry his projected reforms into effect. He was unable to manage the politicians of the old régime, or the insurgent element, and in 1912 revolts broke out under Emiliano Zapata in the south and under Félix Díaz, nephew of ex-President Díaz, in the north. He was charged with being slow and irresolute in his administration of public affairs, of favoring his relatives and of personal peculation from the public treasury. The Díaz revolution was suppressed and General Díaz was imprisoned. Madero, however, was of a forbearing disposition and suspended the death sentence pronounced against the revolutionist. An uprising among the soldiers in Mexico City took place Feb. 9, 1913 and released Díaz and another enemy of Madero, General Bernardo Reyes. The federal troops for a time resisted the revolutionists but on February 17 a force of 1,200 arrived in the city and joined General Victoriano Huerta, Madero's commander in chief, in overthrowing the government. Madero was arrested and imprisoned February 19 and plans for his exile were under way when it was decided to bring him to trial. Together with the vice president, Pino Suárez, Madero was being conducted from the National Palace to the penitentiary when both were shot. No reports except those of the government were available and the official version was that an intervention in behalf of the prisoners was made by Madero sympathizers, whereupon the prisoners attempted to escape and were shot. Huerta was generally held responsible for their deaths and was eventually forced from office, although he denied complicity in the affair.

MADHAVA, or **MADHAVACHARYA,** mä'dȧ-vä-chär'yȧ, Hindu scholar and royal counselor: flourished about 1380 A.D. A writer on religious and philosophical subjects, he collaborated with his brother, Sāyana, on commentaries on the Vedas.

MADHYA PRADESH. See CENTRAL PROVINCES AND BERAR.

MADIA OIL, oil expressed without heat from the seeds of *Madia sativa.* It is transparent, yellow, odorless and may be used on the table as a substitute for olive oil or for oil-cake for cattle.

MADISON, James, American Protestant Episcopal bishop: b. Rockingham County, Va., Aug. 27, 1749; d. March 6, 1812. He was graduated from William and Mary College in 1772, studied law and was admitted to the bar, but soon after abandoned law for divinity. In 1773 he was chosen professor of mathematics in William and Mary College, and in 1775 went to England and was admitted to orders by the bishop of London. In 1777 he was elected president of the college, and during the American Revolution succeeded in keeping the college in active operation. Having been chosen as bishop of Virginia he was consecrated by the archbishop of Canterbury, in Lambeth Chapel, Sept. 19, 1790. He continued to discharge the duties of president of the college and professor of natural and moral philosophy, international law, etc., with those of the episcopate, until his death.

MADISON, James, fourth president of the United States: b. Port Conway, Va., March 5/16, 1751; d. Montpelier, Va., June 28, 1836. Madison was the eldest son of James Madison, a Virginia planter, and of Nelly Conway, daughter of Francis Conway, of King George County, Va. His father, a man of independent means, lived on an estate now known as Montpelier in Orange County. James was born at Francis Conway's home on the Rappahannock while his mother was on a visit to her parents. His educational advantages were excellent for the times; he attended the school of a Scotsman, Donald Robertson, was well prepared for college by the clergyman of the parish, the Rev. Thomas Martin, and entered Princeton in 1769. His application to his studies was excessive, and was in part the cause of later ill health; he succeeded, however, in taking the studies of the last two years in one year and took his B.A. degree in 1771. He remained at Princeton for another year doing special work in Hebrew under Dr. Witherspoon, the president. After his return home he tutored his younger brothers and began a systematic course of reading in theology, philosophy and law. At this time his study of Hebrew and theology seem to indicate a desire to enter the ministry, but he soon abandoned this and prepared himself for the legal profession and for public service. His theological studies bore good fruit later as is evidenced by the stand he took for religious liberty.

Madison was by instinct a politician and not a soldier; he took no active part in the Revolutionary War, but as early as 1774 he was appointed a member of the Committee of Public Safety for Orange County, and in 1776 was elected delegate to the convention which framed the constitution of Virginia. From that time

until he retired from the Presidency he was honored with high public offices by his State and by the nation. In the Virginia Convention Madison succeeded in substituting for a clause in the Bill of Rights permitting the "fullest toleration" in religion, a clause allowing the "free exercise of religion." This was a distinct blow to religious intolerance for, as he said, toleration implies jurisdiction, and the State should have no coercive power over religious thought. He was a member of the first Virginia assembly but failed of re-election because, as his biographer Rives tells us, he refused to conform to the universal custom of his day and "treat" his constituents; he was, however, made a member of the governor's council and so distinguished himself that in 1780 while still under 30 he was chosen as delegate to the Continental Congress. In this Congress he was conspicuous for his opposition to the issuance of paper money by the States; for his efforts to secure for Congress the right of taxing imports, and for his determined stand to retain for the States the right of navigation on the Mississippi. Madison saw clearly that a government so organically weak that it could not enforce its requisitions and could pay its debts only by increasing its debt could never be effective; hence he labored unceasingly to enlarge the power of the central government. The office of delegate was limited to one term, so Madison was not returned to Congress in 1784, but the high esteem in which he was held was shown by his immediate election to the State assembly. Virginia was a very influential State and her attitude toward national questions was of great importance. In the assembly Madison tried to indoctrinate the people of Virginia with his ideas concerning the Federal power. His bill to regulate trade in Virginia and to provide ports of entry led first to the conference between Virginia and Maryland with reference to trade on the Potomac and later to the Annapolis Convention which met in 1786 to consider the trade and commerce of the United States. This Convention at Annapolis urged upon the States the appointment of commissioners to meet in convention at Philadelphia "to devise such further government as shall appear to them necessary to render the Constitution of the Federal Government adequate to the exigencies of the Union." The summoning of the Philadelphia Convention was largely due to the wise bills introduced by Madison in the Virginia assembly and to his direction of public sentiment, and it was eminently fitting that he should be one of the delegates of the Virginia Commission at whose head was George Washington. Madison's views on government are clearly defined in his "outline system" which formed the basis of the Virginia plan proposed to the Convention. His system demanded that there should be a due supremacy of national authority without the exclusion of local authority, that the national authority should extend to the judiciary and to the militia; that the national legislature should be composed of two bodies, the larger elected for a short, the smaller for a longer term; that Congress should have certain coercive powers; that a national executive should be provided and that the basis of representation in Congress should be changed from States to population. The "Virginia plan" was the germ of the Constitution and Madison is rightly called the "Father of the Constitution." His arguments in favor of the proposed government were exhaustive and convincing, and his private notes of the work of the Convention and of his debates purchased from his widow and published by Congress form a valuable addition to our knowledge of this stormy period. While the Constitution was before the people for consideration Madison, Hamilton and Jay wrote a series of papers called in collected form *The Federalist,* in which they discussed government in general, defined the character of the proposed union, met objections and proved the advantages to be derived from effective central government. Madison was a member of the Virginia Convention which met to consider the ratification of the Constitution and by his keen analysis and clear-cut argument contributed more than any other man to secure its adoption. His chief opponent was Patrick Henry; his ablest ally, John Marshall. Owing to Henry's antagonism, Madison was defeated as candidate for the Senate, but was elected as representative to Congress and took his seat in April 1789. During this session of Congress, Hamilton and Madison, who had hitherto been as one in their efforts to centralize power, drifted apart, and Madison gradually began to endorse Jefferson's position as to certain inalienable States' rights. There is no reason to accuse him of bad faith; his statesmanship was never overbold, and Hamilton's commercial system, his extensive financial schemes, especially the funding of the national debt and the assumption of State debts by the general government, gave so much power to Congress that Madison withdrew his support from the Secretary of the Treasury and vigorously opposed his measures. Although Madison had now definitely cast in his fortunes with the Republican opposition his moderation and good sense enabled him to retain the friendship of most of his political opponents.

From 1793 to 1796 the country was greatly agitated over the relation of the United States toward France, and on the outbreak of war between France and England the President issued a neutrality proclamation to the great disgust of the French, who had expected active friendship from the United States. Although both countries interfered shamefully with American commerce, popular sentiment and the Republican party sided with France. In 1794 Madison, supported by Jefferson, introduced a bill demanding retaliatory measures against Great Britain, and a temporary embargo was laid on British commerce. The signing of the Jay treaty by the President was a signal for an outburst of popular indignation, and Madison, as leader of the opposition in Congress, opposed the appropriation of money to carry out the terms of the treaty. In 1797 Madison retired and enjoyed for a short while the pleasures of private life. A year later he was aroused to activity by the passage of the unpopular Alien and Sedition Acts. The Virginia resolutions written by Madison denounced these laws and declared that in case of a dangerous exercise by the Federal government of powers not granted by the compact the States had the right to interfere. These resolutions still further emphasized the position of the Republican party and pledged it to the support of States' rights. The year 1801 brought an overwhelming defeat to the Federalists; Jefferson was inaugurated President and

Madison became secretary of state. He was thoroughly in sympathy with the president's views and shared the popularity of that brilliant administration. The last years of Jefferson's second term were clouded by the insulting actions of England and France with reference to the American Navy. The orders of the British and the decrees of Napoleon concerning the seizure of neutral vessels were ruining American commerce. Vessels were seized by the English and by the French, American seamen were impressed and ports blockaded. Jefferson was opposed to war and in his efforts to coerce France and England by commercial restrictions he induced Congress to lay an embargo on British trade. Instead of injuring England this seriously crippled American commerce and was soon repealed. In this troubled condition of affairs Madison became president in 1809. Like Jefferson he was opposed to war and tried diplomacy. He attempted to have the British Orders in Council withdrawn. The British envoy agreed, but the British government repudiated his action. Subsequent negotiations with another British minister, James Jackson, were also fruitless. Continued insults were heaped upon American ships and men; the country demanded definite action against the aggressors; even the peace-loving president, weary of the offensive attitude of England, at last gave his consent to war. On June 18, 1812, war was declared and continued with varying success until the Peace of Ghent in 1814. After nearly three years of fighting, after ruinous loss of money and property, the country was practically just where it stood in 1812, "its boundary unchanged, its international rights still undefined, the people still divided." Madison lacked vigor as a war president, nor had he sufficient determination to secure advantageous terms of peace. He was far greater as a framer of the Constitution than as an executive.

In 1817 Madison retired from office and settled on his estates of Montpelier. He had married in 1796 Mrs. Todd, afterward the celebrated Dolly Madison, and with her he enjoyed 20 peaceful years in his country home. He was interested in farming, he thought and wrote much on all topics of public interest. He discussed social and moral questions, slavery and education. "Education," he maintained, "was the true foundation of civil liberty." The last public appearance of the venerable statesman was in the Virginia Convention of 1829 which met to amend the state constitution. In character Madison was thoughtful, reserved and cautious; in a time of hard drinkers he was notably abstemious. Moderation characterized all his habits. Dignified and kindly and an excellent conversationalist among those he knew well, he made and retained warm friends. His knowledge was profound and accurate, and he was considered an authority on all constitutional matters. His literary style was labored, but his arguments were keen, comprehensive and convincing.

EMILIE MCVEA,
Late President, Sweet Briar College.

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MADISON, town, Connecticut, in New Haven County, 20 miles northeast of New Haven, at an altitude of from sea level to 367 feet at its highest point. Madison is served by the New York, New Haven and Hartford Railroad. The town is a summer resort, but has some agriculture. Formerly called East Guilford, it was settled in 1649, and in 1826 it was incorporated as the town of Madison. Pop. (1950) 3,044.

MADISON, city, Illinois, in Madison County; altitude 425 feet; on the Mississippi River; opposite St. Louis, Mo.; on Illinois Central and other railroads (freight). Madison, Granite City, and Venice, known as the Tri-Cities, are steel-mill cities. Merchants Bridge at Madison was built in 1890. Pop. (1940) 7,782; (1950) 7,960.

MADISON, city, Indiana, Jefferson County seat; altitude 460 feet; on the navigable Ohio River; 86 miles southeast of Indianapolis; served by the Pennsylvania Railroad (freight only); and three airports. Situated in a region of dairy and poultry farms, it has food processing and packing plants. Tacks and rivets, laundry baskets and hampers, work clothes, porch furniture, saddle trees, and women's shoes are manufactured. From Madison were built the first two turnpike roads, and the first steam railway west of the Allegheny Mountains. Pop. (1940) 6,923; (1950) 7,485.

MADISON, village, Maine, in Somerset County; altitude 290 feet; on the Kennebec River; 35 miles north of Augusta; on the Maine Central Railroad. There is abundant water power and manufactures include plastic textiles, lumber, and paper. Historic Old Point and Norridgewock are nearby. There were some settlers here before the revolution, and the village was incorporated in 1804. Pop. (1930) 3,036; (1940) 2,581; (1950) 3,630.

MADISON, borough, New Jersey, in Morris County; altitude 250 feet; 18 miles west of Newark; on the Delaware, Lackawanna and Western Railroad. It is a suburban residential borough; its only industrial establishments are the greenhouses which give the borough the popular name of Rose City. Madison is the seat of Drew University, and two miles away, at Convent Station, is the College of St. Elizabeth, a Roman Catholic college for women. The Morris and Essex Kennel Club holds an annual dog show at Madison. The borough was incorporated in 1889; its government is administered by mayor and council. Pop. (1940) 7,944; (1950) 10,412.

MADISON, city, South Dakota, Lake County seat; altitude 1,669 feet; 43 miles northwest of Sioux Falls; on the Chicago, Milwaukee, St. Paul and Pacific Railroad. It is in an agricultural area raising livestock and grain, and has flour mills, grain elevators, hatchery, creameries, and packing plants. Eastern State Normal School (coeducational) is here. Lake Madison, two miles away, is a resort. Madison was settled in 1875 and named for the Wisconsin city. Pop. (1940) 5,018; (1950) 5,142.

MADISON, city, Wisconsin, state capital and seat of Dane County, is situated about 80 miles

west of Milwaukee in an agricultural region in the south central part of the state. The city fills and overflows a gently curving isthmus, less than a half mile wide at its narrowest part, between Lake Mendota on the north and Lake Monona on the south. These waters, connected by the Yahara River, form part of a chain known as the Four Lakes, the other two being Lake Waubesa and Lake Kegonsa to the south. In the southwest part of Madison itself is also Lake Wingra. All five lakes can be seen from the dome of the state capitol. The city's altitude varies from about 850 to 955 feet above sea level. The city is served by three railroads—the Chicago, Milwaukee, St. Paul, and Pacific, the Chicago and North Western, and the Illinois Central. A network of federal and state highways provides for motorbus and truck transportation in all directions. The city has its own airport, with commercial airline service; and there is a seaplane base on each of its isthmus lakes.

Economic Life.—Madison is the second most populous city in the state, being exceeded only by Milwaukee. Government service—municipal, county, state, and federal—provides employment for thousands of Madison's residents. Among its educational institutions, the University of Wisconsin (see WISCONSIN, UNIVERSITY OF) alone employs more than 1,500 people on its administrative, teaching, and research staffs. Many of Madison's residents also work in the offices and stores of the wholesale and retail trades, in the railroad shops, or in the city's factories. Madison's most important manufactures are dry cell batteries, turret lathes and other machine tools, balancing machines, die castings, farm machinery, chemical plant foods, paper boxes, bottle caps, hospital equipment, and dairy and other food products.

Educational and Cultural Institutions.—In addition to the state university and public and parochial schools, the educational institutions in the city include Edgewood College (Catholic, for women), music and art schools; and the United States Armed Forces Institute, the largest correspondence school in the world, with an enrollment of more than 100,000 students in 1951. Among Madison's library facilities are the Free (public) Library, the Wisconsin Legislative Reference Library (in the capitol); the extensive libraries of the university, the State Historical Society, and the Wisconsin Academy of Sciences, Arts, and Letters (all located on the university campus); and the important collection of the Forest Products Laboratory, a research institution maintained by the U.S. Forest Service in cooperation with the university. For many years, the city has been a recognized research center, and more recently it has also become a medical center. In 1951, it had seven Class-A hospitals, and $20,000,000 worth of new hospital and medical facilities were under construction.

Buildings.—Madison, with its extensive lake frontage, its many parks, and its fine public and private buildings, is one of the most attractive state capitals in the Union. One of its most imposing buildings is the State Capitol, which occupies a commanding site near the heart of the city on grounds covering 14 acres. Designed in Italian Renaissance style and constructed between 1906 and 1917, its exterior, including even the dome, is of white granite. Within the building are works of art by such noted American painters and sculptors as Albert Herter, Charles Y. Turner, Edwin H. Blashfield, Kenyon Cox, Karl Bitter, and Daniel C. French. A 9-foot marble figure, *The Genius of Wisconsin* by Helen Farnsworth Mears, executed when that famous Wisconsin sculptor was 14 years of age, stands in the capitol's rotunda. The State Historical Society Museum, which contains important collections of Indian, pioneer, and folk and fine arts, owns *The Spirit of Carnival* by Vinnie Ream Hoxie, the renowned sculptor who was born in Madison.

Two of the city's churches are about a century old. St. Raphael's (Catholic) was built in 1854, the year that the first railroad train reached Madison and the first "class" (two men) was graduated from the university. Grace Episcopal Church is younger by a few years (1858), though its parish dates from 1839 and was the first religious organization in Madison. Wisconsin's first synagogue, also erected in Madison in 1858, still stands. The city has always been hospitable to people of all faiths. Among Madison's many beautiful or interesting buildings planned as private dwellings is the mansion, built in 1854, purchased by the state legislature in 1885 as a residence for Wisconsin's governors in office, and now the university's graduate student center. For a number of years it was the home of Senator J. G. Thorp, whose daughter-in-law was Anna Longfellow. It is said that it was she who persuaded her famous father, Henry W. Longfellow, to write his poem, *The Four Lakes of Madison.* Another dwelling is the Braley Home, occupied during the 1880's by Judge Arthur B. Braley, Shakespearean scholar and father of Berton Braley, author and newspaper correspondent. In this home, as a young woman, Ella Wheeler Wilcox wrote one of her most famous poems, *Solitude,* better known as *Laugh and the World Laughs with You.* Near Lake Monona is the B. O. Webster Home, once the residence of Robert M. La Follette, U.S. Senator from Wisconsin and thrice Wisconsin's governor. Madison's yellow sandstone has been used for many public, as well as private, dwellings. City Hall, built in 1858 in an adaptation of the Florentine Renaissance, is constructed of this material. From this building, the city government is administered by 20 councilmen, elected at large, and a mayor.

History.—Almost as soon as the Territory of Wisconsin was organized in 1836, its legislators chose a site in the wilderness for its capital, named it Madison (after the fourth president of the United States who had died a few months before), and made Madison the seat of Dane County. In 1837, the townsite was laid out, the first white family settled there, and workmen arrived to begin construction of the capitol. Before the end of 1838, Madison had crude inns, a general store, a school, a weekly newspaper, a road, and the beginnings of stagecoach service. The first session of the legislature had also been held, but the legislators suffered so much from poor accommodations during their stay that Madison almost lost its position as capital that year. In 1846, with a population of about 625, Madison was incorporated as a village. Ten years later, as a thriving community of several thousand residents (6,611 by 1860) it was incorporated as a city. By that time, Wisconsin had outgrown its first statehouse, and the erection of a new one was begun in 1857, which served for the next half century. The national depression of 1857 was soon reflected in the city's economy; and with the

outbreak of the Civil War, the University of Wisconsin, young, weak, and unpopular at that time, lost almost all its students to the army. From its beginning, pressures for the removal of the capital had plagued Madison's residents, but, following the war, objection waned, and the city entered its long period of civic, cultural, and economic development which was scarcely affected by the later periods of economic depression. In this development the university played no small part for, after its reorganization in 1866 and the assurance of regular appropriations for its support, its fame spread far beyond state boundaries.

The following figures indicate the city's population growth: (1900) 19,164; (1930) 57,899; (1950) 95,594.

The regular population, a large part of which is of German or Scandinavian extraction, is augmented by university students (more than 19,000 in 1950 which are included in the census figures for that year), and by visitors who, like its residents, enjoy the water sports on its lakes.

MADISON, river, in Montana, which has its rise in the Rocky Mountains, at an elevation of 8,300 feet. It flows north through Madison County and unites with Jefferson and Gallatin rivers to form the Missouri River; its whole course is about 180 miles.

MADISONVILLE, city, Kentucky, and Hopkins County seat, altitude 460 feet, on the Louisville and Nashville and the Illinois Central railroads, 125 miles southwest of Louisville; also on state and federal highways. Coal mining, tobacco growing, and dairying are the county's principal activities. The government is mayor-council. The city was named in honor of President James Madison. Pop. (1940) 8,209; (1950) 11,136.

MADLER, mâd'lĕr, **Johann Heinrich von,** German astronomer: b. Berlin, May 29, 1794; d. Hannover, March 14, 1874. He was educated at the University of Berlin. He became a professor and one of the governing faculty at the Berlin Normal School. From 1840–1865 he was professor and director of the observatory at Dorpat (Tartu). He made observations with an accuracy never before attained and he now devoted himself principally to the fixed stars. He published in 1834–1836 a map of the moon in four sheets which surpassed anything then published.

MADOG AB OWAIN GWYNEDD, mȧ' dŏg ȧb ō'wān, or **MADOC,** legendary Welsh prince: b. 1150; d. ?1180. He is said to have gone to sea with 10 ships, and 300 men, in 1170, and discovered America. He made a second voyage to and from this unknown land, but finally was lost to the knowledge of his countrymen. Richard Hakluyt gives an account of the voyages in his collection. In Sir Richard Owen's *British Remains* the legend is referred to. He was the subject of Robert Southey's epic poem, *Madoc* (1805). George Stephens, in *Madoc, an Essay on the Discovery of America in the 12th Century* (1893), asserts that the story of Madoc is a baseless fable.

MADONNA IN ART, The. In the early days of Christianity the teaching of the church was largely carried on by the medium of pictures; statuary was added later. The translation of the Bible was in Latin and examples of the book were produced in parchment manuscripts emanating from the monastery scriptoria. They were very few and therefore costly. Hence it is not surprising that the clergy utilized the graphic abilities of their more talented members and other available artistic sources to portray Biblical scenes in mosaics and wall paintings to impress on the minds of the populace (practically all illiterates) the teachings of their creed. The subjects to be treated were largely selected by the patrons (the clergy), and those subjects naturally were the ones most likely to appeal to the masses. The relation of Mother and Child viewed from the aspect of divine inspiration could not but be foremost of the subjects selected as most certain to gain popular attention and to reach the innermost sentiments of humanity. And, from the limner's standpoint, no theme could better enthuse and inspire genius to perfection of execution and the bringing forth of ecstatic pictorial expression. A natural sequence of these accumulated impulses was the prolific production and reproduction of the Madonna in as many aspects and forms as the differences in genius itself. Hence the innumerable examples of the lovely theme which have present existence. No single subject has been treated so prolifically and from so many viewpoints as this of the divine Madonna. The earliest depiction of the Madonna is a subject of controversy. Legend tells us St. Luke the Evangelist painted pictures of the Holy Virgin, and there are several extant drawings which are claimed to be from his pencil. The Virgin as *orante,* usually termed the "Intercessor," with arms outstretched in Oriental form of supplication, is most generally accepted as the first method of treatment as found in mosaics and on glasses of the 4th or early 5th century, some with the name "Maria" inscribed. An early Assyrian manuscript of the 7th century in the chapel of Venantius has such an *orante* depiction. On ancient Christian sarcophagi the representation of the Holy Virgin is very rare, but in the mosaics of Santa Maria Maggiore (Rome, mid-5th century) we have the *Virgin and Child* in medallions on the triumphal arch, and on the spandrils of the arch are the *Annunciation, Presentation in the Temple, Adoration of the Magi, Journey of Christ with Mary and Joseph to Jerusalem.* Of about the same date is a painting seen in St. Agnes catacomb, in which the Holy Virgin seated stretches forth her hands in prayer. By 736 the Iconoclasts created must destruction of all kinds of Biblical depiction from Byzantine artists, but by 787 comes the revival and the Virgin again appears as *orante,* veiled and aged. With the advance or development of the Madonna theme Giovanni Cimabue (13th century) produced the "enthroned" Madonna. And with the arrival of these talented masters the Byzantine stiffness and prescribed rigid rulings of the Greek Church forbidding natural depiction disappears and the human form and garb take on the suppleness of flesh and clothing. It is the beginning of free and highly developed art, and as such is usually the phase chosen as the first classification with which to deal with detailed descriptions of the theme of the Madonna in art.

The Madonna Enthroned.—In its early conception the subject depicts the "Queen of Heaven" (*Regina Coeli*), seated in the sky, surrounded by the saints and angels. An early example of this is the Virgin in Campo Santo, Pisa. As queen of Heaven, having homage

paid her, she is crowned first then veiled. In this conception of the subject the throne is supposed to be a heavenly throne and symbolic of dignity and divinity. Mary is usually garbed in a red tunic as symbol of love and with a blue mantle signifying Heaven. The Child is vested in a tunic till the 15th century, but then generally appears undraped. The Babe generally holds up a hand in blessing, but in the 6th century mosaic of the enthroned Madonna in the Basilica of San Apollinare Nuovo, Ravenna, Mary raises her hand in blessing. The first human figures we see around the throne are the saints, especially John Baptist, the Apostles and the patrons of the particular church to which the work of art is dedicated. Saint John is represented as a child generally bearing a reed cross; at times, as messenger, he has wings. Later patriarchs, prophets, sibyls are in attendance about the throne. Well-known examples are very many and but few can be mentioned. That of Fra Bartolommeo (Baccio della Porta, 1469–1570) is in the Pitti Gallery, Florence; Andrea del Sarto's Madonna di San Francesco in the Uffizi Gallery there stands on a pedestal throne with harpies at its corners (hence sometimes termed "Madonna of the Harpies"). Luini's Madonna in the Brera, Milan, is seated on a coping. Perugino's Madonna (Vatican, Rome) is one of this master's best works and depicts the Virgin seated on a carved and inlaid architectural marble throne. Pinturiccio's Madonna in the chapel of Saint Andrea, Perugia, has the child Saint John standing at the throne's foot. Raphael's Ansidei Madonna (London National Gallery) is reading a book while Saint Nicholas and Saint John Baptist are in attendance at the two sides. The English government paid £72,000 in 1885 for this wonderful painting. Other enthroned Madonnas of Raphael are the Madonna of Saint Anthony (owned privately) and the Baldacchino Madonna (Pitti Gallery, Florence). Among the early exponents of the enthroned depiction were Vivarini, Bellini and Cima; Girolamo dai Libri's altar-piece in San Giorgio Maggiore, Verona, is noteworthy, and Venice is perhaps richest in Madonna creations. Later masters to paint this subject were Titian, Tintoretto and Veronese. Of the early type Cima's picture in the Venice Academy takes about first position; the Madonna is seated on a marble throne having a pillared portico. Palma's beautiful altar-piece in Vicenza is noteworthy among enthroned Madonnas. Bellini excelled in this style and the examples deserve their renown. Ruskin calls his painting in the Venice Academy "One of the greatest pictures ever painted in Christendom in her central art power." The Virgin is accompanied by three saints on each side and three choristers below. His Frari Madonna (Venice) has three compartments, the Virgin occupying the central one. His San Zaccaria Madonna, in spite of its fine execution and beauty of conception and grouping, was created when the artist was over 80 years old. Next we come (late in the 15th century) to Giorgione (who lived only 34 years) who has two Madonnas, one in the Madrid Gallery, the other in Castel Franco. In the latter the throne is exceptionally high, the upper step being above the heads of the accompanying Saints Liberale and Francis. This shows great depth and refinement of feeling in the drooping head and dreaming eyes. While the queenly aspect of these Italian pictures is never displayed with a crown as is frequent on the mosaics dating from the 8th to the 11th century, except in the pictures by Giovanni da Murano and Carlo Crivelli (Venetian school), the Holy Virgin in German art is frequently crowned when enthroned, as in Holbein's Madonna at Darmstadt, that by Van Eyck at Frankfort and that by Memling at Bruges, and Schongauer's at Munich. In the enthroned Madonna of Quintin Matsys in the Berlin Gallery the Virgin is kissing the Child and the northern tendency is vividly displayed in the accessory of the stand containing food. Of modern artists whose enthroned Madonna creations are worthy of mention should be cited Bouguereau, Ittenbach, etc.

The Annunciation.— The angel's announcement to the Spiritual Bride is a subject as prolifically depicted in Christian art as any other. It was a theme displayed everywhere, in every village, street, church or dwelling, in painting or carving. Early we find it in the mosaics, as on the arch of the Santa Maria Maggiore. The attitudes of the Virgin differ in periods or in accordance with the individual conception of the artists. In some the angel stands before the young virgin who kneels in pious submission, or the angel kneels in some; or again, as in Giotto's work, in Padua, both kneel. Later artists picture Our Lady in the Annunciation often as a crowned queen, bejeweled, but in modern work the Virgin and surroundings are treated with simplicity and mystic symbolism is given to the subject. While it is usual that but one announcing angel appears on the scene, Andrea del Sarto, Tintoretto, Francia and Fra Bartolommeo give an angelic choir. Usually the Holy Dove is seen flying toward Mary from the Father. Pisanello's Annunciation in Verona pictures the most beautiful innocence in girlish beauty. Beautiful purity is expressed in the works of Fra Angelico; that in the Oratorio del Gesù, at Cortona, accompanied by the colonnade and scene of Eve's expulsion as accessories, is extremely impressive. In the Uffizi Gallery is a Boticelli Annunciation depicting the angel paying the deepest obeisance at Mary's feet while the Holy Maid stretches out her hands in surprised humility. Other well-known Annunciations are by Simone Martin in the Uffizi, Fra Filippo Lippi, Carlo Crivelli (National Gallery, London), where the scene is produced in a surrounding of magnificent architectural decoration, while Perugino (in Montefalco picture) shows utter simplicity. Paolo Veronese depicts fear as the Virgin shrinks back at the message. Northern creations reveal their source by bringing in such accessories as a spinning wheel, couches, etc. Jan van Eyck places the Holy Virgin by an altar in an alcove with an open book to rest her arm on, her face averted toward the heavenly messenger, who is in a cope and carries a sceptre. Albert Dürer's series of the life of the Virgin depicts in the Annunciation Mary as a German Hausfrau, surrounded by many architectural accessories. In the National Gallery, London, we find Rosetti's work affording very simple treatment in modern depiction, and Burne-Jones gives the scene in a finely constructed painting.

The Nativity.— In the works of the masters

on this subject we find Mary beside her Son's cradle in the act of adoration. Even the early pictures show angels attendant but the veil found in earlier depiction is discarded later. The scene is cast in a cave or cleft in a rock generally transformed into a stable, but there are variations to suit the conceptions of the different masters. In Santa Maria, Trastevere, is a mosaic displaying Mary reposing on a couch in the cleft of a rock. Giotto's school makes the scene a stable of wooden construction; some place the theme in the open with perhaps a ruin or fragment of some structure as accessory. The *swaddled* Babe of the Italian school is, of course, the *bambino* of that country. Orcagna (church of Assisi) places Mary sitting beside the cradle arranging the covering, while Giotto has the Child before her while she is seated on the ground. Perugino's Nativities (in Perugia and Rome) display Mary and Joseph kneeling in adoration of the Babe with angels present. Well known is the Nativity in the London National Gallery by Piero della Francesca (unfinished) in which the Child is lying on the ground with the mother kneeling beside while angels are playing on lutes and singing. That depiction by Luca Signorelli in the same place also shows the Infant on the ground, Mary kneeling beside Him. In the same gallery we have Botticelli's depiction of the scene enacted in a shed, and Carlo Crivelli uses the same surroundings. In Luini's picture an angel holds the Child while Mary kneels with folded arms, her face one of the most beautiful of any of the Madonnas. In most of the above and in others shepherds are portrayed in more or less proximity. In some cases the painting is properly called "Adoration of the Shepherds" on account of their close presence to the Virgin and Child, but later works generally place them in the background. The illumination of the scene frequently (with Rembrandt, Correggio, etc.) emanates from the glowing rays passing from the Holy Babe.

Adoration of the Magi.— This was a favorite subject with the Catacomb dwellers and we find over 20 depictions of the scene in these subterranean galleries. Mary is seated on a throne and the Magi in their tunics and Phrygian caps bring gifts of dishes and baskets. Their number runs from three to six. The early method of treatment makes the Babe rest in the mother's arms, but in the Santa Maria Maggiore (Rome) mosaic the Child is seated on a pedestal with hand upraised in benediction. Usually we find Him in His mother's lap. The emanating glory of the Babe frequently is the source of light and the benediction act is frequently His pose. An Adoration of the Magi mosaic (about 6th century) is in the chapel of San Apollinare Nuovo at Ravenna, in which the Magi lead a procession of female martyrs bringing their crowns as votive offerings to the Madonna. Giotto's painting in Padua places the scene in a stable while Fra Angelico (National Gallery, London) chooses the entrance of a cave as the scene of the King's devotions. In Filippo Lippi's 'Adoration of the Kings' in the Uffizi, Florence, Mary is located in a wide landscape in which figure a host of persons surrounding her. Other noted Adorations are by Baldassare Peruzzi (London National Gallery), Pinturicchio, Mehling (Bruges), Rogier van Weyden (Munich), Rembrandt; Rubens painted 15, of which one is in Madrid, another in the possession of the Duke of Westminster.

Flight into Egypt.— In pictures brought under this title Mary is sometimes seen seated on an ass with Joseph walking beside; the ox which tradition says accompanied them rarely appears in the paintings. Sometimes an angel leads the ass. Well-known depictions of this scene are by Giotto (Padua), Fra Angelico (Florence), Pinturicchio, Memling (Munich).

Riposo.— This phase of the Madonna series is more popular with artists of the past than the 'Flight.' It depicts the Holy Family after the tedious journey through the desert resting in a fertile country surrounded by fruit trees, Mary bathing the Child, etc. It was greatly favored by German and Flemish masters (Albrecht Altdorfer's in Berlin, Lucas Cranach, Martin Schongauer's in Vienna, etc.).

Pastoral Madonnas.— From the 15th century a new style of treatment of the Madonna theme arrives. It is the placing of the Virgin in a landscape surrounding. There are but few, such as Raphael's earliest Madonnas. Three most noted are La Belle Jardinière (Beautiful Gardener) in the Louvre; Madonna in the Meadow (Madonna in Grünen) in Belvedere Gallery, Vienna; and the Cardellino Madonna (Madonna of the Goldfinch) in the Uffizi, Florence. All three among the most prized paintings in the world and too popularly multiplied to need description. Raphael's later work, the Casa Alba Madonna, is less well known with its turbaned Roman patrician depiction of the Virgin. Leonardo da Vinci's Madonna of the Rocks gives the Holy Virgin, in the foreground of a grotto, grouped with the Child and the infant John. Luini painted a pastoral Madonna (in the Brera, Milan), but very noted is Correggio's 'La Zingarella' (Gipsy) or 'Madonna del Corniglio' (Naples) which is posed in a lovely landscape as is also his kneeling Madonna in the Uffizi, both of which always call forth admiration. Palma Vecchio's 'Santa Conversaziones' in Naples, Dresden, Munich and Vienna are public favorites. In the *pastoral* class of Madonnas must be included the three "enclosed garden" examples by Francia (Munich), Filippino Lippi (Florence) and by Schongauer, in which the Virgin and Child are surrounded by a hedge of roses with a landscape in the rear perspective.

Domestic Groups.— This method of depiction of the biblical scene was vogue among painters of the middle 15th century. They consisted of the Holy Virgin and Child associated with Saint Joseph, Saint Elisabeth and her son, and frequently other attendants. A number depict Saint John Baptist child playing with the Holy Infant; Saint Ann, mother of the Holy Virgin, appears in some; da Vinci even depicts (in a cartoon) Our Lady seated on Saint Ann's knees. Girolamo dai Libri (London National Gallery) painted such a group, and Perugino has a work in which Saint Ann rests her hand on the Virgin's shoulders while boys and women relatives are grouped about. Very popular are the groups that include the infant Saint John Baptist playing with the Child (as Raphael's in National

Gallery, London). Both Botticelli and da Vinci created pictures of Saint John adoring the Infant. In the same inspiration is Luini's 'Madonna dell' Agnello' at Lugano. Another popular group subject adopted in pictures by Titian, Perugino, Correggio, Parmigiano, Borgognone, Memling, etc., is the 'Marriage of Saint Catherine,' in which the Child is placing a ring on the finger of the saint. Good modern representations of such groups are by P. A. J. Dagnan-Bouveret in the New Pinakothek, Munich, in which the holy mother, depicted as a peasant, is seated on a bench in the carpenter's shop and the Child at her breast, under her mantle, illuminates and pierces with rays of glory the coarse textile. But, though numerous, both French and German modern paintings of the Madonna lack the devotion or even inspirational features which give such glory and beauty of conception to the early Italian masters and those of the Renaissance.

Madonnas in Domestic Surroundings.— These include the 'Holy Family' series. The worldly environment in depiction of this mystic religious subject has found few exponents, and those confined largely to northern artists. To the German and Dutch the maternal dignity of the *Hausfrau* appeals so strongly as to call from their limners' hands sacred Madonnas in everyday household surroundings. Of such we have pictures by Quintin Matsys (Munich) with its Flemish sleeping apartment, having the Virgin and Child as occupants; the 15th century German artist Schongauer (Belvedere Gallery, Vienna) gives Joseph feeding the cattle from hay in his arms looking with fondness in the doorway at the Virgin holding a bunch of grapes while the Child nestles in her lap. But in Italy, Giulio Romano in his Madonna della Catina (Dresden) portrays the Divine Babe in a basin (*catina*), ready for the bath, while the infant Saint John pours water from a ewer. The Madonna dell' Impannata (of the papered window), formerly considered as Raphael's and later ascribed to Romano, pictures Elisabeth, Mary Magdalen and the child Saint John beautifully grouped with the Virgin and Child. The picture of the French artist Mignard (Louvre) called 'La Vierge à la Grappe' is well known. Salembini's Holy Family (Pitti Palace) depicts the gambols of the Child Jesus and Saint John with puppies. Rembrandt's two 'Ménage du Menuisier' (carpenter's home), in the Louvre and Petrograd, picture a combined living and workroom with Joseph at his bench and Mother and Child as central subjects; his painting in the Munich Gallery also brings Saint Joseph as carpenter into the scene.

Mater Amabilis.— The Madonna of Love. Some consider this the most popular type of the Madonna in Art. The depiction of a mother's love is one of the most endearing themes of the artist for all humanity. Raphael's sublime depictions, of course, lead in this type with his Madonna Tempi (Munich), in which the Virgin Mother presses her lips to the Child's cheek. His Conestabile (Petrograd) and Ansedei Madonnas and Babe peering in companionship into the Book of Wisdom belong here, also the Holy Family of Francis I, in which she stoops to lift the Child from the cradle and the Madonna della Sedia (chair Madonna) in the Pitti Gallery, Florence, embracing the Infant. Correggio's painting in the Uffizi really belongs to this series with the Virgin stooping over the Babe, and his Madonna del Cesta (of the basket) in the London National Gallery, named after the basket (*cesta*) lying on the floor; and his Madonna del Latte (Petrograd), also his Madonna della Scala (of the Staircase) in Parma are surely of this category. Titian sometimes created such a Mother of Love as in his 'Vierge au Lapin' (Louvre) in which she is calming a rabbit for her Child to play with, also the Madonna with Saints Ulfo and Brigida (Madrid) in which the Child is accepting a gift of flowers from the latter saint, and another in the Uffizi Gallery. Of pictures portraying the Holy Mother suckling her Babe there are a number, best known perhaps being the Madonna of the Green Cushion (Louvre) by Andrea Solario. And the Mother watching the sleeping Babe is another phase of the theme treated by masters of art, such as Raphael's Madonna of the Diadem (Louvre), others by Guido Reni (Rome), Sassoferrato, Carlo Dolce, etc. And among northern artists the Mater Amabilis has been pictured by Dürer, Holbein (Meyer Madonna), Rembrandt, Rubens, van Eyck, Schongauer. Among modern artists who have created fine pictures of this theme are Gabriel Max, Bouguereau, Carl Müller, N. Barabino, Dagnan-Bouveret, Guay, Macomber, Bodenhausen.

Madonna in Gloria.— The Madonna in the Sky. These usually represent a landscape below and the Madonna in the upper sky. In the Madonna dell Stella by Fra Angelico, in San Marco, Venice, a star is located over the head posed on the veil, the figure is full length surrounded by a mandorla of golden rays. The Madonna of Saint Sebastian (Dresden) has a surrounding of cherubs and clouds with saints below. Moretto (Brescian school) treated the theme traditionally, but very lovely is his Madonna of San Giorgio Maggiore, Verona, which shows very naturalistic effects in atmosphere above and depicts Saints Cecilia, Lucia, Catherine, Agnes and Barbara beneath; another of his is in the Berlin Gallery, a mandorla encompassing Mother and Child. Three paintings on this subject are in Venice by Gianfrancesco Caroto, also one by Cavazolla (Morando); these all are of the Brescia school. Tintoretto and Titian produced creations of this theme. Raphael gave us the Foligno Madonna (Vatican), which is greatly admired, but his Sistine Madonna (Dresden) brings us to the apex of highest inspiration with its majestic full-length figure in perfect poise and the charm of the cherubs surpasses all found in other depictions. Later came the selection of the crescent moon on which artists posed the Madonna in Glory; the exponents of this style are Albrecht Dürer, Sassoferrato (Vatican), Tintoretto (Berlin). Modern painters of the theme are Bouguereau, Bodenhausen, Defregger, etc.

Pietà.— This is probably the most popular and touching conception of the Madonna in Art. Every Roman Catholic church has one. It is the representation of the Virgin displaying the complete sacrifice. Francia's beautiful conception of the theme is shown in his painting in the London National Gallery, in which the outstretched limp body of the Crucified

One lies across the lap of the Holy Virgin while an angel on either side attends. Luini portrays the Head, crowned with thorns, falling back on the Mother's brow while she supports Him. The same scene with Saint John and Mary Magdalen attending is often termed a Pietà but correctly the groups should consist of Mother and the lifeless Savior, perhaps with angel or angels attending. Giovanni Bellini's painting in the Ducal Palace, Venice, shows the Crucified One being raised from the tomb by Mary, His head resting on her face, Saint John holds up His arm; another by this master is in the Uffizi Gallery. Crivelli painted two very pathetic Pietàs, one of which is in the Vatican. In the Pitti Palace is a Pietà by Fra Bartolommeo of most touching aspect. But Michelangelo's great group in the Vatican is said by many to be unsurpassed in its sublimity.

Mater Dolorosa.— The Divine Mother in anguish. This theme has called forth from the great painters facial expression of excruciating human agony of the most touching and pathetic depiction ever accomplished. The true pathos of sorrow displayed by the Spanish school is very prominent, Murillo's depictions excelling in their pictured anguish and tears. Tradition poses the hands clasped, the veil casting a shadow on the Virgin's head, the face, with its welling tears, glancing upward. At times the Madonna is placed at the foot of the Cross. For the most part the face is of middle age, except as with Michelangelo, who depicts youth and to a critic declared "Purity enjoys eternal youth"; Reni and later artists frequently depict a young maiden. Many of the paintings of the Mater Dolorosa type are but the head, others half-length figures. A beautiful example of Quintin Matsys' is in the London National Gallery. Many of the creations are disfigured by the unnecessary swords depicted as piercing the Virgin's bosom, referring, of course, to Simeon's prophesy. They are supposed to emphasize the pathetic subject — Vandyck uses the weapons.

Other phases of the Madonna theme pictured by masters are many but space forbids further description. Of such are the subjects known in the art world under the titles: "Purification," "Presentation to the Temple," "Assumption," "Last Judgment," "Seven Joys and Seven Sorrows of the Virgin," etc.

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MADOQUA, măd'ō-kwą, a diminutive antelope (*Cephalolophus abyssinicus*), one of the duiker-boks (q.v.), common in Abyssinia. The fore-parts are rufous, but gray is the prevailing hue. The same name is sometimes applied to other very small north African antelopes, as the Beni Israel.

MADRAS, British India, the capital of the presidency of Madras, on the Coromandel coast, lies on an open, sandy shore, exposed to the swell of the Bay of Bengal, which breaks upon the beach with great violence. It is 835 miles southwest of Calcutta. A modern harbor formed by two piers obviates the former dangerous passage through the surf. The city is built on level ground and with its nine suburbs occupies 27 square miles. The chief commercial portion is Black Town, now George Town, closely and irregularly built, containing the native and East Indian (or mixed) population, with a few European merchants and their families. On the south is the ancient Portuguese settlement Saint Thomé founded in 1504, with a Roman Catholic cathedral. One of the chief objects of interest is Fort Saint George, which commands George Town and the network of roads, and may be considered the nucleus of the city. It was built in 1639, and is admirably situated for the defense of the town and shipping. It contains a church, the barracks, and an arsenal. The government-house, the cathedral of Saint George and some of the other churches and public buildings, are handsome structures. Besides the university, the Presidential College and a medical college, supported by government, there are large missionary institutions. The public park, containing a small zoological collection, is the chief recreation ground of the city. From the meridian of the observatory connected with the university all India takes its time. Madras is the chief seat of the provincial government offices, of the Supreme Court, a board of revenue, marine board, etc. Notwithstanding the disadvantages of its position it is a place of great trade, and a new harbor has greatly tended to increase traffic. The landing and shipping of goods is effected partly by lighters to the pier-head inside the harbor, and partly by the old *massula* or surf-boats, which land their cargoes on the beach. The imports are chiefly manufactured goods from the United Kingdom, especially cottons, wines, spirits, metals, stationery, etc. Among the principal exports are cotton, grain, indigo, coffee, tea, hides, oil-seeds, dye-stuffs, pepper, etc. The chief industries are connected with the preparation of goods for export, such as coffee pressing and cotton cleaning. Cotton-spinning factories have been established at Madras. The country at a short distance from the city presents a remarkable contrast to its barren sandy shore, having the appearance of a fine park. The mean annual temperature is 82°, which rises in the hot weather to 96° in the shade. The city has railway communication with all the principal places of India, has good water supply and sewerage systems, is lighted by electricity and gas and is administered by a body of 32 commissioners.

Madras was founded in 1639 by the English, who obtained the grant of a piece of ground for the erection of a town and fort (Fort Saint George) from the Rajah of Chandgherry. It soon became a flourishing city and the chief station of the English on the Coromandel coast. In 1746 it was taken by the French, who kept it until 1749, when peace was made and the place was restored to the English by the Treaty of

Aix-la-Chapelle. In 1758 it was again besieged by the French under the celebrated Lally, who was obliged to retreat after a siege of two months. Pop. about 647,000, of whom 88 per cent are Hindus, 9 per cent Mohammedans and 3 per cent Christians.

MADRAS, mą-drăs', British India, a presidency occupying the southern portion of the Indian Peninsula. It stretches from the Bay of Bengal to the Arabian Sea, almost enclosing Travancore and Mysore, while a long, narrow portion extends along the west side of the Bay of Bengal till it meets the Bengal province about 70 miles from the mouth of the Mahánadi. It has a total area, excluding native states, of 142,260 square miles, the area of the native states being 10,696 square miles. Jaipur and Haidarabad bound it on the northwest, while the west borders for a short distance with Bombay. The chief mountain ranges are the Western Ghâts, the Eastern Ghâts and the Nilgiri Mountains. The principal rivers are the Godâveri and Kistna, with their tributaries; and the North Penner, South Penner, Palar, Kaveri, Coleroon and Vaiga. There are no lakes of any importance, but many salt lagoons or inlets of the sea. Extensive forests yield teak, ebony and other valuable timber trees. The wild animals are those common to other parts of India, the elephant, tiger, chetah, bear, bison, elk, spotted deer, antelope, jackal, wild hog, jungle sheep, etc. The climate generally is reckoned the hottest in India, but differs wildly in different localities according to elevation. Of the population, 71 per cent is engaged in agriculture, and 86 per cent of the cultivated area is under food crops. The soil along the coasts, particularly that of the Carnatic, is for the most part light and sandy; inland it consists of a decomposed syenite impregnated with salt, which in dry weather covers the ground with a saline efflorescence. The district of Tanjore on the banks of the Coleroon is esteemed the granary of southern India. The principal vegetable productions are rice, wheat, barley, maize and all the other grains common in India; sugarcane, areca, yam, plantain, tamarind, jack-fruit, mango, melons, cocoanuts and a variety of other fruits; ginger, turmeric, pepper, tobacco, hemp and cotton, for the growth of which the soil seems to be particularly well adapted. Tea is grown to some extent. Weaving is the only indigenous art of any consequence, and cotton cloth, muslins, carpets and silks are manufactured to a limited extent. The grand total of sea-borne trade for 1936–37 was rupees 661,000,000. Of external trade, 66 per cent is with the British Empire, and 33 per cent with the United Kingdom. The government of the presidency is vested in a governor subordinate to the governor-general of India. The revenue usually exceeds the expenditure, but the apparently healthy condition of the finances is largely illusory, as the presidency has been living on windfalls in the shape of grants from the Indian government. At the head of the educational institutions is the Madras University, an examining body, and since 1923 a teaching university, granting degrees in arts, law, medicine and engineering. There are various schools and colleges affiliated to the university.

The province is divided into 22 districts with a population of about 46,700,000. The native feudatory states of Travancore, Cochin, Banganapalle, Puddakotai and Sandur, with a total population of about 5,461,000, were in 1923 placed in direct relation with the government of India. The languages are Tamil, Telugu (spoken by the great majority of the inhabitants), Canarese and Malayalam, with lesser dialects spoken by the more barbaric tribes in the mountains; Mahrathi and Gujerathi in the northern and northwestern parts; Uriya in the northeast; while Hindustani is the language spoken everywhere by the Mohammedans. Capital, Madras (q.v.). See also INDIA.

MADRAS HOUSE, The, is not only an admirable example of the work of Granville Barker as a dramatist but also of the modern type of play written by, and for, those who conceive of the theatre as a place where it is permissible, even enjoyable, to *think* as well as to *feel*. It does not depend for its effect on thrilling situations, violent emotions or cunningly devised mystery but depicts the dramatic interplay of character and circumstance under normal conditions with a skill, insight and humor which afford even more pleasure, perhaps, to the reader than to the spectator. Of all the wide variety of human relations involved in the play, none are dealt with, so to speak, in actual crisis and there is a resulting lack of dramatic tension, but the author succeeds, nevertheless, in making one acutely conscious of the intensity and force of the emotions that underlie the surface not only of the play but of life. The two main themes are business and sex. The particular aspect of business which is presented is one that is unfamiliar in America, namely, the "living-in" system, inherited from the days of guilds and apprentices in England, under which clerks and other employees receive board and lodging as part of their wages. It is obvious that in a large "drapery establishment" employing both men and women, like the Madras House, such an arrangement would be likely to give rise to social complications. The business theme, therefore, although open to the reproach of being local in its application, may boast the charm of novelty for Americans. The sex interest, on the contrary, is of the familiar, universal, all-pervading variety. It inter-penetrates the life of the conventional suburban family, into which we are introduced in the first act; it comes frankly to the fore in the second, in the case of Mr. Brigstock, "third man in the hosiery," and one of the "lady shop assistants"; it pulls the strings during the sale of Madras House to an American millionaire in the third act; and it looms largest of all in the last act, in which that unconscionable old lady-killer, Constantine Madras, finally renounces his family and the trammels of conventional morality and turns Mohammedan. In this, as in his other plays, Barker, following Bernard Shaw's lead, omits the customary list of *dramatis personæ* and introduces his characters in a sort of literary preface to each act which is no less interesting and illuminating than the dialogue. "The Madras House" was written in 1910 and was first produced at the Duke of York's Theatre in London on 9 March of the same year under the direction of the author.

MADRAZO, mä-drä'thō, **Raimundo de,** Spanish painter: b. Rome, Italy, 24 July 1841; d. 1920. He studied under his father, Federigo de Madrazo, and Léon Cogniet in Paris. He was very successful in portrait and genre and numbered many prominent Americans among his sitters. He was equally happy in pastel and oils, and his 'Fête during the Carnival' in Mrs. W. K. Vanderbilt's collection is as brilliant in conception as in technique. Among his most celebrated portraits are those of the Queen Regent of Spain; the Countess Pillet-Will; Mrs. Cornelius Vanderbilt; Mrs. Whitney; Miss Anne Morgan; Madame Madrazo; Samuel P. Avery. 'The End of a Masked Ball' was awarded a first class medal at Paris in 1878 and was subsequently purchased by W. K. Vanderbilt. Other genre works all of a high order are 'Fête during the Carnival'; 'Girls at a Window' (both in Metropolitan Museum, New York); 'Lady with a Parrot' (purchased by W. A. Clark, New York); 'Lady with Guitar'; 'Déjeuner of the Infanta'; 'Pierrette.' Madrazo was made commander of the Legion of Honor. His brother, Ricardo (b. 1852), was also a pupil of his father and achieved some success as a portrait and genre painter.

MADRAZO Y KUNT, Federigo de, Spanish painter: b. Rome, 12 Feb. 1815; d. Madrid, 11 June 1894. His father, José de Madrazo y Agudo (1781–1859), was a painter of note and from him Federigo received his early instruction. Subsequently he studied under Winterhalter at Paris. His early works are 'The Resurrection of Christ' (1829); 'Achilles in his Tent'; 'The Continence of Scipio' and portraits of Baron Taylor and Ingres; 'Godfrey Proclaimed King of Jerusalem' (1837). Thereafter he went to Rome and while there painted 'Maria Christina' (1843); 'Queen Isabella'; 'The Duchess of Medina-Cœli'; 'Countess de Vilchès' (1847), and several portraits. In 1873 he was elected foreign member of the Paris Academy of Fine Arts. After his father's death he became director of the Prado Gallery and director of the Academy of San Fernando. He founded *El Artista,* the pioneer of Spanish art journals; it was followed by *El Renacimiento* and *El Semanario pintoresco.* Of his later works the best known are the genre pieces, 'The New Song'; 'The Cigarette'; 'The Musical Matinee,' etc. His brother, Louis de Madrazo, was also a painter. His best work is 'The Burial of Saint Cecilia' (1855).

MADRE DE DIOS, mä'drĕ dĕ dē'oos, or **AMARU-MAYU,** Bolivia, a river, the chief affluent of the Beni, rising in the Carabaya Mountains, Peru, about 50 miles east of Cuzco, and after an easterly course, south by north, of 900 miles, chiefly through the Bolivian department of La Paz, uniting with the Beni at Rivera Alta, where it is 1,500 yards wide. It was explored in 1865 under the auspices of the London Geographical Society, and since 1881 has been the highway for the exploitation of the rubber forests along its course.

MADREPORE, a genus of coral-forming polyps (see Coral and Coral Islands) containing numerous species from the warmer and tropical seas of all parts of the earth. The true Madrepores increase by budding, the result being usually large branching colonies in which the coral between the cups containing the polyps is perforate and spiny. The different species frequently attain large dimensions and constitute one of the most important elements in the formation of coral reefs. The polyps have 12 septa and 12 tentacles, 6 being large, the other 6 smaller, while a peculiar feature is the presence of 6 U-shaped tubes connected with the œsophagus at either end. The term *Madreporaria* is sometimes used to include all polyps in which the parts are arranged in multiples of six, and which secrete coral on the external surface of the body.

MADRID, ma-drid' (Sp. mä-drēd'), Spain, the capital of the republic and of the province of Madrid, a part of New Castile, situated near the centre of the country, on the left bank of the Manzanares, a sub-affluent of the Tagus. It is built on several low and irregular sandhills on a plateau 2,140 feet above sea-level, and is surrounded by a barren and extensive plain, treeless save in the vicinity of the city, and stretching northward to the snow-capped Sierra de Guadarrama. In winter the climate is exceedingly severe, and even in summer, when the heat is excessive, piercingly cold blasts descend from the mountains. The prevailing winds are the parching southeast *Solano,* and the icy north wind from the Guadarrama. The climate is described in a Spanish proverb as "three months of winter and nine months of hell." The temperature ranges from 18° to 105° F.; is subject to frequent and sudden changes; and between the sunny and shady sides of a street the difference of temperature is sometimes as great as 20°. Madrid was until recently surrounded by a wall 20 feet high, pierced by 5 large and 11 small gates; of these gates 3 remain: the Puerta de Alcala on the east, the Puerta de Toledo on the south, and the Portillo de San Vicente on the west. The streets are distributed somewhat irregularly around the Puerta del Sol, which is in the centre of the capital. The principal streets are broad, long and airy; and the houses are in general well constructed, substantial and of good appearance.

In common with most European capitals, Madrid has undergone much modern improvement; the streets are traversed by electric and horse car lines; are lighted by gas and electricity; the telephone system is efficient; and sanitation has been much improved. The former abundant and pure water supply, is, however, inadequate to the demands of the growing population. Madrid has no edifices of great antiquity. The royal palace, situated at the western extremity of Madrid, is one of the most magnificent in the world. It occupies the site of the original Alcazar (castle) of the Moors, and is of enormous extent, being 470 feet each way, and 100 feet high. The architecture is a combination of Ionic and Doric. It contains a small but splendid Corinthian chapel, and a library of nearly 100,000 volumes, and the armory is one of the finest in the world. The Chamber of Deputies, which occupies an area of 42,700 square feet, has a hexastyle Corinthian portico on the grand façade, destined for the entrance of royalty on state occasions. On the two lateral façades are the entrances for the members. The Royal Exchange and the Bank of Spain are two modern imposing buildings.

Madrid stands far behind many provincial towns as regards its churches, which are, with exception of a few attached to conventual establishments, poor and of indifferent artistic merit. The church of San Jeronimo el Grande is probably the most distinctive. The most important of the charitable institutions are the military hospital, an extensive building in the northwestern corner of the city; and the Hospicio of San Fernando, with schools for both sexes, the pupils being taught various handicrafts. At the southeastern corner of the city stands the general hospital. There are also hospitals for orphans and for foundlings, and numerous charities, mainly of a religious kind.

Madrid has 72 public squares, which are generally irregular both as regards their form and their edifices, as well as deficient in decorative monuments. Of these the Plaza Mayor is one of the largest and most regular. The Plaza de Oriente is adorned with 40 statues of Gothic kings, as well as those of the Asturias, Leon, Castile and Aragon. In the centre is a fine equestrian statue of Philip IV. Among places of amusement the most popular is the Plaza de Toros (bull-ring), a building which is about 1,100 feet in circumference, and capable of containing 12,000 spectators. The Prado, a sort of wide boulevard, about two miles long, running north and south on the east of the city, is the chief promenade, and beyond it is the chief public park, including the Buen Retiro gardens, near which are the new handsome building for various ministerial departments and the new station of the Southern Railway Company. The Royal Picture Gallery which stands in the Prado contains more than 2,000 pictures, including a great many by all the best masters, especially those of Spain. There are also good pictures in the Academy of Fine Arts. The National Library, founded by Philip V, contains 650,000 volumes. The Library of San Isidoro consists of 66,000 volumes. The University of Madrid (the most important in Spain) which arose out of that of Alcalà de Henares, founded in the 15th century, has an average attendance of 5,000 students. There are besides numerous other schools, academies and colleges, public and private, including a normal school, a deaf and dumb institution, a normal school for the blind, a commercial school, schools for engineers, a conservatory of music, an academy for the fine arts with a picture gallery, a veterinary college, an academy of medicine and surgery, etc. The famous monastical and palatial Escorial (q.v.) is 27 miles northwest of the city.

The industries have shown a remarkable development during the last decade, the chief manufactures being tobacco, leather goods, chocolate, beer, shoes, boots, plated ware, coaches, gloves and fans. There is a royal carpet and tapestry factory in the Pacifico suburb. The commerce is important, as Madrid is the entrepôt for all the interior provinces. Retail business is mainly in the hands of foreigners, mostly French, but most of the wholesale trade is carried on by native houses. Madrid has railway communication with Paris and Lisbon, and the chief cities of the Peninsula.

Madrid in the Roman period probably was the insignificant hamlet Majoritum. Under the name Majorit it appears as a Moorish outpost of Toledo when captured in 932 by Ramiro II of Leon. Henry IV about 1461 made some additions to the older town, which was placed on the western eminence over the river. Madrid only began to be a place of importance under Charles V. Declared the seat of the court by Philip II in 1560 the city rapidly grew up at the expense of the older and better situated capitals. It was the creation of a century, and its increase was very slow after the age of Philip IV. The gross mistake of a position which has no single advantage except the fancied geographical merit of being in the centre of Spain was soon felt, and on Philip II's death his son, in 1601, endeavored to move the court again to Valladolid, which, however, was found to be impracticable. The French under Murat entered Madrid in 1808 but soon evacuated it. The French held it again from 1909–12 when Wellington took it and restored it to the Spaniards. After 1873 it suffered greatly from civil struggles and in 1937 it was besieged by Generalissimo Franco, but the city held out through bombardments and air attacks until May 1939 when the Loyalist government surrendered it to the insurgent Nationalists. The population of the city in 1934 was 1,048,072 and that of the province, which has an area of 3,084 square miles, was 1,535,322. No population figures were available after the civil war, 1937–39.

MADRIGAL, a short lyric poem generally on amatory subjects. Those of Tasso represent the finest specimens of Italian poetry.

MADRONA, a large and ornamental tree of California (*Arbutus menziesii*), of the heath family, which often grows nearly 100 feet in height. It has a wide-spreading head, small evergreen leaves and the limbs and large parts of the trunk, where the thin outer bark easily peels off, are bright red. It grows in the foothills, and up to a moderate elevation, but not naturally in the valleys. It is a near relative of the strawberry tree of Europe.

MADSTONE, a vegetable substance or stone which when applied to a wound caused by the bite of a mad dog is said to prevent hydrophobia. The most famous one in the United States is owned by the descendants of a family named Fred, in Virginia. This stone was brought over from Scotland in 1776. It is said to be the one spoken of by Sir Walter Scott in 'The Talisman' and has been religiously preserved as one of the most valuable relics of the age. It is about two inches long by one inch broad, and about half an inch thick, and is of a chocolate color. When applied to the wound it adheres till all the poison is absorbed, when it drops off. It is then soaked in warm milk or water for a time, and when removed the liquid is found to be full of a greenish-yellow scum. It is said that of the 130 cases in which it has been applied for the bite of a mad dog, none ever suffered from hydrophobia. There are said to be three authenticated madstones in the United States.

The belief in a madstone was common hundreds of years ago in the East, and travelers in India in 1677 and 1685 make mention of it. Tradition said it grew on the head of certain snakes. George F. Kunz, a New York expert in gems, identifies the madstone, or snakestone, of the East, with the stone known as tabersheer, which is a variety of opal found in the joints

of the bamboo in Hindustan and Burma. This stone is formed of juice which by evaporation becomes mucilaginous, then a solid substance, and when placed in the mouth will adhere to the palate or cause water to boil. Sir David Brewster says it is found in the joints of diseased corn-stalks and is formed by sap depositing silica.

MADURA, mä-doo'rä, southeastern Asia, an island of the Malay Archipelago, Dutch East Indies, off the east end of Java, from which it is separated by the Strait of Madura. The island is about 105 miles long east to west, and 30 miles broad, with an area of 1,770 square miles. Madura forms one of the 17 Dutch residences or provinces into which Java and Madura are divided, and is administered by a governor or resident. The Dutch first landed in Madura in 1747. It is undulating but not mountainous, and though in general well watered, in some places, especially on the coast, there is a want of water, and the soil is unfertile. The interior, however, is fertile, though not so productive as Java. Maize, cocoanuts, tobacco, Jamaica pepper, tamarinds and salt are the chief products; stock-raising is an important industry; and the exports include also birds'-nests, country cloths, white and striped, poppy-oil, rattan-mats and baskets, etc. The chief towns are Bangkalang (pop. 24,000), Pamekasan (the capital, pop. 22,000), and Sumanap. Pop. 1,843,601, of whom 4,734 were Chinese and 621 Europeans.

MADURA, southern India, the capital of a district of Madras, 344 miles by rail southwest of Madras. It was the capital of the ancient Pandhyan kingdom, for over 2,000 years was the political and religious capital of southern India, and is noted for its interesting architectural monuments, chief of which is the Temple of Minarchi, dating from almost prehistoric times, restored and added to by Tirumulla Nayak (1622–62). It ranks fourth among the seven strongholds of Hinduism, and occupies a parallelogram of 56,000 square feet containing 50 buildings. The city was known to the Greeks and Romans. Cotton and tobacco manufactures and coffee mills, are the principal industries. Madura is the seat of Catholic and American Protestant and other missions, and has several high-grade educational institutions. Pop. 182,018.

MADVIG, mäd'vig, **Johan Nikolai**, Danish scholar: b. Svanike, island of Bornholm, 7 Aug. 1804; d. Copenhagen, 13 Dec. 1886. Educated at Frederiksborg and Copenhagen, he was from 1829 till 1879 professor of Latin in the University of Copenhagen. He took a profound interest in the politics of his country, and from 1848 till 1851 was Minister of Education and Religion. He is best known by critical editions of Latin classics and by his Latin grammar translated into English and most European tongues. His chief works are 'Emendationes in Ciceronis Libros Philosophicos' (1828); 'Cicero's De Finibus Bonorum et Malorum' (1839, amended 1876); 'Ciceronis Orationes Selectæ Duodecim' (1830); 'Cicero's Cato Major and Lælius' (1835); 'Opuscula Academica' (1834–42; new ed., 1887); 'Emendationes Livianæ' (1860); 'Livii Opera' (with Ussing, 1861–66); 'Adversaria Critica' (1871–84); 'Latin Grammar' (1841); 'Greek Syntax' (1846); 'Constitution and Administration of the Roman State' (1881–82); 'Autobiography' (published posthumously, 1887). Consult Sandys, J. E., 'A History of Classical Scholarship' (Cambridge 1908).

MÆANDER, mē-ăn'dẽr, now **MENDERES**, a river of Asia which arises in Phrygia not far from Celænæ. It forms the boundary between Caria and Lydia, and flows into the Icarian Sea between Priene and Myus, opposite Miletus. It covers a course about 200 miles long, is deep and narrow, and navigable only for small vessels. It was celebrated among the ancients for its winding course, and gave its name to the intertwined purple borders on mantles and other dresses, as well as upon urns and vases.

MÆANDRINA, mē-ăn-drī'nä, one of several genera of brain corals, so called from the elongate and meandering cups containing the polyps, which give a spherical mass of these corals an appearance strikingly like the human brain with its convolutions. This appearance is due to the fact that the polyps in their growth do not completely divide, but stretch out into long bands, frequently branching, with many mouths and tentacles, and a common body and digestive cavity. Brain corals occur in all tropical seas, several species being found in Florida and the West Indies. Their solid masses make them important factors in the formation of coral reefs.

MÆCENAS, mē-sē'näs, **Gaius Cilnius**, Roman nobleman: b. between 73 and 63 B.C.; d. 8 B.C. He was the friend of Augustus, and patron of Virgil and Horace. It is unknown where he received his education, but he was intimate with the literatures both of Greece and Rome, and was himself an occasional writer in prose and verse. We first hear of him authentically (40 B.C.) as negotiating a marriage between Octavianus and Scribonia; and in the same year he contributed materially to bring about the Peace of Brundisium, by which Octavian and Antony were reconciled. Two years later he was again employed in reconciling these self-willed potentates; and 36 B.C. he was twice dispatched by Octavian from Sicily to Rome to quell disturbances which had broken out there. He was for these services entrusted with the administration not only of Rome, but of all Italy, when Octavian became emperor with the title of Augustus. His palatial residence and gardens on the Esquiline were the rendezvous of all the *literati* of Rome, and of numerous parasites. But those admitted to his intimacy were the greatest geniuses and scholars of Rome, among them being Virgil and Horace. To the intercession of Mæcenas, Virgil was indebted for the recovery of his farm, and Horace also owed to him many favors. Consult Baehrens, 'Fragmenta Poetarum Romanorum' (Leipzig 1886); Harder, F., 'Fragmenta des Mäcenas' (Berlin 1899).

MAELAR, Lake of. See MÄLAR.

MAELSTROM, māl'strŏm, or **MOSKOESTROM**, Norway, a rapid current or tidal whirlpool off the northwest coast immediately southwest of Moskenesoe, the southernmost of the Lofoten Isles. The current runs with the tides alternately, six hours from north to south and six hours from south to north, producing

immense whirls. The depth of the water around does not exceed 20 fathoms, though immediately to the west the soundings are from 100 to 200 fathoms. When the wind is northwest and opposed to the reflux of the waves it attains its greatest fury, but in ordinary circumstances it may be traversed without difficulty. An imaginative description was given by Edgar Allan Poe in *A Descent into the Maelstrom.*

MAENAD, mē′năd, (Greek, mad woman), in Greek mythology, one of the alternative names for the Bacchaes, the frenzied female companions of Bacchus (q.v.) or Dionysus.

MAERLANT, mär′länt, **Jacob van,** Flemish poet: b. near Bruges, 1235? d. Damme, Belgium, ?1300. Besides writing original poems, he made free translations of French romances into rhymed verse. He rendered the *Biblia Scolastica* of Petrus Comestor into a rhymed Biblical history, but his most ambitious work was *The Mirror of History,* inspired principally by the *Speculum Historiale,* of Vincent of Beauvais. Maerlant, who founded the didactic school in the Netherlands, was one of the most learned men of his time.

MAES or **MAAS,** mäs, **Nicolaes,** Dutch genre and portrait painter: b. Dordrecht, 1632; d. Amsterdam, Nov. 24, 1693. He entered the studio of Rembrandt at Amsterdam about 1650 and studied there about four years, attaining a style of execution and coloring so similar to that of his master that many of his paintings were for a long time believed to be Rembrandt's work. He returned to Dordrecht in 1654, and in the succeeding 10 years he did his best work, which retained the influence of Rembrandt, particularly in coloring. From the time of his going to Antwerp in 1665 his style changed and he abandoned the domestic genre type of work for that of portraiture, and his subsequent pictures show the influence of Van Dyck. So different were the characteristics of the two periods that at one time it was believed that there were two artists of the same name. Of his earlier and better period notable examples are *The Reverie*; *Card Players*; *The Eavesdropper*; *Young Girl Peeling an Apple*; *Hagar's Departure,* long believed to be a Rembrandt and *The Listening Girl.* Numerous other examples exist in the galleries of Berlin, Brussels, Munich, The Hague, Frankfort, and Hanover.

MAESTRICHT. See MAASTRICHT.

MAETERLINCK, mä′tĕr-lĭngk, COUNT **Maurice,** Belgian poet, dramatist, and essayist: b. Ghent, Aug. 29, 1862; d. at his villa on the French Riviera, near Nice, May 6, 1949. He was educated in a Jesuit school in Ghent, and at the university, and in 1886 he was admitted to the bar. On a visit to Paris the next year he came under the influence of Philippe Villiers de l'Isle Adam (1838–1889) and other writers of the symbolist school, and soon thereafter gave up the law to devote himself to literature. He settled in Paris in 1896 but retained his citizenship as a Belgian. In 1911, he was awarded the Nobel Prize for literature, and during World War I he engaged in relief work in France and Belgium; on his 70th birthday the king of the Belgians raised him to the rank of count. He had visited the United States on a lecture tour in 1919, and in 1940, following the surrender of France in World War II, he visited New York City, returning to France several years later to pass the rest of his life writing his memoirs. His works, comprising lyric verse, dramas, and philosophical essays, were written in French, and many of them achieved an international reputation; a large number are available in English translation. While his verse is imaginative, it lacks in any strong degree the melodic quality. Superlatively praised and extravagantly censured, Maeterlinck has described his plays as written for marionettes, and his prose as verse in solution. As a rule his plays depend on mood rather than movement, suggestion of the event rather than its presentation; they are attempts to clothe mystical conceptions in concrete form. His chief absorption is with the mystery of life. The marks of his method have been described as parallelism, symbolism, suggestion, and the use of realistic means for romantic effects. To many, the essays are his ultimate test as a force in literature, the most interesting things that Maeterlinck did. Plays translated into English comprise: *The Princess Maleine* (1892); *Pelleas and Melisande* (1892); *Alladene and Palomedes* (1898); *Aglavaine and Selysette* (1899); *The Death of Tintageles* (1899); *The Blue Bird* (1909); *Betrothal* (1912); *The Wrack of the Storm* (1916); *The Burgomaster of Stilemonde* (1918). English translations of his essays and philosophical works are: *The Treasure of the Humble* (1897); *Wisdom and Destiny* (1898); *The Buried Temple* (1902); *The Double Garden* (1904); *The Life of Space* (1922); *The Magic of the Stars* (1930); *The Hour Glass* (1936). Works on natural history in English translation comprise: *The Life of the Bee* (1901); *The Life of the White Ant* (1926); *The Life of the Ant* (1931); *Pigeons and Spiders* (1936); *The Great Beyond* (1947); and an autobiographical book of memoirs entitled *Blue Bubbles* (1949).

MAEVIAD AND BAVIAD. See BAVIAD.

MAFEKING, măf′ŭ-kĭng, Union of South Africa, town of the Cape of Good Hope province, approximately 750 miles northeast of Capetown. Standing at an elevation of 4,194 feet above sea level, it is close to the border of the Bechuanaland Protectorate; it contains the administrative headquarters of that protectorate, and thus is in the unique position of serving as the capital of a country beyond its frontiers. Mafeking is also the headquarters of South Africa's railway system between Kimberley and Bulawayo, and it is the chief business center for the western Transvaal and Bechuanaland Protectorate. The surrounding district is pastoral, and the town contains creameries and malt and cement works. A mile distant from the town proper, on either side of the Milopo river, is the native *stad,* or town, which serves as headquarters of the Barolong tribe; the chiefs retain administrative and judicial powers there. Mafeking was founded in 1885, after a force under Sir Charles Warren (q.v.) had suppressed the republics of Stellaland and Goshen and effected the annexation of British Bechuanaland (that part of the Cape province in which Mafeking lies). The town was the starting place of the Jameson Raid (see JAMESON, SIR LEAN-

DER STARR), and was the base of subsequent operations against the Matabele. During the South African War a British force under Col. Robert S. S. (later Baron) Baden-Powell (q.v.) was besieged in Mafeking from Oct. 12, 1899, until May 17, 1900. Pop. (1936) 4,666.

MAFFEI, mäf-fâ'ē, MARCHESE **Francesco Scipione di,** Italian dramatist and archaeologist: b. Verona, June 1, 1675; d. there, Feb. 11, 1755. He studied at the Jesuit College, Parma, for five years, and from 1698 at Rome. During 1703–1704 he served as a volunteer in the war of the Spanish succession, being present at the battle of Höchstädt on the Bavarian side. His literary career commenced in 1710 with publication of *Della scienza cavalleresca,* a noteworthy censure of duelling. He was one of the founders of the *Giornale dei litterati,* and he edited, with introductions, some of the best plays of the Cinquecento (q.v.). In 1713 appeared his own play *Merope,* since frequently reprinted, one of the most brilliant successes achieved in the history of dramatic literature. While it lacks a love motif, it is considered a masterpiece of Italian tragedy. Voltaire adapted it for the French stage, declaring it "worthy of the most glorious days of Athens," and it inspired Home's celebrated English drama *Douglas.* His versatility and scientific attainments are shown in subsequent work which include *Teatro italiana* (1723–1725); *Storia diplomatica* (Mantua 1727); *Le Ceremonie* a comedy (1728); and *Verona illustrata* (1732). From 1732 he spent four years in travel in France and England, returning by way of Holland and Germany, and wrote *Galliae Antiquitates* (Paris 1733); *Storia teologica* (Trent 1742); *Dell' impiego del denaro* (1746), justifying loans on interest; and *Arte magica* (1749–1754). He was also associated with Maratori in the great collection of the *Rerum italicarum scriptores* which occupied 15 years and were published in 25 folio volumes (1723–1738). A complete edition of Maffei's works were published in 21 volumes (Venice 1790); and selected *Opusculi litterari* (Venice 1829; Milan 1844). See MEROPE.

MAFIA, mä'fē'ä, third largest island off the east African coast, 11 miles from the mouth of the Rufiji River. It was within that portion of the domains of the sultanate of Zanzibar transferred in 1888 to German East Africa (later Tanganyika Territory). The island, 170 square miles in area, is fertile, supporting large numbers of coconut palms. At Tirene Bay, on the southwest of the island, is the principal harbor, a poor one, and Chobe, the largest village. Traces of early settlement by Arabs have been found at Kua, on the neighboring small island of Dshuani.

MAFIA, or **MAFFIA,** mä-fē'ä, in Sicily, a spirit of lawlessness prevalent among a section of the inhabitants; in a collective sense, those who share such spirit. In popular usage, Mafia came to be regarded as a form of organized criminality operating through a secret society akin to the Camorra (q.v.), but the organization was quite elastic. Its origins are traced to the ill-disciplined forces of gendarmerie instituted in Sicily by Ferdinand IV. The members, known as Mafiosi, were required to prove their daring in a knife duel; they accepted a primitive code of honor, and were sworn to defy all established forms of justice. The movement partook of the nature of the vendetta (q.v.). Reaching its highest pitch about 1860–1870, the Mafia carried on robbery, smuggling, and murder; strongest in and around Palermo, it showed itself also in Italy, and attempts at suppression were made in 1874–1875. The influence of the Mafia was felt among the Italian born population of the United States; various outrages were attributed to the Mafiosi, notably at New Orleans, La., in 1890 and 1895. In Sicily, the Mafia was broken up in 1928 by Mussolini and Cesare Mori, prefect of Palermo.

MAFRA, mä'frä, Portugal, a town in Estremadura province, 20 miles northwest of Lisbon (Lisboa). Its principal architectural feature is a huge monastery which, with cloister and church, was built by John V between 1717 and 1732 to replace a small Franciscan friary. The monastery, modeled after the Escorial, contains more than 800 rooms. The church, richly built and lavishly decorated, has twin towers each containing a chime of 57 bells.

MAGADI, mä-gä'dē, a "lake" in Kenya Colony, East Africa, the surface of which is solid, being entirely composed of carbonate of soda. It lies at an elevation of 1,978 feet above sea level, southwest of Nairobi and immediately north of the border of Tanganyika Territory. Bore holes put down to a depth of 10 feet over an area of 30 square miles has proved some 40 million surface tons of carbonate of soda, and the total deposit is estimated to amount to 200 million tons.

MAGALHAES, mä-gä-lyāēs', **Domingo José Gonçalves de,** VISCOUNT OF ARAGUAYA, ä-rä-gwī'yä, Brazilian poet and diplomat: b. Rio de Janeiro, Aug. 13, 1811; d. Rome, Italy, July 10, 1882. He was educated in medicine, but entered upon a diplomatic career in 1836, when he became an attaché at the Brazilian embassy in Paris. From 1859 till 1867 he was minister at Vienna, and for the next four years he was ambassador at Washington, D.C. At the time of his death he was ambassador at Rome. He began the writing of verse at an early age and attained a considerable reputation, being regarded as the leader of the romantic school of Brazilian poetry. His more important works were *Suspiros poeticas* (1836); *A Confederação dos Tamóios* (1857); *Mistérios* (1858); *Urânia* (1862). In 1834 he published a literary history of Brazil. His *Obras completas* were published in Paris in 1864.

MAGALHAES, Fernando de. See MAGELLAN, FERDINAND.

MAGALLANES, mä gä yä'nās, Chile, a territory lying in the southern extremity of the republic, south of lat. 47° 50′ S. It comprises all mainland between the Pacific and the frontier of Argentina, together with all islands off that coast; the latter include most of the Fuegian archipelago and the western portion of Tierra del Fuego. The total area is 52,271 square miles. The islands are barren, but there are extensive forests on the mountainous mainland. Beautiful bays and fjords are characteristic of the coasts. The climate

is disagreeable and stormy. The animal life is not abundant; the seal and sea-otter frequent the coast and in the sheltered regions east of the Andes cattle, horses and sheep are raised. Coal has been found in the southern part and there are also copper and gold mines. The capital is Punta Arenas. Pop. 29,000.

MAGDA. Sudermann's 'Heimat' ("Home") was the sensation of the theatrical season 1889–90 in Berlin, and the play, either in the original German or in translations commonly bearing the title 'Magda'— the name of the heroine — is probably to be regarded as the most widely known and the most successful drama of the end of the century. Its success is traceable to at least four causes: its theme of revolt against paternal tyranny is one to which the times were sympathetic, its construction is skilful and in every sense theatrical, it contains a number of picturesque episodes and amusing characters, and is distinguished for animated dialogue; but most of all, its heroine is an unconventional, self-assertive, and emotional "new woman" who affords an actress an unusual opportunity for temperamental display. The technique is a clever combination of the naturalism of Ibsen and the methods of the *drame à thèse* familiar in the works of Dumas *fils*. The conventional *raisonneur* — in the person of the Pastor Heffterdingk — mediates between Magda and her father, and debates with each the problems presented by the situation of a prodigal daughter who returns home after a life of moral irregularity but operatic success. We are bidden to despise respectability and admire independence. But the representative of each side is far from being an acceptable champion. Magda's father fails to recognize the difference between a child with duties and a human being with rights, and Magda reveals no conception of the fact that duty is only in part a social obligation and is in its innermost essence an obligation of self-respect. Translated by C. E. A. Winslow (Boston 1896); edited by F. G. G. Schmidt (Boston 1909).

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MAGDALA, măg'dą-lą, or **MAKDALA,** Abyssinia, fortified town on the plateau of Talanto in Shoa, 72 miles northeast of Debra Tabor. The original fort was built on an isolated rock 3,300 feet above the Beshilo, and was stormed and wholly destroyed by the British troops under Sir Robert Napier 13 April 1868, Sir Robert becoming Baron Napier of Magdala in recognition of the achievement. The natural strategic advantages of the position, however, caused the fort to be rebuilt and the town has acquired considerable importance. Altitude, 9,110 feet. Pop. about 4,000.

MAGDALEN, măg'dą-lĕn, a name applied to one of the Marys in the Gospels, derived from her place of birth, or former residence, in order to distinguish her from other women of that name (Matt. xxvii, 56, 61; Mark xv, 40, 47; Luke viii, 2; John xix, 25).

MAGDALEN (môd'lĭn) **COLLEGE,** Oxford, England, originated in Magdalen Hall, founded in 1448 by William Patten, commonly called William of Waynflete, from the place of his birth, bishop of Winchester and Lord Highchancellor of England, who 10 years later added the College of Saint Mary Magdalen. In some respects Magdalen is the most noteworthy college of the university. Five of the fellowships are attached to five Waynflete professorships, of moral philosophy, chemistry, mineralogy, physiology and pure mathematics, established in lieu of the three former lectureships of divinity, moral philosophy and natural philosophy. There is also a professorship of botany. The buildings are noted for their beauty and occupy extensive grounds. Among Magdalen's celebrated alumni are Addison, Camden, Foxe, Gibbon, Hampden, John Lyly, Sacheverell, Selborne, Tyndale and Cardinal Wolsey. Consult Wilson, 'Magdalen College' (1899); Glasgow, 'Sketches of Magdalen College' (1901).

MAGDALEN (măg'dą-lĕn) **ISLANDS,** Quebec, Canada, near the centre of the Gulf of Saint Lawrence, 54 miles northwest of Cape Breton, Nova Scotia, and 100 miles southwest of Newfoundland. Amherst, Alright, Coffin, Wolf, Grindstone, Deadman, Entry and Byron islands compose the group which are politically attached to the district of Gaspé, Quebec. The inhabitants exist chiefly by the fisheries of the adjacent waters; gypsum which is found in veins and hollows, and grindstones from Grindstone Island, are exported. House Harbor on Alright Island, and Amherst where there is a custom house, are the chief settlements. Pop. about 5,000.

MAGDALENA, măg-dä-lā'nä, a river of Colombia, South America, which has its rise in the Andes Mountains in the southwestern part of Colombia, and flows north to the Caribbean Sea. A short distance from the sea, at the city of Barranquilla, the river divides and discharges its waters through two channels. It is about 1,000 miles in length. It is navigable for ocean steamers to La Dorada, 592 miles from Barranquilla, and for small steamers to about 900 miles from its mouth. Magdalena River is the principal route from the sea to the interior of the country, and the work of clearing and canalizing both the upper and lower parts of the stream has greatly increased its importance and value as a means of communication and transportation. Bogota (q.v.), the capital, is largely dependent upon this river for means of communication with places on the coast. The largest tributary is Cauca, whose source is near that of the Magdalena, and part of its course is almost parallel with the main river. Short railroads connect some of the interior towns with the river and its tributaries.

MAGDALENA (măg-dą-lē'ną) **BAY,** an inlet on the west coast of Lower California, in Mexico, one of the best harbors on the Pacific Coast. The inlet or arm of the sea is about 40 miles long and 12 miles wide and is protected by a long, low sand-bar. A town of the same name is situated on the harbor.

MAGDALENE (măg'dą-lĕn) **COLLEGE,** Cambridge, England, was founded in 1542 by Thomas, Baron Audley of Walden, in place of Buckingham College, established by Edward, Duke of Buckingham, in 1519, which had succeeded a monks' hostel for students founded in 1428. There are seven open fellowships on the foundation, and 12 open scholarships. There

are also several exhibitions. The annual Pepysian benefaction, value £50, is in the master's gift, and is usually bestowed upon poor and deserving students. The buildings consist of two courts, restored and altered in 1880, a chapel and hall dating from the 15th century and the Pepysian Library, built in 1688. Samuel Pepys, Charles Kingsley and Charles Stewart Parnell were educated at Magdalene College.

MAGDALENIAN STAGE, a period in the history of Paleolithic man in southwestern Europe when humanity lived largely in caves (wherefore these people are called «cave men»). They had attained a remarkably high degree of skill in the graphic arts, and adorned the interior of caverns with paintings and many objects with engravings of animals and other subjects. See STONE AGE.

MAGDEBURG, măg'dĕ-boorg, Germany, city, capital of the Prussian province of Saxony, on the Elbe, about 88 miles southwest of Berlin. The manufacturing and trade of Magdeburg are extensive, and its facilities for transportation by water and railroad are excellent. Among its industrial establishments are the Gruson Works, noted for their connection with the Krupp Works, the beet-sugar factories and a number of other establishments. It has a large number of excellent schools, gymnasia, a pedagogical seminary, art schools, industrial schools, etc. Magdeburg is a place of great antiquity, being a trading centre in the 9th century. It early distinguished itself in the Reformation. During the Thirty Years' War the town was besieged, stormed and sacked by Tilly, when 20,000 persons are said to have been murdered. Pop. (1925) 292,290. Consult Wolter, 'Geschichte der Stadt Magdeburg' (3d ed., Magdeburg 1901); Dodge, 'Gustavus Adolphus' (New York 1906).

MAGDEBURG CENTURIES, a Protestant history of the Christian Church by centuries, written in Latin in 1562 by Matthias Flacius of Magdeburg and other Lutheran theologians. It first appeared as 'Historia ecclesiæ Christi' (7 vols., Basel 1559–74); a German translation of the earlier part also appearing (Jena 1560–65). German Protestant princes bore the cost of publication. The 'Ecclesiastical Annals' of Baronius (q.v.) were a Catholic reply to the Magdeburg Centuries. See PROTESTANTISM.

MAGDEBURG HEMISPHERES, a celebrated invention of two hollow hemispheres, made of copper or brass, with their edges accurately fitted to each other, and one of them furnished with a stopcock. When the edges are rubbed over with grease, pressed tightly together and the globe thus formed exhausted of air through the cock, the hemispheres, which fell asunder before exhaustion, are now pressed together with immense force. If they are one foot in diameter they will, after exhaustion, be pressed together with a force of nearly a ton. This experiment was first performed by Otto von Guericke of Magdeburg, in 1654, at the imperial Diet at Ratisbon, to the astonishment of the Emperor Ferdinand III and the royal family.

MAGELLAN, ma-jĕl'an, **Ferdinand** (Port. FERNÃO DE MAGALHÃES; Sp. FERNANDO MAGALLANES), Portuguese navigator: b. probably at Villa de Sabroza, Trazos-Montes, about 1480; d. Philippine Islands, 27 April 1521. He served in the Indies with distinction, especially at Malacca, and in 1514 saw service in Morocco. In resentment at his treatment by the king, who had not, he thought, duly rewarded his services, he, with Ruy Falero, a geographer and astronomer, renounced his nationality and offered his services to Spain. Magellan's proposal to seek a western route to the Moluccas was accepted by Charles V, and on 20 Sept. 1519 he set sail from San Lucar de Barrameda in command of five vessels. He passed through the strait which bears his name (see MAGELLAN, STRAIT OF), and on 28 Nov. 1520, reached the great ocean which he called the Pacific from its calmness. With his three remaining vessels he sailed by way of the Ladrones Islands to the Philippines, discovering Samar on 16 March 1521. He caused the king of Zebu to swear allegiance to Spain, but was killed in a fight with the natives of Matan. His vessel, the *Victoria,* under Sebastian del Cano, completed this, the first circumnavigation of the globe. The chief authority for the voyage is a work by Pigafetta, an Italian who accompanied Magellan. Consult Lord Stanley, 'The First Voyage Round the World' (1875); and Guillemard, 'Ferdinand Magellan' (1891).

MAGELLAN, Strait of, the channel which separates the continent of South America from Tierra del Fuego and thus forms a communication between the south Atlantic and the south Pacific oceans. It is upward of 360 miles long, and is of difficult navigation. Its breadth varies exceedingly, the maximum being somewhat over 70 miles. There are a number of bays along the shore and at the southwestern end a group of several small islands. Punta Arenas is the best harbor. The strait was discovered in 1520 by Fernão de Magalhães or Magellan.

MAGELLANIC CLOUDS, *in astronomy,* called the Nubeculæ, Major and Minor, from their cloud-like appearance, two oval masses of light in the southern hemisphere near the pole; often both visible to the naked eye. Sir J. Herschel describes them as consisting of swarms of stars, clusters and nebulæ of every description.

MAGENDIE, François, frăn-swä mă-zhŏn'-dē, French physician and physiologist: b. Bordeaux, 15 Oct. 1783; d. Paris, 8 Oct. 1855. He was the pupil of the celebrated surgeon, Boyer, and at 20 was appointed successively *aide d'anatomie* in the faculty of medicine, and demonstrator. He, however, subsequently devoted himself principally to the practice of medicine, was in 1819 elected a member of the Academy of Sciences and in 1831 succeeded Récamier in the chair of anatomy in the College of France, which he retained until his death. As an experimenter in physiology he occupied a high position and his experiments on living animals were at one time so numerous and involved so much suffering to the animals that the French government deemed it necessary to interfere. The results obtained, however, were of great importance, if they do not absolve him from the charge of cruelty. Among them may be named an original demonstration that the two roots of the spinal nerves are devoted to two separate functions; that the veins are organs of absorption; that strychnine acts upon the

spinal cord and contracts by tetanic spasm the nerves of respiration, thus inducing asphixia; that food destitute of nitrogen is not nutritious, and that prussic acid is a valuable remedy in certain forms of cough arising from irritation in the lungs. He was a prolific author of medical works, the most important of which are 'Formulaire pour la préparation et emploi de plusieurs nouveaux médicaments' (1821), containing an account of the effects of certain plants then recently introduced into the materia medica, and which has been translated into all the languages of Europe; 'Précis élémentaire de physiologie' (1816–17), for many years an important manual for students; 'Leçons sur les phénomènes physiques de la vie' (1836–42); 'Leçons sur les fonctions et les maladies du système nerveux' (1839); 'Leçons sur le Sang' (1839); 'Recherches philosophiques et cliniques sur le liquide cephalorachidien ou cérébro-spinal' (1842).

MAGENTA, mä-jĕn'tä, Italy, town in the province of Milan, 16 miles west of Milan, is situated in a grape region, in which the cultivation of grapes and mulberries and the manufacture of wine are the principal industries. Considerable raw silk is exported. It was the scene of a famous engagement 4 June 1859 between the French and Sardinian forces and the Austrians. The Austrians were defeated, largely through the superior tactics of General Mac-Mahon of the French army. Pop. about 10,000.

MAGENTA, or **ANILINE RED,** a coal-tar dye, which consists of a mixture of the hydrochlorides of rosaniline and para-rosaniline. (See ROSANILINE). It may be prepared from aniline oil by digesting the aniline with arsenic acid or with nitrobenzene and ferrous chloride. When the oxidation is complete the rosaniline hydrochloride is precipitated by the addition of common salt in large excess, the hydrochloride being formed by double decomposition and thrown down because it is but sparingly soluble in salt solutions. Consult Benedikt, 'Chemistry of the Coal-Tar Colors.'

MAGGIORE, mäd'jō'rĕ, **Lake,** one of the largest lakes in Italy, the *Lacus Verbanus* of the Romans, is situated for the most part in Italy, but also partly in the Swiss canton of Ticino. It is 39 miles in length and varies in breadth from one-half mile to five and one-half miles. It is 646 feet above the level of the sea and has a maximum depth of 1,158 feet. The river Ticino flows through it. In the south-western expansion of the lake are the Borromean Isles (q.v.). On the north and west it is surrounded by granitic mountains, 7,000 feet high, on the south and east by vineyard-covered hills. On its shore are a large number of villages and cities noted for beautiful scenery and historic connections.

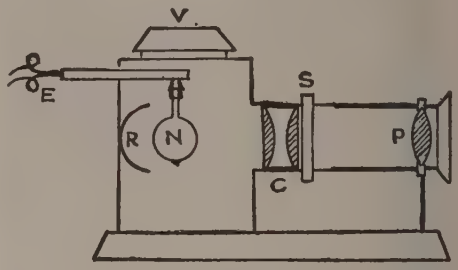
MAGGOT, the larva of a fly. (See FLIES).

MAGI, mā'jī (Lat. *Magus,* Gr. *Μαγος*), an Accadian term recently brought to light by Assyrian scholars; Accadian being the language of the people of Babylon and Media. The word signifies "august," "reverend," and was the title of their learned and priestly caste. The Semitic nations afterward dominant in Babylonia and Assyria adopted the learning and many of the religious observances of the early inhabitants, as also the name for the learned caste; and out of the Semitic form the Greeks made *magos.* Under the Persian Empire the magi were not only the "keepers of the sacred things, the learned of the people, the philosophers and servants of God," but also diviners and mantics, augurs and astrologers. They were held in the highest reverence, and no transaction of importance took place without or against their advice. Hence their almost unbounded influence in both private and public life. Apart from the education of the young princes being in their hands, they were the constant companions of the ruling monarch. Zoroaster, in the course of his great religious reform, reorganized the body of the magi, chiefly by reinforcing the ancient laws as to their manner and mode of life, which was to be one of the simplest and severest, befitting their sacred station, but which had become one of luxury and indolence, and by reinstituting the original distinction of the three classes of *herbeds* ("disciples"), *mobeds* ("masters") and *destur mobéds* ("complete masters"). The food, especially of the lower class, was to consist only of flour and vegetables; they wore white garments, slept on the ground and were altogether subjected to the most rigorous discipline. The initiation consisted of the most awful and mysterious ceremonies, and was preceded by purification of several months' duration. As far as we can learn the principle of good and evil, as represented by Ormazd and Ahriman, was recognized, and belief in the coming of a savior, in the resurrection and in a future life was held. Gradually, however, their influence, which was all-powerful during the epoch of the Sassanian kings of Persia, began to wane, and, from being the highest caste, they fell to the rank of wandering jugglers, fortune-tellers and quacks, and gave their name to sleight-of-hand and conjuring tricks. But the name seems to have been also current as a generic term for astrologers in the East, as is evidenced by the New Testament narrative of the homage of the Magi to the Infant Christ. According to the narrative (Matt. ii, 1–12) the three wise men came from the East to Jerusalem, led by a star, which at length guided them safely to the place of the Nativity at Bethlehem, where they offered their gifts of gold, frankincense and myrrh. As the "Three Kings" their names became celebrated in the Middle Ages, and Bede distinguishes them as Kaspar, Melchior and Balthasar. (See also PARSEES; ZOROASTER). Consult Cumont, F. V. M., 'Oriental Religions in Roman Paganism' (Chicago 1911); id., 'Les mystères de Mithra' (3d ed., Brussels 1913); Moulton, J. H., 'Early Zoroastrianism' (London 1913).

MAGIC, or **BLACK ART,** was formerly the means of producing supernatural effects with the assistance of evil spirits. Doubtless in very remote time magic and religion were practically one, but the development of mentality brought about a differentiation. The fundamental fact was a strong belief in what was considered supernatural. Magic is of a more positive nature, but it carries with it the idea of taboo (q.v.). Supernatural effects were at an early period naturally associated with the exercise of the healing art. In the rudest stage of society this was confined to the women, and naturally arrived at the dignity of a profession in the hands of the older, whom

experience had gifted with superior skill. As their art was for the most part a mystery to themselves, they gradually came to be regarded as objects of fear as much as of hope, and magic medicines became synonymous with poison. The sorceress, poisoner and witch were in time reckoned identical. (See WITCHCRAFT). Mediea, Persia, and the neighboring countries, famous for their knowledge of astronomy and astrology, are described as the chief seats of the ancient Magi, whose doctrine seems to be, in part, of great antiquity. This doctrine represented opposition or strife as the parent and original cause of all things. After the opposition between light and darkness, Ormuzd and Ahriman, was established, the whole series of finite beings, the whole sensual world, proceeded from this constant struggle of light and darkness, good and evil. The change of day and night, light and darkness, the whole series of ages, time itself, is only a consequence of this struggle, in which sometimes light, sometimes darkness, appears victorious, until finally light shall conquer for ever. If all finite things stand under the influence of preserving and destroying powers in nature, it is clear that he who could master these powers could dispose at his pleasure of the things subject to them; and the doctrine of the Magians was that by prayer and a true knowledge of those laws of opposition, love and hatred, light and darkness, such power could be obtained; and that thus also it was possible to pry into futurity. But it was believed that as the world became sinful the light of the ancient doctrine of the Magi was obscured, and those who bore the name became at last only evil-disposed sorcerers. One important branch of their art was now the excitement of love by potions and enchantments. Their love potions consisted partly of ingredients which are still known to the physicians as stimulants, partly of parts of animals who had died longing for food or air, or the saliva of hungry dogs, and other still more disgusting substances. Magic at this period also occupied itself with fortune telling, calling up the dead and bewitching by the look—a superstition which is found existing in the processes against witches in modern times. It can hardly be doubted that the art of the ancient magicians was founded to a considerable degree upon a knowledge of the powers of nature superior to that of the general public. At one time magic was greatly studied in Europe, and many distinguished names are found among its students and professors. The most famous of these are Albertus Magnus, Roger Bacon, Cornelius Agrippa, Michael Nostradamus, John Dee, William Lilly, etc. While magic is a thing of the past there are still many survivals to be found today among the superstitions held by a large number of individuals. Consult Lang, A., *Magic and Religion* (New York 1901); Marett, R. R., *The Threshold of Religion* (New York 1914); Frazer, James G., *The Magic Art* (New York 1925); Thorndike, Lynn, *History of Magic and Experimental Science During the First Thirteen Centuries of Our Era* (New York 1929); Mackay, Charles D., *Memoirs of Extraordinary Popular Delusions* (New York 1929).

MAGIC LANTERN, an instrument used for projecting highly magnified images upon a screen or other adapted surface. A basic type which is shown in the accompanying diagram represents a longitudinal section through a magic lantern fitted with a nitrogen lamp (N), attached to lighting wires (E), and provided with a pair of plano-convex condensing lenses (C). The reflector is indicated at R; the



slot in which the slides are inserted at S; the double convex projecting lens at P; and the ventilating chimney, to carry off excessive heat, at V.

The magic lantern is used to show magnified representations of transparent pictures painted or photographed on glass. The projection is said to be diascopic if the light traverses the object and episcopic if by reflected light. The size of the image will depend upon the brilliancy of the light, hence the circle which it is capable of illuminating. Secondarily the size will depend upon the distance of the lantern from the screen, and the ability to focus the image thereon. See STEREOPTICON.

MAGIC MIRROR OF JAPAN, some few specimens of the small, round bronze mirrors made in Japan which differ from others by reflecting upon a white screen the raised figures on the back of the mirror when a strong beam of light is thrown upon the polished convex surface. The mirrors are made of bronze with a polished, slightly convex face and the backs are decorated with raised ornaments. The characteristics of the magic mirrors was long a mystery, as much to the makers as to others, the peculiarity being apparently accidental. The Japanese themselves, while possessing a reverence for all mirrors, placed no undue value upon the magic mirrors. The Chinese noticed the phenomenon as early as the 11th century and gladly paid fabulous prices for such as possessed the trait. The physical nature of the mystery was first revealed by the French physicist, Charles Cléophas Person, in 1847. He observed that the convex surface of the magic mirrors was not uniform, the portions in front of the ornamental figures being plane, and therefore reflecting direct rays, while the convex portions gave divergent rays and so made the reflection of the images indistinct. The theory was worked out by W. E. Ayrton and J. Perry, who discovered the phenomenon to be due to peculiarities in the composition of the metal in some of the mirrors, the pressure used in polishing the thicker portions containing the raised ornaments resulting in a difference on the reflecting surface too minute to affect the reflection under ordinary light, but plainly apparent when thrown on a screen by a bright light.

MAGIC MOUNTAIN, The. In this long and brilliant novel (1924) Thomas Mann (q.v.) paints a symbolic picture of the dissonance and struggle between two seemingly irreconcilable forces in man's nature: the hypnotic lure of the esthetic, estranging the artist and the abstract thinker from the practical world of reality and robbing him of the strength for action, on the one hand; and on the other his sense of responsibility to that world and his longing for association with the commonplace activities and people of the world of reality. In this dualism Mann sees the disease which afflicted the German middle class before World War I.

In a luxurious tuberculosis sanitarium on a high mountain in Switzerland a group of characters from all parts of the world is gathered, from as far west as Daghestan, from the Graeco-Roman world of Mediterranean culture, from Holland, Germany and elsewhere. Into this motley assembly comes the hero, or rather the central figure (for he is designedly represented as a very ordinary bourgeois individual), Hans Castorp, not at first as a patient. He comes to visit a cousin, planning to stay three weeks, and remains seven years. The author's choice of scene was in itself an almost magical stroke of genius, for the rarified air of the mountain, the boundless horizons of snow, the enforced inactivity of the patients, and the disease itself convincingly symbolize the remoteness from the real world below (the Flatland) and suggest the devitalizing effect of a life of exclusively romantic, esthetic, or metaphysical speculation.

Hans Castorp is constantly exposed to the impact of the divergent attitudes of these characters toward life, chiefly by way of dialectic exchanges and conversations rather than action, for there is no plot in the usual sense. Each of them tries to persuade Hans toward his own particular way of life: the practical realist, the humanist, the romanticist, the sensualist, etc. As they come and go (the scene being what it is, Hans repeatedly finds himself beside a death-bed) his vacillation persists, until, with the outbreak of World War I, he hurries down to the Flatland to fight for his country, his resolve suggesting that he has after all maintained something of a balance between the "two souls that dwell within his breast."

The novel ends on a questioning note which Mann himself calls "the philosophic renunciation of much that I once loved . . . a book of pedagogic self-discipline." See also BUDDENBROOKS, THE, and JOSEPH AND HIS BROTHERS.

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MAGIC SKIN, The or **WILD ASS' SKIN** (Fr. LA PEAU DE CHAGRIN), one of the most famous of the novels which make up the imposing series of *The Human Comedy* (*La Comédie Humaine*) by Honoré de Balzac (q.v.). It was also one of the earliest (1831). While it offers abundantly that penetrating observation of human conduct and character and that minute record of the myriad little concrete details of circumstance and environment that condition and explain them, that mark the realism of Balzac and make his work so full of what the French critic Hippolyte Adolphe Taine called "human documents," it is essentially an allegory and enforces, under the form of a magic symbol, a profoundly moral truth. The magic skin is a piece of shagreen bearing this inscription: "Possessing me thou shalt possess all things, but thy life is mine, for God hath so willed it. Wish and thy wishes shall be fulfilled; but measure thy desires, according to the life that is in thee. This is thy life, with each wish I must shrink even as thy own days. Wilt thou have me? Take me. God will hearken unto thee. So be it." The young man who becomes the possessor of this talisman in a moment of suicidal desperation demands of it a princely fortune and sees himself with the power to have every wish gratified. With each exercise of his power, however, he observes with horror that the magic skin continuously shrinks and that his demands on its power bring with them less and less satisfaction. The story is not of even interest throughout, and the narrative of the youth of the hero, which takes up half of the book, may seem somewhat long drawn out. But it is one of the best examples of Balzac's peculiar power of seeing facts and illuminating them with ideas.

See also ALKAHEST, THE; AUBERGE ROUGE L'; CHOUANS, THE; COMÉDIE HUMAINE, LA; EUGÉNIE GRANDET; CESAR BIROTTEAU; and PÈRE GORIOT.

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MAGIC SQUARES. A magic square is a square divided into equal smaller squares, each containing a term of a series of integers, the sums of the numbers in any horizontal, vertical and diagonal line being the same.

A

3	4	1	5	2
2	3	4	1	5
5	2	3	4	1
1	5	2	3	4
4	1	5	2	3

B

15	0	20	5	10
0	20	5	10	15
20	5	10	15	0
5	10	15	0	20
10	15	0	20	5

C

18	4	21	10	12
2	23	9	11	20
25	7	13	19	1
6	15	17	3	24
14	16	5	22	8

The construction of such squares is an amusement of great antiquity. They were known in India and China before the Christian Era, and a knowledge of them was introduced into Europe by Moschopulus who flourished in

Constantinople early in the 15th century. Talismanic virtues and occult properties were ascribed to them by the ancients. They were engraved on metal and stone and worn as amulets, as in India at the present day. A magic square of the fourth order is engraved on the gate of the fort at Gwalior in that country. Mediæval astrologers and physicians were filled with superstitions in regard to magic squares. They associated the squares of the orders 3, 4, 5, 6, 7, 8 and 9 with the astrological planets Saturn, Jupiter, Mars, the Sun, Venus, Mercury and the Moon. A square containing one cell symbolized the unity of the Deity; one of the second order, not being possible, signified the imperfection of the elements air, earth, fire and water. Albert Dürer's well-known painting, 'Melancholy,' contains a magic square of the fourth order, doubtless because of its supposed mystical significance. They have been made the subject of elaborate research by various investigators but the world is indebted chiefly to the French mathematicians for the development of the theory of magic squares.

In this article general rules for the construction of magic squares of any order will be given, illustrated by particular examples. The squares produced by these methods by no means exhaust all possible arrangements, but the rules furnish squares in great number and variety.

Magic squares are divided into two general classes according as the numbers of cells on a side is odd or even. Even squares are subdivided into doubly even, i.e., when the root is divisible by 4, and singly even, when the root is divisible by 2 but not by 4. A horizontal line of cells is called a row, and a vertical line a column. Two cells in a row equidistant from the ends are termed a *horizontal pair*, and two cells in a column equidistant from the ends are termed a *vertical pair*. In a series of natural numbers any two equidistant from the ends are said to be complementary.

Magic Squares of an Odd Order.— La Hire's method for constructing odd magic squares requires the formation of two auxiliary squares A and B. For a square of the fifth order diagram A is formed with the series of natural numbers 1, 2, 3, 4 and 5 as follows: First, put 3 (the mean of the numbers) in the top left-hand corner cell, and the numbers 1, 2, 4 and 5 in the cells of the top row in any order. Next, the number in each cell of the top row is repeated in the cells of a diagonal sloping downward to the right. The cells filled by the same number form a *broken diagonal*. Form a new square by making the left-hand column of A (beginning with its bottom number) the first row in the new square, and so on. Next, instead of the numbers 1, 2, 3, 4 and 5, substitute respectively the numbers 0, 5, 10, 15 and 20, thus producing square B. In each cell of square C place the sum of the numbers in similarly situated cells of squares A and B. The result is a magic square of the fifth order. Any magic square of an odd order can be constructed in a similar manner.

La Loubère's Method.— In order to construct a magic square of an odd order by this method, place 1 in the middle cell of the upper row, and using the series of natural numbers (any arithmetical series will answer) proceed always diagonally upward to the right, except when the edge of the square or a cell already filled is reached. When a number would fall outside the square, carry it to the extreme cell in that row or column in which the cell outside would fall. When a cell is reached that is already filled or when the righthand upper corner cell is reached, place the number in the cell just below. The magic square D is formed by this rule. It may be remarked here that from any magic square, whether odd or even, a number of other magic squares can be formed by the mere interchange of the row and column which intersect in a diagonal with the row and column which intersect in some other cell in the same diagonal. In this way from each magic square of the fifth order 48 other magic squares can be formed.

D

30	39	48	1	10	19	28
38	47	7	9	18	27	29
46	6	8	17	26	35	37
5	14	16	25	34	36	45
13	15	24	33	42	44	4
21	23	32	41	43	3	12
22	31	40	49	2	11	20

Magic Squares of an Even Order.— To construct a magic of the sixth order proceed according to the following rule which is a modified form of a method due to La Hire.

E

1	5	4	3	2	6
6	2	4	3	5	1
6	5	3	4	2	1
1	5	3	4	2	6
6	2	3	4	5	1
1	2	4	3	5	6

F

0	30	30	0	30	0
24	6	24	24	6	6
18	18	12	12	12	18
12	12	18	18	18	12
6	24	6	6	24	24
30	0	0	30	0	30

G

1	35	34	3	32	6
30	8	28	27	11	7
24	23	15	16	14	19
13	17	21	22	20	18
12	26	9	10	29	25
31	2	4	33	5	36

As in his rule for odd squares two auxiliary squares are employed. For a square of the sixth order the first auxiliary square E is constructed as follows: First, fill the cells of the

H

1			4
	6	7	
	10	11	
13			16

I

1	15	14	4
12	6	7	9
8	10	11	5
13	3	2	16

two diagonals with the numbers 1, 2, 3, 4, 5 and 6, beginning on the left-hand side. Second, fill each of the remaining cells of the first column with the same number as that already in two of them or with the complementary number, i.e., with a1 or a6 in any way, provided that there are the same number of these numbers in the column. Third, cells horizontally paired with those in the first column are filled with the complementary numbers. Fourth, the remaining cells in the second and third columns are filled in an analogous way to that in which the cells in the first column were filled; and then the cells horizontally paired with them are filled with the complementary numbers. Observe that in the case of a singly even magic square it will be necessary in constructing E to take care in the second step that in every row at least one cell which is not in a diagonal shall have its vertically paired cell filled with the same number as itself.

The second of the auxiliary squares F is constructed as follows: Rewrite square E, making another square F in which the left-hand column of E (beginning with its top number) becomes the top row of the new

K

71	64	69	8	1	6	53	46	51
66	68	70	3	5	7	48	50	52
67	72	65	4	9	2	49	54	47
26	19	24	44	37	42	62	55	60
21	23	25	39	41	43	57	59	61
22	27	20	40	45	38	58	63	56
35	28	33	80	73	78	17	10	15
30	32	34	75	77	79	12	14	16
31	36	29	76	81	74	13	18	11

square, the second column of E becomes the second row of the new square, and so on. Then instead of each of the numbers 1, 2, 3, 4, 5 and 6, substitute the corresponding number from the series 0, 6, 12, 18, 24 and 30. The result is square F. Next, if in each cell of G the sum of the numbers in the corresponding cells of squares E and F be placed, the required magic square is formed.

The following method is applicable to the construction of doubly even magic squares only. Imagine the square to be divided into squarelets of four cells each, the four central cells comprising one; and conceive these squarelets to be of *two* kinds, alternating with each other. Place 1 in the left-hand upper corner cell, and proceed horizontally to the right counting a number to each cell, but filling successively the squarelets of one kind only. When the end of one row is reached turn to the left-hand cell of the next row and again advance, filling cells of one kind as before, and so on. For the

L

1	63	62	4	5	59	58	8
56	15	49	48	19	44	20	9
55	47	25	39	38	28	18	10
11	22	36	30	31	33	43	54
53	42	32	34	35	29	23	12
13	24	37	27	26	40	41	52
14	45	16	17	46	21	50	51
57	2	3	61	60	6	7	64

4-square the result of this operation is seen in diagram H.

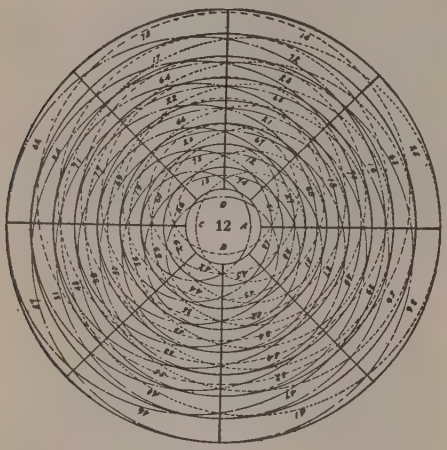
Next, begin with the right-hand lower corner cell, considering 1 as falling on it but not writing the number, and proceed regularly to the left, row after row, filling the empty cells with the numbers belonging to them but not writing numbers in the cells already filled. The result of the two operations is the magic square I. This is the most perfect magic square of the fourth order. Not only do the horizontal, vertical and diagonal lines of numbers sum up 34, but there are 38 other ways in which sets of four numbers may be selected whose sum is 34, making 48 ways in all. By the interchange of rows and columns according to the rule enunciated above, other squares may be formed, but none so perfect as this.

The above methods for the construction of magic squares are, in the writer's opinion, the simplest of all those proposed. Limited space permits only two other methods to be noticed, which, however, are applicable to only a limited class of cases. The first relates to the construction of composite magic squares. For example a square of 81 cells may be considered as made up of 9 smaller squares each containing 9 cells. The magic square in diagram K is built up by this method.

The other method consists in surrounding a magic square with a border of cells, constituting what is termed a concentric square. In

this way from the magic square of the third order can be built up squares of any odd order; and similarly even magic squares of any order may be built up from the magic square of the

M

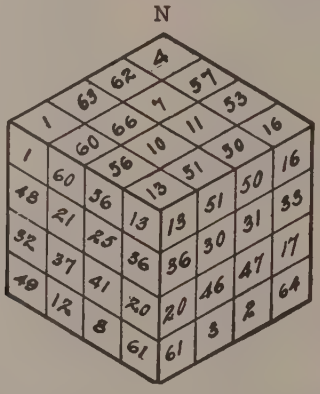


fourth order. Diagram L is constructed this way.

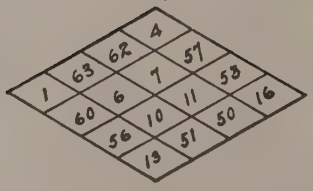
To Dr. Franklin is due the construction of diagram M which he called *The Magic Circle of Circles.* (See the illustration herewith). It is composed of a series of numbers from 12 to 75, inclusive, placed in eight concentric circular spaces and arranged in eight radii, with the number 12 in the centre. Like the centre this number is common to all the circular spaces and to all the radii. The numbers are so placed that the sum of all those in any of the circular spaces, together with the central number 12, is 360, the number of degrees in a circle. The numbers in each radius together with the central number make 360. The numbers in half of any of the circular spaces taken above or below the horizontal diameter, with half the central number, make 180, the number of degrees in a semi-circle. If any four adjoining numbers be taken, as if in a square, in the radial division of the circular spaces, the sum of these with half the central number is 180. There are, moreover, included five sets of other circular spaces bounded by circles which are eccentric with respect to the common centre. The centres of the circles which bound them are at A, B, C and D. The numbers in these eccentric circular spaces possess the same magic properties as the numbers in the first-mentioned circular spaces.

Magic squares have been developed into figures of three dimensions termed magic cubes. Diagram N is a magic cube of the fourth order. 1, 2, 3 and 4 are horizontal sections of N

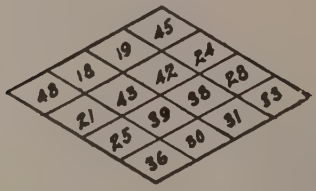
N



1



2



3

4

numbered from the top down. There are 52 ranks of numbers in this cube which sum up 130, namely, 16 vertical columns, 16 horizontal rows from front to back, 16 horizontal rows from left to right, and four diagonal lines uniting four pairs of opposite corners. The sum of any two numbers which are diametrically opposite each other and equidistant from the

O

30	21	6	15	28	19
7	16	29	20	5	14
22	31	8	35	18	27
9	36	17	26	18	4
32	23	2	11	34	25
1	10	33	24	3	12

centre of the cube equals 65; and the sum of the numbers in the 48 sub-squares of four cells each is 130.

Among curiosities in magic construction may be mentioned the following: The square in diagram O is filled with the natural numbers in the path of a knight returning to its starting cell, and possesses the property that the difference of any two numbers equidistant from and on opposite sides of the centre is 18. It is due to Euler, the famous mathematician.

W. S. Andrews in his *Magic Squares and Cubes* gives a magic cross filled with 145 numbers, with the statement that it contains the almost incredible number of 160,144 different columns of 21 numbers whose sum is 1,471.

A certain class of magic squares has received much attention in recent years. They are called *Nasik squares* in England, and in France *diabolic squares.* They are formed so that the sums along certain lines, such as all the rows, columns, diagonals and broken diagonals are the same. Diagram P is a unique example, as it is composed entirely of prime

P

1013	251	449	911	881
839	1301	941	113	311
41	173	701	1229	1361
1091	1289	461	101	563
521	491	953	1151	389

numbers. It is due to the ingenuity of C. D. Schuldham and appeared in a recent number of *The New York Sun.*

This square possesses the Nasik properties above mentioned, and in addition the sum of any two numbers equidistant from the centre and opposite each other is 1,402, or twice the central number.

Magic rectangles, crosses, stars, cylinders, etc., have been constructed, but want of space forbids any further notice of them.

Varying estimates as to the possible number of magic squares of a given order have been made by different investigators. W. W. Rouse Ball in his *Mathematical Recreations* thinks that those of the fifth order probably exceed half a million. Theodor Hugel in his *Die Magischen Quadrate* has calculated that the paper required to contain all the magic squares of the 13th order would cover the whole surface of the earth about 348 times.

As to the scientific value of magic squares the following paragraph is quoted from a paper by Maj. P. A. McMahon, F.R.S., published in *Proceedings of the Royal Institution of Great Britain,* 1892. "What was at first merely a practice of magicians and talisman makers has now for a long time become the serious study of mathematicians. . . . It was considered possible that some new properties of numbers might be discovered. . . . This has in fact proved to be the case, for from a certain point of view the subject has been found to be intimately connected with great departments of science such as the Infinitesimal Calculus, the Calculus of Operations, and the Theory of Groups."

A. B. Nelson.

MAGIC WOOD, a wood used in cups which were sent to Spain in the 16th century as presents to princes, and were highly valued first as curiosities and later as a means of health. The "magic" consisted in the fact that water put into the cup speedily turned a rich blue. Although it has been a subject of inquiry ever since it is not until lately that the wood has been identified botanically, and the cause of its effect on water is still unknown. The identification was made by William E. Safford, of the United States Department of Agriculture, who described the result of his investigation in *The American Museum Journal* (New York, Vol. XVIII, p. 48, 1918) with a colored illustration. He has discovered that two separate kinds of wood are involved in the history of this matter. The description of the early writers mostly refer to a shrub of Mexico called sweet-wood (*Eysenhardtia polystacha*); but the cups were made of wood of the gigantic narra tree (*Pterocarpus indicus*) of the Philippines. Although very different botanically, both produce effects on water virtually indistinguishable; and as in early times most of the communication between Spain and the Philippines was by way of Mexico, the double confusion as to origin easily arose. When water was poured into the narra cups, or chips of the Mexican sweet-wood were infused in a glass, the water became fluorescent in beautiful colors. In the early accounts of the cups (Pterocarpus) it was said that the water at once turned blue, which deepened if left to stand for some time. When this water was poured into a flask and held to the light it appeared perfectly clear, "but if you move this glass phial toward a more shady place the liquid will assume a most delightful greenness, and if to a still more shady place, a reddish color. . . . In the dark, however, or in an opaque vase, it will once more assume its blue color." As was customary in those days this changeably tinted

water was regarded as having medicinal value, especially in any disorder of the kidneys, and was carried to Europe in great quantities and thus used under the name *lignum nephriticum*. Similar colors were obtained from the Mexican shrub. A few small chips in ordinary tap-water tinged it a golden yellow, which soon deepened to orange. When the glass was held against a dark background the liquid glowed with a beautiful peacock fluorescence very much like that seen in quinine. Placed partly in a sunbeam, half of the liquid appeared yellow and the other half blue; "and when the sunlight was focussed upon it by the lens of a common reading-glass the vial seemed to be filled with radiant gold penetrated by a shaft of pure cobalt."

MAGIE, mà-gē′, **William Francis,** American physicist: b. Elizabeth, N. J., Dec. 14, 1858; d. Princeton, N. J., June 6, 1943. Graduating from Princeton in 1879, he afterward studied at the University of Berlin. He was instructor in physics at Princeton, 1879–1884; became professor in 1885; and was dean of the faculty, 1912–1925. He published *The Second Law of Thermodynamics* (1899); *A Course of Lectures on Physics* (1904); *Principles of Physics* (1911). He translated C. Christiansen's *Elements of Theoretical Physics* (1896), and revised W. A. Anthony and C. F. Brackett's *Physics* (1896).

MAGINN, mà-gĭn′, **William,** Irish author: b. Marlboro's Fort, Cork, Ireland, July 10, 1793; d. Walton-on-Thames, Aug. 21, 1842. He was graduated from Trinity College, Dublin, in 1811, and was for some years a schoolmaster. In 1819 he became a contributor to *Blackwood's Magazine* (using the pseudonym R. T. Scott), and *Literary Gazette*. He was in turn Paris correspondent of *The Representative*, joint editor of the *Standard*, and one of the founders of *Fraser's Magazine* (1830), his contributions to which made it famous. His most popular story was *Bob Burke's Duel with Ensign Brady* (1834). He is portrayed by the character Captain Shandon in Thackeray's *Pendennis*.

MAGINNIS, Charles Donagh, American architect: b. Londonderry, Ireland, 1867. He was educated at Cusack's Academy, Dublin, and won Queen's prize in mathematics at South Kensington, London, in 1883. He came to the United States in 1885, engaged in practice as an architect at Boston in 1886, and became a member of the firm of Maginnis and Walsh. He is especially interested in ecclesiastical architecture. He was a member of the Muncipal Art Commission, Boston (1909–1917), and of the Massachusetts State Art Commission, Boston (1911–1920). He is author of *Pen Drawing* (1898). He is a trustee of the Boston Museum of Fine Arts, and was appointed president of the International Congress of Architects by the United States government.

MAGINOT, mà-zhē-nō′, **André,** French politician: b. Paris, Feb. 17, 1877; d. there, Jan. 7, 1932. A deputy representing Bar-le-Duc from 1910, he was a member of the Democratic and Social Action Party. Undersecretary of war in 1913, he joined his regiment as a private on the outbreak of World War I the following year, received promotions to the grade of sergeant and was severely wounded. On his recovery in 1917 he was elected president of the army committee and severely criticized the conduct of the war. The same year he became minister of colonies in Alexandre Ribot's Cabinet, and was subsequently minister of pensions under Alexandre Millerand, Jean C. G. Leygues, and Aristide Briand. As minister of war in Poincaré's cabinets (1922–1924) he introduced the bill creating the ministry of air (1922). Again serving as minister of colonies (1928–1929), he returned to his preferred post of minister of war in November 1929 in the Tardieu Cabinet, retaining it until his death. His masterwork was the construction of the Maginot Line, so named in his honor. The Maginot Line fortifications protected France's eastern border from Switzerland to Luxembourg with a series of underground forts connected by casements and pillboxes. The Germans in World War II never dared attempt to assault it. Unfortunately, financial and political reasons prevented its extension along the Belgian frontier. See also Fortifications.

MAGINOT LINE. See Maginot, André; Fortifications.

MAGISTRATE. See Court.

MAGLIABECHI, mä-lyä-bä′kē, or **MAGLIABECCHI, Antonio,** Italian bibliographer: b. Florence, Oct. 29, 1633; d. there, July 4, 1714. In the early part of his life he was in the employ of a goldsmith, which he relinquished to devote himself to literary pursuits. Through unremitting application he acquired a multifarious stock of erudition, which made him the wonder of his age. Duke Cosimo III made Magliabechi keeper of the library which he had collected and gave him free access to the Laurentian Library and the Oriental MSS., and of the latter collection he published a catalogue. He left his personal library, Magliabechiana, to the Grand Duke of Tuscany. It is now a part of the Biblioteca Nazionale of Florence.

MAGLIONE, Luigi, Italian cardinal, Catholic churchman and diplomat: b. Casoria, archdiocese of Naples, March 2, 1877; d. there, Aug. 22, 1944. His brother, a priest, supervised his early education. Later he entered a Jesuit school at Naples and from there went to the Gregorian University, Rome. He received his degrees in philosophy and theology at the Gregorian, and later received his degree in canon law at the University of St. Apollinaris. In 1901 he was ordained priest and in 1905 began a two-year course in preparation for the Vatican diplomatic service at the Academy of Noble Ecclesiastics. In 1908–1918 he was professor at the Academy of Noble Ecclesiastics, and in the latter year was sent as representative of the Holy See to Switzerland. In 1920 he was created titular archbishop of Caesarea in Palestine and was made nuncio to Switzerland. In October 1926, Archbishop Maglione became nuncio to Paris, where he remained nine years. His work in Paris was so appreciated by the French government that he was awarded the Grand Cross of the Legion of Honor. On Dec. 16, 1935, Pius XI created him cardinal. Pope Pius sent his red hat for presentation to him by President Albert Lebrun in accordance with accepted custom when affairs at the nunciature prevented his return to the Vatican to receive it. Despite the request of the French government that he be left at Paris,

Pope Pius recalled him to Rome and appointed him prefect of the Congregation of the Council. On March 11, 1939, Pope Pius XII appointed Cardinal Maglione his secretary of state, the office that he himself had occupied under Pius XI.

MAGMA, măg'mȧ, rock which is in a fluid condition due to heat, and commonly said to be molten. For a discussion of the modern conception of a magma see the article on ROCKS.

MAGMATIC STOPING, the process by which a fluid rock mass (magma) heats the overlying rock till it fractures and portions break off and settle into the magma, there to be assimilated or to remain as solid blocks or xenoliths. The process is believed to be important in the mechanics of igneous intrusion.

MAGNA CARTA, măg'nȧ kär'tȧ, or **MAGNA CHARTA** (GREAT CHARTER). In its earliest form this was a grant of liberties extorted from King John of England (1199–1216) in 1215 by a group of rebellious barons. It was reissued with modifications and omissions in 1216 by the regency headed by William Marshall, earl of Pembroke, ruling for the infant Henry III (1216–1272). In 1217 the regency reissued the charter as two separate documents: the charter of liberties and the charter of the forest. In 1225, after Henry III had been declared of age, these charters again were issued in essentially the same form as in 1217. The charters of 1225 became the accepted version and were placed at the beginning of all medieval collections of English statutes. The original text of John's charter was not known to scholars until the 17th century.

Background.—Ever since the Norman conquest of England in 1066 the English kings had striven to develop their power at the expense of that of the feudal class: the barons, their vassals, and their rear-vassals. The barons had opposed this process and had risen occasionally in open revolt. When Henry I (1100–1135) ascended the throne, he issued a charter of liberties in which he promised to stop certain practices of his father and elder brother. Stephen (1135–1154) and Henry II (1154–1189) each issued similar charters. But these promises had little effect on the actual policies of the royal government. All these monarchs with the exception of Stephen steadily increased the royal power.

Henry II's sons, Richard I (1189–1199) and John, followed the example of their predecessors with great enthusiasm. This was particularly true of John. The late 12th and early 13th centuries was a period of rising prices, in which the costs of government also increased rapidly and the incomes of those who drew their revenues directly from the land also increased. The feudal class as a whole was steadily growing richer, but, as most royal revenues were fixed by custom, it was difficult for the king to tap the new wealth. John tried every means which an ingenious and not too scrupulous mind could devise. He abused his feudal rights by demanding exorbitant reliefs when heirs inherited their fathers' fiefs. He sold heiresses in his custody, both maidens and widows, to the highest bidder. John also levied scutages (payments to avoid feudal military service) far more frequently than former kings and on several occasions without actually conducting a campaign. In addition he used novel forms of taxation. He twice collected income and property levies. He experimented with customs duties. Finally he attempted to increase the annual rents or farms owed by the sheriffs for the counties which they administered. John also continually expanded the jurisdiction and hence the revenues of the royal courts at the expense of the baronial courts. In short, while in general John followed the policies set by his predecessors, he did so with extraordinary vigor and with little regard for protests.

At the same time John aroused the personal enmity of many of his barons. He was both cruel and licentious. He either murdered or procured the murder of his nephew, Arthur, duke of Brittany. When the wife of a baron made an indiscreet reference to this crime, John crushed her family's power, drove her husband and one son into exile, and starved the baroness and her eldest son to death in a dungeon. He seduced the sister of at least one great lord, and there probably were similar cases. But perhaps John's chief fault was that he trusted no one and hence no one trusted him.

Baronial Revolt.—In the autumn of 1214, King John returned from an expedition against King Philip Augustus of France. John and his allies had been crushingly defeated. This blow to the king's military prestige greatly encouraged the discontented barons. A group of these lords met at Bury St. Edmunds to discuss their grievances. These nobles not only hated John personally, but also they felt that he had deprived them of specific things to which they were entitled, such as lands, castles, privileges, and hereditary offices.

With the barons was Stephen Langton, archbishop of Canterbury, who had suffered from King John's enmity. Since he had been elected archbishop in the papal court without the king's assent, John had refused to admit him to England. For seven years Langton had waited in France until peace between John and Pope Innocent III allowed him to assume his office. During that time his relatives and friends were driven from England by John. Langton was one of the most able theologists and canon lawyers of his day. Having devoted a large part of his time to applying canon law throughout Christendom, he believed that, just as there was a canon law to govern the internal polity of the church and its relations to the lay world, there should be a recognized system of law to rule the affairs of secular states. Langton persuaded the barons to suppress for the moment their personal hatreds and ambitions and to sponsor a general program which would appeal to the entire feudal class. The assembled barons swore in the abbey church of Bury St. Edmunds that if John refused to grant their demands, they would wage war against the king. While it is impossible to discover which lords attended this meeting at Bury St. Edmunds, it seems probable that they numbered about a fifth of the English baronage.

In January 1215 the rebellious barons conferred in London with their king, who listened to their grievances and promised to give them an answer by Easter. Between January and June 1215, John's policy was extremely complicated. He had no intention of surrendering any of the royal authority and he was certain that eventually he could crush his foes. But only a small part of the four fifths of the English baronage not in the rebel ranks was willing to support the king actively, since most of the barons dis-

liked both parties and remained neutral. Hence John sent agents to Flanders and Aquitaine to hire mercenary troops. He also sent men throughout England to place the royal castles in a state of defense. Then he dispatched messengers to Pope Innocent III, whose vassal he was, to complain of the behavior of the barons. At the same time the king engaged in more or less continuous negotiations with the rebels.

The barons committed their first overt act of rebellion in April, when they gathered in arms at Stamford. Thence they marched to lay siege to the great royal castle of Northampton. Finding this castle too strong for them, they moved against Bedford, which was held by one of their number. The barons knew that John was mustering troops and would soon have an army which they could not meet in the field. Since they needed a secure refuge, they opened negotiations with the citizens of London and on May 17 they occupied the city without meeting any resistance. The capture of London was the victory which won Magna Carta. Since John could hardly hope to collect a force large enough to expel the rebels from the city, his only course was to make peace.

Issuance.—On June 15, 1215, King John and his supporters met the rebel leaders on a meadow called Runnymede lying in the valley of the river Thames between Windsor and Staines. The barons presented to the king a document embodying their demands—the Articles of the Barons. John agreed to accept the demands and ordered his clerks to attach his seal to the document. Then the royal clerks set to work to incorporate the clauses of the articles in a formal charter. This was no simple task. The clauses of the articles were not very well arranged and many were loosely drawn and hence vague. The expert royal clerks rearranged the clauses and tightened the wording. Some changes were made in the text—presumably by mutual consent. On June 19, King John notified his officials that peace had been made and directed them to execute the provisions of the charter, which was to be read publicly in every shire. Thus it seems likely that a complete draft had been made by June 19. But the work of the royal clerks continued. There was to be a copy for every sheriff and for every cathedral chapter—a total of some 47 copies. It seems likely that this task took several weeks. Moreover, since the clerks improved the drafts to some extent as they proceeded, all the copies are not exactly alike. Four of these copies are still extant: one in Lincoln cathedral, one in Salisbury cathedral, two in the British Museum in London. That at Lincoln is generally believed to be the nearest perfect.

Content.—The provisions of Magna Carta fall naturally into three groups. Fifteen chapters treat the feudal relations between the king and his vassals. Thirty-two are concerned primarily with the procedures and policies of the royal administration. These 47 chapters seek to redress general grievances—mostly long-standing ones. They could have been aimed at Henry II or Richard I as appropriately as at John. The last 12 chapters canvass the immediate situation—the king's quarrel with his barons and the resulting revolt. They express practical terms of peace rather than basic principles of law.

The chapters on feudal relations discuss such questions as the relief to be paid by the heir of a tenant-in-chief of the crown, the marriage of ladies in the king's wardship, and the custody of fiefs during minorities. Only one of these clauses is of modern interest. The 12th chapter provides that no scutage or aid could be levied without the "common counsel of our realm" except for three occasions on which aids were sanctioned by feudal custom: the ransoming of the king if he were captured, the knighting of his eldest son, and the marrying of his eldest daughter. The 14th chapter defines the body competent to give this "common counsel of the realm" as an assembly of all tenants-in-chief of the crown. As the king had many petty tenants-in-chief and hence this assembly would have been large and unwieldy, it is rather doubtful that it ever was summoned. This chapter, in fact, was dropped when the charter was reissued in 1216. But the principle embodied in it was observed. John's successors did not levy such scutages or aids without the consent of some assembly. For a while it was usually simply the great council of barons and prelates which was called, but later this became a prime function of Parliament. Hence the principle that the government could not ask for a special levy without the approval of some competent assembly was clearly expressed in Magna Carta.

Most of the chapters dealing with the policies and procedures of the government are also of temporary importance. The problems which they solved were of that day and are now forgotten. Some of them severely hampered the financial administration and were omitted when the charter was reissued. Chapter 21, providing that earls and barons could be amerced only by their peers, is probably the remote origin of the privileges of the peerage. But the most significant clause is chapter 39, which states that no free man can be arrested, imprisoned, deprived of his property, outlawed, exiled, or "in any way destroyed" except by "legal judgment of his peers or by the law of the land." Scholars have argued and will continue to argue about what this meant to the men of the time, but all admit that it forbade arbitrary action by the government. It was a guarantee of "due process of law"—we simply cannot be sure what sort of process is described. In all probability it meant trial in a feudal court by one's peers, when that was the proper procedure for the case, and otherwise by the established customary law.

The last group of chapters discussing John's relations with the rebel barons and their allies are no longer of any interest except to the historian. The last chapter attempted to create machinery by which John could be compelled to observe the charter. Twenty-five barons were to be elected to serve as a committee to hear complaints. If the king refused to correct the grievances which this committee presented to him, they were to wage war on him. The problem was a real one—how to oblige the king to obey the law which he recognized—but the establishment of a partisan commission was not an adequate solution.

Significance.—The conception of government limited by law was implicit in the feudal system. The feudal custom in each fief, be it petty barony or kingdom, was molded by the vassals of the lord in his court. Every feudal lord was subject to the law made in his court. Magna Carta makes this explicit for the kingdom of England. John admitted that he was bound by law. Then chapter 39 (cited above) safeguards the individ-

ual from arbitrary action by the government. It is true that Magna Carta did not apply to all the people of England. Its first chapter clearly defines the beneficiaries: "all the freemen of our realm." This included the whole feudal class, agricultural tenants by such free tenures as socage, and probably the townsmen. The mass of the agricultural population was excluded. But as that agricultural population, the villeins, obtained freedom, they fell heir to the rights granted by the charter. Thus the principles of limited monarchy and individual liberties are embedded in Magna Carta.

Later History.—The Englishmen of the later Middle Ages fully realized the importance of Magna Carta as an admission of the king's submission to the law. Whenever the barons or later the Parliament felt that the king was being too high-handed, they were inclined to insist that he confirm Magna Carta. It was confirmed 44 times before the death of Henry V (1413–1422). For the men of this period it was still a living document. Its next great era began in the reign of Elizabeth (1558–1603). Lawyers and scholars used it to confound contemporary monarchs. This was especially true during the reigns of the first two Stuarts (1603–1649), who were inclined to base their procedure on the practices of the Tudor monarchs (1485–1603) and whose opponents sought medieval precedents to oppose them. Magna Carta was used extensively by the great Sir Edward Coke (1552–1634). And it was Coke and his contemporaries and their immediate successors who wrote the legal treatises which shaped the thought of men like Thomas Jefferson. Thus Magna Carta forms part at least of the background of the political ideas which shaped the United States.

Bibliography.—The standard scholarly work on Magna Carta itself is W. S. McKechnie's *Magna Carta* (Glasgow 1914). The most recent account of the political and constitutional background is given in J. E. A. Jolliffe, *The Constitutional History of Medieval England* (London 1937). Sir Maurice Powicke's *Stephen Langton* (Oxford 1928) is extremely important for an understanding of the charter's relation to the political ideas of the time. Sidney Painter's *The Reign of King John* (Baltimore 1949) discusses the background of the charter and the document itself. For discussion of important details *Magna Carta Commemoration Essays* (London 1917) is very useful. The later history of Magna Carta is thoroughly and ably covered by two books by Faith Thompson, *The First Century of Magna Carta* (Minneapolis 1925) and *Magna Carta, Its Role in the Making of the English Constitution* (Minneapolis 1948).

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MAGNA GRAECIA, măg'nȧ grē'shȧ, "Great Greece," the name commonly given in ancient times to that part of southern Italy which was inhabited by Greek colonists. Apparently the name was in use as early as the time of Pythagoras (586–506 B.C.). Strabo includes the Greek cities of Sicily under the appellation, but the name refers generally only to the Greek cities in the south of Italy, including those on the shores of the Tarentine Gulf and the Bruttian Peninsula, with Velia, Posidonia and Laüs, on the west coast of Lucania. The name was not at first territorial or coextensive with any region, but applied merely to the Greek cities on the coasts. Cumae was the most ancient of all the Greek settlements in Italy, but from its remote position it was in a great measure isolated from the later Greek settlements. The Achaeans were the real colonizers of southern Italy, their first settlement being Sybaris (720 B.C.). A few years later (708 B.C.) Spartan colonists founded Tarentum (modern Taranto), and to counteract their encroachments the Achaeans founded Metapontum, on the frontier of the territory of the Tarentines, between 700 and 680 B.C. The Locrians founded further south the city known as Locri Epizephyrii, nearly contemporary with Crotona (710 B.C.). The Chalcidic colony of Rhegium, on the Strait of Messina, claims to have been more ancient even than Sybaris. The Greek cities on the shores of Bruttium and Lucania were, Velia excepted (540 B.C.), offshoots from the earlier settlements, and not founded by colonists direct from Greece. The arrival of Pythagoras at Crotona (530 B.C.) produced a marked change in the cities of Magna Graecia, and led to the introduction of great political changes. He and his followers were ultimately expelled from Crotona. Very little of the early history is known. The coast cities were essentially mercantile. Trade was well developed, and in the 6th century there was an extensive commerce, especially with Greece. The colonists who pushed to the interior subdued the opposing natives and developed the fertile plains into agricultural settlements. There was a high development of intellectual life. At various times there were temporary alliances among the cities. Warfare was common, and to this fact is largely due the decline of the territory. Magna Graecia comprised the provinces of Campania, Apulia, Iapygia, Lucania, and Bruttium.

MAGNALIA CHRISTI AMERICANA, măg-nā'lĭ-ȧ krĭs'tī ȧ-mĕr-ĭ-kā'nȧ, an ecclesiastical church history of New England, from 1620 to 1628, published by Cotton Mather in 1702. It treats more extensively of the early history of the country than its title seems to indicate, and is divided into seven books: the first treating of the early discoveries of America and the voyage to New England; the second is *Lives of the Governors;* the third, *Lives of many Reverend, Learned and Holy Divines;* the fourth, *Of Harvard University;* the fifth, *The Faith and the Order in the Church of New England;* the sixth, *Discoveries and Demonstrations of the Divine Providence in Remarkable Mercies and Judgments on Many Particular Persons;* the seventh, *Disturbances Given to the Churches of New England.* In the sixth book the author gives accounts of the wonders of the invisible world, of worthy people succored when in dire distress, of the sad ending of many wicked ones, and of the cases of witchcraft at Salem and other places.

MAGNENTIUS, măg-nĕn'shĭ-ŭs, **Flavius Popilius,** Roman emperor of the West: d. Aug. 11, 353. Having been entrusted by Constans with a high military command he availed himself of his office to plot the emperor's overthrow. On Jan. 18, 350, presenting himself in imperial purple at a great banquet given by one of the conspirators at Autun, he was saluted with the title of Augustus; and assassins sent for the purpose having dispatched Constans, Magnentius was acknowledged as emperor by all the western provinces except Illyria. Constantius II, on hearing of his brother's murder, hastened from the confines of Persia and defeated Magnentius (351). These disasters led to the defection of all the countries that had recognized the usurper. Constantius then became master of the entire empire, and Magnentius fled to Gaul, where he committed suicide.

MAGNESIA, the oxide of magnesium, MgO. See MAGNESIUM.

MAGNESITE, a mineral (magnesium carbonate, $MgCO_3$; carbon dioxide 52.4 per cent, magnesium oxide 47.6 per cent theoretically pure) in which silica magnesium compounds, calcium carbonate and iron oxide are always present, with a hardness of 3.0 to 3.5 (Mohs scale) and a specific gravity of 3.0-3.1.

Occurrence.—(1) In crystalline form as magnesite marble or "spathic": as a replacement of dolomite $MgCa(CO_3)_2$, commonly as a resultant of hydrothermal activity by magnesium solutions associated with granitic intrusives. There are deposits in Manchuria, Russia, Austria, Czechoslovakia, Brazil, British Columbia, Quebec, Washington, and Nevada. Colors range widely through the effect of oxidized impurities—blue-black, light red, mottled gray, gray to white. (2) As sedimentary beds it is cryptocrystalline, dense and exceedingly fine. Usually shallow the beds may be of great lateral extent, typical of desert conditions as in San Bernardino and Kern counties, California, and Clark County, Nev. The color is white to gray-white. (3) As veins and replacements in other rocks, notably in the ultrabasic intrusions of California. Associated with serpentine ($H_4Mg_3Si_2O_9$) it occurs in the coastal and Sierra Nevada ranges, also in Baja California (Mex.) and Venezuela deposits. Amorphic, the color is porcelain white.

Uses.—Chiefly for refractory brick and sintered grains as MgO after "dead burning" above 2900° F. The light burned (caustic) powder is used in oxy-chloride flooring especially on ship decks and in public buildings, as a fertilizer addition and as a rubber filler. Synthetic magnesia is produced for the same uses from various brines including sea water.

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MAGNESIUM, a metallic element whose compounds are abundant and widely distributed, but which does not occur in nature in the metallic form. Magnesium resembles calcium in its chemical deportment, and the oxides of the two metals were long confused with each other. Metallic magnesium was first prepared by Davy, in 1808, both by electrolysis and by the reduction of white-hot magnesia in an atmosphere of potassium vapor. In 1830 Bussy obtained a larger and purer yield of the metal, by heating a mixture of potassium and anhydrous magnesium chloride to redness. It is commercially produced by the electrolysis of the fused anhydrous chloride or the direct reduction of the oxide by ferrosilicon or carbon. Pure magnesium is silvery-white in color, lustrous and moderately hard. It may be hammered, rolled, filed and polished. Its specific gravity is 1.74 and its specific heat 0.246. Its melting point is 651° C. When raised to a bright-red heat (out of contact with the air) it volatilizes, depositing upon cool surfaces again in the form of lustrous silvery crystals which belong to the hexagonal system, and are isomorphous with those of zinc; this property has been commercially used in the production of metal of high purity. It expands by 0.000026 of its own length, per Centigrade degree of rise of temperature; and at 20° C. its electrical resistance is 0.0481 of that of mercury.

Chemically, magnesium is a dyad. It has the symbol Mg, and an atomic weight of 24.32. Its most important compounds are the oxide, MgO, the chloride, $MgCl_2$, the sulphate, $MgSO_4$, and the carbonate, $MgCO_3$. Metallic magnesium is not altered upon exposure to dry air, but ordinary air oxidizes it superficially. It dissolves readily in dilute acids, with the formation of the corresponding salts. Chlorine, bromine, iodine, fluorine, sulphur, phosphorus and arsenic combine with it directly. Red-hot metallic magnesium also slowly combines with free nitrogen to form a solid nitride. In the isolation of argon, helium and the other rare gases of the atmosphere advantage is taken of this fact for separating these gases from the nitrogen of the air. (See ARGON.) When strongly heated in the air, metallic magnesium takes fire and burns with an exceedingly brilliant white light that is rich in chemical rays; the product of the combustion being magnesia, MgO. Advantage is taken of this property in flashlight photography. Magnesium will also burn when sufficiently heated in steam, carbon dioxide or sulphur dioxide.

Magnesium oxide, or "magnesia," MgO, is usually prepared by heating the nitrate or carbonate of the metal; on account of this method of preparation it is commonly known as "calcined magnesia." Magnesia is a white substance, without taste or odor. It does not have a strongly alkaline reaction, but it acts as a powerful base, reacting with acids to form the magnesium salts. It is scarcely soluble in water, but it slowly absorbs moisture and carbon dioxide from the air, becoming converted into a mixture of the hydrate and carbonate. One of the most distinctive characteristics of magnesia is its infusibility, the electric furnace being required to melt it. On account of its infusibility magnesia is used in the manufacture of crucibles and of firebrick.

Magnesium chloride, $MgCl_2$, is prepared by dissolving magnesia in hydrochloric acid. This substance is largely used as a preventive of mildew, in the sizing of cotton cloth. The mineral carnallite contains magnesium chloride, having the composition $MgCl_2 \cdot KCl \cdot 6H_2O$; the chloride is also recovered from the bitterns, or mother liquors, remaining after the crystallization of salt from brine wells in Michigan, Ohio and West Virginia, and as a byproduct in the recovery of potash from langbeinite ($K_2SO_4 \cdot 2\,MgSO_4$) in New Mexico. Magnesium sulphate occurs native (in combination with one molecule of water) as kieserite, and it may also be prepared artificially by dissolving magnesium oxide or carbonate in dilute sulphuric acid. When combined with seven molecules of water, magnesium sulphate constitutes the familiar substance known as Epsom salts (q.v.), which is largely used in medicine. Magnesium carbonate, $MgCO_3$, is a white substance, insoluble in water, but soluble in a solution of ammonium chloride, and also in water that contains carbon dioxide in solution. It occurs in nature as the mineral magnesite, which crystallizes in rhombohedral forms, isomorphous with calcite. Dolomite, which occurs in nature in enormous quantities, is a carbonate of magnesium and calcium.

Magnesium salts are used to a considerable extent in medicine. The name "magnesium" is derived from "magnesia," which substance is said to have been obtained from the province of Magnesia in Thessaly.

Metal Production.—The expansion of the

production of magnesium metal in response to Second World War demands is one of the miracles of war production.

As an industrial metal, magnesium has been on the market for comparatively only a few years; production in the United States in 1932 was under 400 short tons, but had increased to 6,260 tons in 1940, with corresponding increases in other countries, and a world total in 1940 of about 45,000 tons. At that time these increases were considered phenomenal, but they fade into insignificance in comparison with the performance of the next three years, when mushrooming war demands brought developments in months that normally would have required years.

Nothing very specific is known of progress during this period in countries outside of the United States, but the results accomplished here may be taken as more or less representative of the progress that has been made in the other belligerent countries. However, that Germany and Japan had anticipated the coming war demand for magnesium is evidenced by the fact that the 1940 estimates attribute over half the world total to Germany, one sixth to England, somewhat less to the United States, and the remaining one sixth in decreasing amounts to Japan, France, the Soviet Union, Switzerland, and Italy. To this prewar list, Norway was added in 1941, and Canada, beginning in August 1942, the latter with an output of 3,575 tons in 1943.

While there are other uses for magnesium, air warfare claims the bulk of the output, for plane construction, incendiary bombs, illumination flares, tracer bullets, and similar items. As the field of war expanded, and the American plane construction program was enlarged accordingly, the potential demand for magnesium grew by leaps and bounds; a War Production Board estimated requirement of 550 tons a day was considered almost fantastic for a metal which only a few months earlier was being turned out at a rate of 520 tons per month, but almost before people had time to accustom themselves to the first figure, it was raised to 1,000 tons a day. Confronted with such demands, plant construction was started on an unprecedented scale, to supplement the output of the single prewar producer. This one original producer increased the capacity of its plant and built a second, while another company built a third, while the government financed and built 12 additional plants and doubled the capacity of the second private plant. By the end of 1943 these 15 plants were in production, with a rated capacity of 26,000 tons a month, with a maximum output of 21,000 tons in January 1944, practically double the output rate a year earlier.

This output was not the maximum of which the plants were capable of producing, and was only 70 per cent of the planned output, but as it turned out actual consumption failed to reach the high levels that had been anticipated, and by the end of the first quarter of 1944 sufficient surplus had been accumulated to permit a reduction of output. By June 1944 production had been scaled down by 30 per cent, with further cuts in prospect. Total production in 1943 has been reported at 184,000 short tons, with 112,700 tons in the first half of 1944.

These 15 magnesium plants use one of three basic processes for the production of the metal:

(1) Electrolysis of fused magnesium chloride,

(2) Reduction of magnesium oxide by ferrosilicon,

(3) Reduction of magnesium oxide by carbon.

The electrolytic method is preferred, especially if the required chlorides are directly available; if not, the oxide must be converted to chloride. Although the reduction procedure is simple and direct, producing fused magnesium of relatively high purity, the process has the disadvantages of requiring a cell feed of high purity, producing and handling the anhydrous chloride from the hydrated salt; providing means of handling and disposing of the chlorine produced, and providing a large amount of electric power.

The ferrosilicon reduction process is likely to prove somewhat higher in cost, but this is partly offset by the use of the oxide instead of the chloride, and is helped still more by the fact that the oxide need not be pure MgO; a calcined dolomite, containing lime (CaO) works better than the pure MgO. This is due to the fact that the silica (SiO_3) produced by the reduction must be slagged off as a silicate; if pure MgO is used, from one third to one half of the MgO is lost in this way; however, if the cheaper and more plentiful dolomite is used, the CaO does the slagging work, with a corresponding saving of MgO. The calcined dolomite is ground, mixed with ground ferrosilicon, briquetted, and charged into retorts, where they are heated in a vacuum to a temperature of 1100–1200° C. The reduced magnesium is volatilized and recovered as liquid metal in condensers attached to the retorts.

In the carbon reduction a briquetted mixture of MgO and carbon is heated in an electric arc furnace. In this case both products of the reaction are gases—carbon monoxide (CO) and magnesium vapor. If these are permitted to cool normally, the reaction reverses itself, with the reformation of MgO; this can be partially prevented by cooling the mixture to below the reaction temperature so rapidly that the reoxidation can not be completed. This is done by sweeping the mixed gases out of the furnace with a current of hydrogen or natural gas. Even this does not prevent some reoxidation, and the magnesium vapor condenses as a fine droplet of liquid metal, the surface of each particle being covered with a layer of MgO, which prevents coalescence. To obtain a pure metal this powder is charged into a redistillation furnace, from which the metal is again volatilized and condensed as liquid metal.

A modification of the carbon reduction method uses calcium carbide as the reducing agent. It is also possible to use aluminum instead of silicon, but the cost would be prohibitive in a commercial application.

The primary raw material for the electrolytic process (magnesium chloride) may be obtained from the residual bitterns from salt brine wells, from the mother liquors in the recovery of potash from langbeinite, or if necessary by chemical treatment of magnesium oxide. The oxide used in the thermic reduction processes may be supplied from mineral sources (mostly magnesite, dolomite) but at least two large plants use an elaborate process for the recovery of the 0.1 per cent of MgO in sea water and then converting it to the chloride for electrolysis, in preference to utilizing a relatively higher MgO content in mineral form. (See tables next page.)

TABLE I

ESTIMATED WORLD PRODUCTION OF MAGNESIUM, 1938–42, BY COUNTRIES, IN METRIC TONS*

Country	1938	1939	1940	1941	1942
Australia	.....	.....	.....	200	430
Canada	.....	.....	.....	.....	230
France	1,800	2,500	2,000	3,000	3,000
Germany	14,100	16,500	25,000	35,000	50,000
Italy	102	300	500	2,500	5,000
Japan	1,500	2,000	3,000	5,000	12,000
Norway	.....	.....	.....	100	2,000
Switzerland	750	750	750	1,000	1,500
U.S.S.R.	500	1,000	1,500	4,000	5,000
United Kingdom	2,200	4,831	6,500	12,000	16,500
United States	2,918	3,039	5,680	14,782	44,418
Total	23,900	30,900	44,900	77,600	140,100

TABLE II

ACTUAL DOMESTIC CONSUMPTION OF PRIMARY AND SECONDARY MAGNESIUM (MAGNESIUM CONTENT), 1941–42, BY USES, IN POUNDS*

Use	1941	1942	Use	1941	1942
Structural products[1]	21,951,900	63,519,400	Chemicals	27,600	22,900
Aluminum alloys	6,762,200	14,317,200	Other	32,300	23,300
Other alloys	59,000	[2]431,100			
Scavenger and deoxidizer	130,400	211,800	Total	29,346,600	84,525,700
Pyrotechnics	383,200	6,000,000			

[1] Castings, sheet, extruded shapes, forgings, etc.
[2] Includes 396,100 pounds of magnesium contained in 50-50 aluminum-magnesium alloy.

TABLE III

SPECIFIED MAGNESIUM COMPOUNDS PRODUCED, SOLD, AND USED, BY PRODUCERS IN THE UNITED STATES, 1943–44†

Product	1943				1944			
	Produced	Sold[1]		Used	Produced	Sold[1]		Used
	Short tons	Short tons	Value	Short tons	Short tons	Short tons	Value	Short tons
Precipitated magnesium carbonate	55,207	[2]5,795	[2]$509,405	[2]49,462	52,918	4,845	$448,619	47,917
Pharmaceutical grade magnesia and magnesium hydroxide	[3]3,888	3,809	847,583	.....[4]	[3]4,694	4,391	923,695	.....[4]
Magnesium chloride—100 per cent basis	640,708	55,740	1,931,036	587,089	525,223	19,086	712,826	509,365
Magnesium sulfate — 100 per cent basis	26,710	26,416	1,320,104	.....	25,316	25,565	1,289,448	.....

[1] Sales by one producer to an affiliated consumer for immediate use are not included in "Sold" but are reported under "Used."
[2] Partly estimated.
[3] Exclusive of magnesia made from magnesium hydroxide, to avoid duplication.
[4] Magnesia and magnesium hydroxide used by producing firms in making other magnesias are not shown.

TABLE IV

SECONDARY MAGNESIUM RECOVERED IN THE UNITED STATES, 1943–44, IN SHORT TONS†

Type of product or use	1943	1944
Magnesium-alloy ingot[1] (gross weight)	11,009	13,379
Magnesium-alloy castings (gross weight)	327	235
In aluminum alloys	34	23
In lead alloys	.....	2
In zinc alloys	1	5
Consumed in chemical and incendiary uses	33	541
Total	11,404	14,185
From new scrap	11,254	13,976
From old scrap	150	209

[1] Figures include secondary magnesium incorporated in primary magnesium ingot.
* *Minerals Yearbook, 1942.*
† Mineral Industry Surveys, Bureau of Mines, *Mineral Market Reports:* June 21 and July 30, 1945.

MAGNET WIRE. Magnet wire is a term given to conductors used for winding electromagnets. They differ from other conductors in having thin insulating coverings, and are used on comparatively low voltage circuits in the contruction of electrical devices where electrical energy is to be transformed into magnetic energy, as in relays, solenoids, contactors, transformers, field coils, and armature coils.

The power of "pull" of an electromagnet, or solenoid, depends upon the current in amperes and the number of turns (ampere turns) of the magnet, which produce magnetic lines of force. A reduction of current requires a greater number of turns and, with a "fixed" conductor size, the insulation of the conductor has much to do with the winding space required for a given magnet. For high efficiency and compact design, the wire, and thus the current, should be in as close proximity as possible to the magnetic circuit, or iron, in the magnet or solenoid. Insulation must be thin and flexible, and must possess high dielectric strength. The winding space varies according to the type and amount of insulation necessary for adequate protection.

Since each application of magnet wire has its own particular requirements, there is no universal magnet-wire insulation. There are, however, several different insulations, such as oil-type enamel; synthetic-resin base, including vinyl acetal; cotton; silk; paper; asbestos; cellophane; and glass fiber, which may be used alone or in combination where best suited for space factor, dielectric strength, flexibility, appearance, and resistance to heat, to solvents, and to moisture.

Two Temperature Classes.—The temperature limits on which the rating of electric machines and apparatus is based are largely determined by the character of the insulating materials used. Two classes are defined by the American Institute of Electrical Engineers (AIEE).

Class A insulation consists of cotton, silk, paper, and similar organic materials when impregnated or immersed in enamel; and of enamel as applied to conductors. The limiting "hottest-spot" temperature for Class A material is 105°C.

Class B insulation consists of mica, asbestos, and enamel in organic materials in built-up form combined with binding cement. The limiting "hottest-spot" temperature for Class B material is 125°C.

AIEE recognizes the ability of manufacturers to employ Class B insulation successfully at maximum temperatures of 150°C. or even higher. However, as sufficient data covering experience over a period of years at such temperatures was unavailable, the institute adopted 125°C. as a conservative limit for this class of insulation. Any increase above this figure should accordingly be made the subject of special guarantee by the manufacturer.

Class A Types of Magnet Wire.—The most commonly used Class A types are synthetic-resin coated magnet wire, enamel wire, and enamel single cotton wire. Many other types are available for special applications.

Vinyl-Acetal.—Later developments include magnet wire having a tough insulating film of synthetic resins, including those of the vinyl-acetal type.

Enamel wire has physical limitations that necessitate, in many applications, the use of protective coverings, such as cotton, paper, silk, or combinations. These coverings partially compensate for the physical limitations of the enamel film. However, because of the space they take up, these coverings increase the size—and hence the cost—of finished apparatus.

Formvar wire, in addition to having excellent electrical characteristics, has outstanding mechanical properties. It is remarkably strong, tough, and flexible, and needs no additional protective covering. It thus has many advantages: its first cost is generally less than that of fabric-covered

MAGNET WIRE

B. & S. Gage No.	Turns per Linear Inch			Turns per Square Inch			Feet per Pound		Capacity at 1500 Cm. per Amp.	Current Required to Fuse	B. & S. Gage No.
	Enamel	D.S.C. or S.C.C.	D.C.C.	Enamel	D.S.C. or S.C.C.	D.C.C.	Bare	D.C.C.			
10	9.6	9.3	8.9	90	85	80	32	31	6.9	330	10
11	10.7	10.3	9.8	113	110	97	40	39	5.5	285	11
12	12.0	11.5	10.9	140	136	120	50	49	4.4	235	12
13	13.5	12.0	11.8	175	170	150	64	61	3.5	200	13
14	15.0	13.5	13.1	220	210	183	80	77	2.7	165	14
15	16.8	15.	14.6	275	262	222	101	97	2.2	140	15
16	19.	17.	16.4	350	320	270	128	119	1.7	120	16
17	21.2	19.	18.1	435	400	330	162	150	1.3	100	17
18	23.6	21.	20.0	550	490	400	203	188	1.1	85	18
19	26.4	24.	21.8	680	590	480	256	237	.86	70	19
20	29.4	26.	23.9	850	775	625	323	300	.68	58	20
21	33.1	29.	26.2	1060	940	750	408	370	.54	50	21
22	37.0	31.	28.5	1340	1150	910	514	460	.43	42	22
23	41.3	34.	31.1	1660	1400	1080	648	585	.34	34	23
24	46.3	38.	33.6	2100	1700	1260	817	745	.27	30	24
25	51.7	41.	36.2	2630	2060	1510	1030	900	.21	25	25
26	58.0	45.	39.9	3320	2500	1750	1300	1180	.17	20	26
27	65.0	50.	42.6	4140	3030	2020	1640	1420	.13	17	27
28	72.7	54.	45.5	5250	3670	2310	2060	1750	.11	15	28
29	81.7	58.	48.	6500	4300	2700	2600	2200	.08	12	29
30	90.5	65.	51.1	8100	5040	3000	3275	2530	.07	10	30

D.S.C. = Double Silk Covering. S.C.C. = Single Cotton Covering. D.C.C. = Double Cotton Covering.

From *Electrical and Radio Dictionary* by Gorder, Dunlap and Haan. Courtesy of American Technical Society.

enamel wire; it is smaller, and thus allows the use of the same amount of copper in less space, or more copper in the same space; it permits higher winding speed with fewer rejections; it saves on varnish treatment, and under severe conditions it will last much longer.

Formex is available in round sizes No. 10 to No. 40 awg. inclusive, with insulation thicknesses comparable to National Electrical Manufacturers Association (NEMA) standards for single and heavy enamel wire.

Enamel Magnet Wire.—Enamel wire differs from vinyl-acetal wire in that the base of the varnish is of the conventional-oil type instead of being of synthetic resin. Its electrical properties are about the same, but it has not the same high degree of physical toughness. Its first cost is lower, and it is available in all standard types and sizes.

Cotton-covered Wire.—This type consists of a wrap, or wraps, of specially selected cotton yarn applied over the conductor (either bare or enameled), producing a closely wrapped uniform covering which may serve as a protection to the enamel film against physical abuse during winding and assembly operation. It is available in all round, rectangular, and square standard types and sizes.

Other Types.—Among other types of magnet wire that are quite widely used are: enamel double cotton, single and double silk and enamel single silk, artificial silk covered, bonded cotton covered, paper insulated, and litzendraht (litz) wire. (Litz wire is made up of a number of fine, separately insulated strands, woven together in such a way that each strand successively takes up all possible positions in the cross-section of the entire conductor. This type reduces skin effect, which means lower resistance to high frequency currents.)

Class B Types of Magnet Wire.—There are only two Class B types of magnet wire, but at least three varieties of each type are available.

Asbestos-insulated Wire.—Asbestos-insulated magnet wire consists of nonferrous asbestos applied with an adhesive directly to the bare copper. The outer finish may be one of several varieties. The three below are the most common: (1) brown (varnish treated); (2) black (asphaltic base); and (3) white (untreated asbestos).

Round and square wires are made to have the same overall dimensions as does double-cotton magnet wire. This facilitates the changing of a double-cotton winding to a Class B type, because the same slot space would be required for the cotton magnet wire as would be required for the asbestos-insulated type.

Asbestos-insulated magnet wire is used principally where high current densities and operating temperatures are such that Class A magnet wire would fail because of heat.

For specialized applications, particularly where a wire with a higher voltage breakdown is required, it is recommended that an enameled conductor be used, with asbestos insulation overall.

Practically all Class B requirements can be met with the brown (varnish-treated) magnet wire. There are certain applications, however, that lend themselves particularly well to the black type of insulation, particularly where severe edgewise bends are to be made. The white wire is recommended for those applications where there is a maximum of heat and practically no moisture.

Glass-insulated Wire.—Glass-fiber-insulated magnet wire is commonly manufactured in three types: (1) double glass; (2) single glass; and (3) enamel single glass.

The choice of these wires depends upon the space permissible in the winding, and on the dielectric strength necessary.

Glass insulation is applied over the conductor as a wrapping of yarn, much as in the cotton-covered type. However, it is always necessary that an adhesive be used between the conductor and glass wrap; also, the glass should be impregnated with a finishing varnish. The varnish increases the resistance to abrasion.

Where increased dielectric strength is necessary, enamel single-glass or enamel double-glass wire is recommended.

For all types of asbestos- and glass-insulated magnet wires, both square and rectangular wires can be furnished.

Selection of Magnet Wire and Magnet Wire Symbols.—The selection of magnet wire depends upon many factors, such as finish, space factor, dielectric strength, resistance to abrasion, oils, solvents and moisture.

Symbols.—There are also many types of insulation used for covering magnets, each represented by a letter or group of letters, as follows:

MAGNET WIRE SYMBOLS

	Symbol	Combinations: Enamel	Combinations: Heavy enamel
Enameled wire			
Enamel	E	E	....
Heavy enamel	HE	....	HE
Cotton-covered wire			
Single cotton	C	EC	HEC
Bonded single cotton	BC	EBC	HEBC
Single cotton varnished	CV	ECV	HECV
Double cotton	DC	EDC	HEDC
Bonded double cotton	BDC	EBDC	HEBDC
Double cotton varnished	DCV	EDCV	HEDCV
Silk-covered wire			
Single silk	S	ES	HES
Bonded single silk	BS	EBS	HEBS
Single silk varnished	SV	ESV	HESV
Double silk	DS	EDS	HEDS
Bonded double silk	BDS	EBDS	HEBDS
Double silk varnished	DSV	EDSV	HEDSV
Paper-covered wire			
Single paper	P	....	....
Single paper bonded	BP	EBP	HEBP
Double paper	DP	....	....
Double paper bonded	BDP	EBDP	HEBDP
Paper- and cotton-covered wire			
Single paper single cotton	PC	....	....
Single paper double cotton	PDC	....	....
Double paper single cotton	DPC	....	....
Double paper double cotton	DPDC	....	....
Silk- and cotton-covered wire			
Single cotton single silk	CS	....	....
Single cotton double silk	CDS	....	....
Double cotton single silk	DCS	....	....
Double cotton double silk	DCDS	....	....
Asbestos-covered wire			
Asbestos covered	A	EA	....
Asbestos covered varnish treated	AV	EAV	....
Vinyl-acetal-covered wire			
Vinyl-acetal insulation—single	F	....	....
Vinyl-acetal insulation—heavy	HF	....	....
Fibrous-glass-covered wire			
Single glass	G	EG	....
Double glass	DG	EDG	....
Cellulose-acetate-covered wire			
Cellulose-acetate insulation	L	....	....
Cellophane-covered wire			
Cellophane insulation	K	....	....

MAGNETIC DIP, the angle formed with the horizon by a magnetic needle free to move vertically in the plane of the magnetic meridian. It is also called *inclination* and *dip of the needle.* At the magnetic equator it is 0°, and 90° at the magnetic poles. See also DECLINATION NEEDLE; DIPPING NEEDLE; MAGNETISM.

MAGNETIC FIELD. See ELECTRICAL TERMS.

MAGNETIC FLUX. See ELECTRICAL TERMS.

MAGNETIC MOMENT. See MAGNETISM.

MAGNETIC POLE, either of two spots on the earth's surface toward which the compass needle points from any direction throughout adjacent regions. The North Magnetic Pole is at north latitude 71°, west longitude 96°, and the South at south latitude 72-73°, east longitude 156°. See also MAGNETISM.

MAGNETIC SEGREGATION, a process or processes in the preparation of ore by which the more valuable minerals are separated from the waste material and from each other by the use of magnets. A usual type of segregator consists of a belt conveyor carrying the ores below the magnet which raises the magnetic ore to another belt traveling at right angles to the first. As it passes out of the magnetic field the segregated ore drops into a receptacle. By weakening or strengthening the magnetic field it becomes an easy matter to separate the nonmagnetic from the magnetic, and the weakly magnetic from the strongly magnetic.

MAGNETISM, the name applied to a peculiar force action first observed in connection with certain iron ores. This ore, often called lodestone, is supposed to have been discovered in Magnesia, a part of Asia Minor. It is not possible to state just when this discovery was made, but certain passages in Lucretius show that something was known concerning it before the beginning of the Christian era. About the year 1200 we have the statement that a lodestone free to turn takes up a definite position in space. Some further details were noted by Peregrinus Proteus (1269), but the greatest of the early works is that of Dr. William Gilbert, a physician, who published his *De Magnete, Magneticisque Corporibus* in 1600. Those interested in the history of the subject may consult the *Intellectual Rise of Electricity* by Park Benjamin, in which an excellent historical sketch may be found.

The only direct evidence that a body is magnetic is its ability to exert a force on certain substances, which, by reason of their susceptibility to this action, are called magnetic substances. A lodestone brought in contact with several small bodies will select those of iron or steel, if such be present, but show no appreciable force on copper, lead, wood or in fact on any except iron, nickel, cobalt, certain rare metals and certain alloys of relatively nonmagnetic metals, and a few others to a lesser degree. Of even greater interest and importance is the fact that the lodestone is able to endow steel or iron with the ability to exert this force. Soft iron loses its external magnetic qualities when removed from the immediate neighborhood of the exciting source, but hard steel or iron will retain this property for a long time. If a bar or rod of hard steel is drawn across a piece of lodestone or other permanent magnet and is then suspended so as to be free to turn about a vertical axis, it will take up a definite position; usually its line of greatest length will be approximately north and south. If it be plunged into a box of iron filings, little magnetic action will be manifest near the middle of the bar, but near the ends considerable quantities of filings will be attracted and may be lifted against the action of gravity. These facts led to the naming of the regions of greatest external action the poles of the magnet and since the lines joining these regions would, in the case of a freely suspended magnet, lie in many places nearly north and south, the pole which seeks the north is often called the north-seeking or positive pole, and the other which turns toward the south is correspondingly named the south-seeking or negative pole. The entire subject was formerly studied with reference to the behavior of like and unlike poles, and it was even supposed that these poles consisted of opposite sorts of magnetic matter. Later investigations have developed methods less directly dependent upon the idea of poles, which are preferable for many purposes.

If we suppose two long magnets placed as shown in Fig. 1, a study of their mutual force

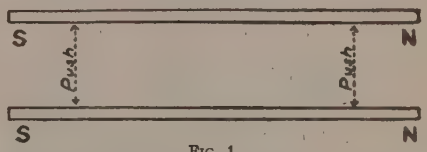

FIG. 1.

action would indicate that each is exerting a push tending to increase the distance between them, and that the amount of this repulsion will vary with the distance between the magnets. If one of the bars be replaced by another whose magnetic quality is different the force action will be modified. If one of the magnets be reversed in position a corresponding force tending to reduce the distance between the bars would be observed. It is convenient to use as a preliminary definition the statement that a unit pole is one which would exert unit force upon a precisely equal pole at a distance of one centimeter. The law of pole action can then be stated by saying that the force is equal to the product of the two poles' strengths divided by the square of the distance between the two poles.

If a freely suspended magnet is brought into

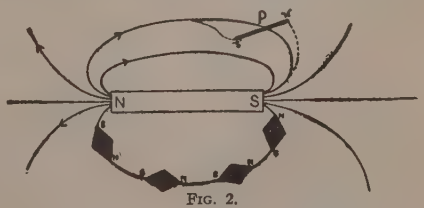

FIG. 2.

the neighborhood of a large bar magnet as indicated in Fig. 2, it will be observed to take up a position somewhat as indicated in the lower

part of this diagram, as its point of suspension is moved along the line. The region where this directive force is noticeable is called the *field* of the magnet. (Gilbert's «orb of virtue»). If continuous lines are drawn, which at each point have the direction taken by the free magnet, these lines are called lines of magnetic force, and they offer a very convenient method for a general study of magnetic action. While these lines have no objective existence, it is, nevertheless, desirable to imagine that they are real and that they possess certain definite qualities. They should always be considered as being directed away from the north-seeking or positive pole. In the early conception of magnetic action these lines would have been regarded as the lines of flow of the magnetic material, and the word flux, still in use, bears evidence of this conception. It is convenient also to regard the lines of force as being under tension and capable of repelling each other. The number of actual lines of force which could be drawn about a magnet is infinite. For purposes of comparison, however, it is customary to represent the force action at a point upon the unit pole placed at that point by the number of lines drawn per square centimeter on a surface perpendicular to the field. A unit field is one in which a force action upon a unit pole is one dyne, about the weight of 1–1000 of a gramme.

In order to compare magnets and to facilitate magnetic computations, certain methods of measurement have been devised. Only a brief sketch can be given here, as full details of these operations may be found in books devoted to this subject, some of which will be mentioned at the end of this article. When a bar magnet is placed at right angles to the lines of a uniform magnetic field it will experience a twist tending to place it along these lines. The amount of this twist will depend upon three things. First: The pole strength of the magnet in question. Second: The distance between the poles. Third: The strength of the field where it is placed. The product of the pole strength by distance between poles is called the magnetic moment of the magnet. When a magnet is suspended freely and slightly displaced from a position parallel to the lines of force it will vibrate about this position. The time required for a complete swing is found to depend upon the magnetic moment, the moment of inertia and the strength of the field where the magnet is placed. The vibration period may be directly observed and the moment of inertia computed from the dimensions and weight of the magnet. In this way the product of the magnetic moment by the field strength may be found. If the same magnet is held with the line joining its poles east and west it will cause a small freely suspended magnet some distance to the east or west to turn slightly from its equilibrium position. The amount of this deflection depends on the distance between the magnets and the ratio of *magnetic moment* to *field strength*. If we denote the magnetic moment by ml and the field strength by H, the product of ml times H is found from the time of vibration, and by means of the deflection of the small auxiliary magnet $\frac{ml}{H}$ may be determined. When ml times H or ml divided by H is known either ml or H is readily computed. When the field at any point is known, a comparison of the time of vibration of a magnet at the known point with its period when vibrating at any other point enables us to compare the two fields without further measurement. The law of change being that if periodic time is doubled the field strength would be four times as great; or the period varies inversely as the square foot of the field in which the magnet vibrates.

The facts mentioned above regarding the ability of a magnet to cause pieces of neutral iron or steel to show magnetic properties is frequently spoken of as magnetic induction. The general phenomena can be readily remembered if we imagine that it is easier for lines of magnetic force to pass through iron than through air. Small pieces, as shown at P, Fig. 2, would have lines entering at «S» and leaving at «N» and would behave as small magnets placed in corresponding positions. Owing to the tension of the lines of force these small pieces would tend to set themselves nearly parallel to the undisturbed direction of the lines. If a sheet of glass or other non-magnetic material is placed over a magnet and iron filings are sprinkled on its surface, a slight tapping, sufficient to overcome friction, will enable the lines of force to arrange the small temporary magnets parallel to the field. In this way maps of magnetic fields may be readily found, and their study throws considerable light upon many de-

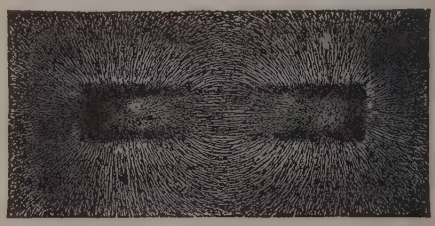

FIG. 3.

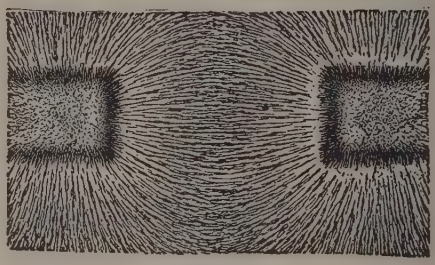

FIG. 4.

tails of these peculiar phenomena. Such fields are shown in Figs. 3 and 4. If a sphere of iron or cobalt is free to move in a magnetic field which is not uniform, a tendency is always observed for the iron to place itself in the strongest part of the field, or so that as many of the magnetic lines pass through it as possible. Such a substance is called paramagnetic. Some substances, as for example a sphere of bismuth, will tend to move to the weaker portions of the field, indicating that it is more difficult for magnetic lines to pass through the material than through air. These are called diamagnetic bodies.

The importance of magnetic action in both theoretical and practical affairs is due largely

to its intimate connection with the phenomena of the electric current. In fact it is absolutely impossible under any conditions to have an electric current flow in a conductor without producing a magnetic field. In the case of a long straight wire carrying current the magnetic lines are circular in form, concentric with the wire, and their planes are perpendicular to its axis. If a wire is wound in a long, straight, cylindrical coil, frequently called a solenoid, and a current be passed through it, the field produced will be nearly identical with that of a bar magnet, the difference being that the lines of force are entirely in air and are not modified by the peculiar properties of iron. By increasing the strength of the current and the number of turns of wire, a comparatively strong magnetic field may be produced at the centre. A piece of soft iron or steel inserted in the coil becomes a powerful temporary magnet, while strips or bars of hardened iron or steel would in the same way become permanent magnets. The requirements of modern electrical processes have led to very careful investigations of the magnetic behavior of iron in connection with the production and the measurement of electric energy. Only a brief sketch of the fundamental features can be given here. If we suppose an electric current flowing in a long solenoid, which does not contain an iron core, the strength of the magnetic field through the inside of the solenoid may be readily computed from a knowledge of the number of turns of wire and the strength of the current. The symbol H is generally used to indicate the field strength when iron is absent. If now a bar of iron be inserted it will be found that the magnetic field is greatly increased. The new field will depend partly on the original value of H and partly on the quality and previous magnetic history of the iron inserted. The symbol B is generally used to denote the intensity of the field when iron is present. It may then be stated that B equals μH, where μ is a variable factor depending on the nature of the iron and the field strength; this factor is called the *permeability*. The original field H is frequently spoken of as the magnetizing field and the new one as the induction. Or H stands for the number of lines per square centimeter where iron is absent and B stands for the number of lines per square centimeter in the iron. If iron, in a neutral magnetic condition, is placed in a solenoid and the electric current is gradually increased from zero the iron will be subjected to a steadily increasing magnetizing field. A comparison of corresponding values of B and H in such a case leads to very important results. The relation between these values is best explained by reference to a curve drawn by using these quantities as co-ordinates. Such curves, usually called the curves of magnetization, are shown in Fig. 5. It should be observed that when H is almost zero, the induction is very small, then B increases more and more rapidly with a rising field until at point two the rate of increase of B with H begins to fall off rapidly, and shortly a value of B is reached which cannot be materially increased no matter how strong a magnetizing field is used. For example in the specimens shown it is useless to extend the value of H much above 70, and in actual practice this limit would be taken much lower. When as many lines as possible are carried through the iron it is said to be saturated. The exact shape of the magnetization curve will depend upon the nature and previous magnetic history of the specimen, but the ratio B-H at any point gives the ability of the iron to multiply magnetic field strength for that particular

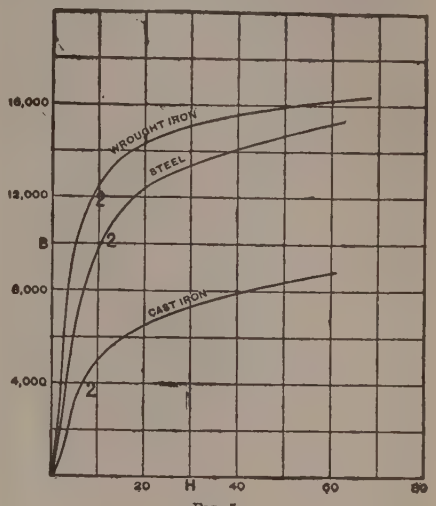

FIG. 5.

field. If, however, any definite state of magnetization is attained as at the point M, Fig. 6, it will be found that upon reducing the field, H, the values of the induction, B, will not agree with those found for the same value of H when the field was increasing. In fact if H be changed to zero and then to negative values and back again to the former condition the value of B will form a loop as indicated. This peculiar lag of the induction when the field is

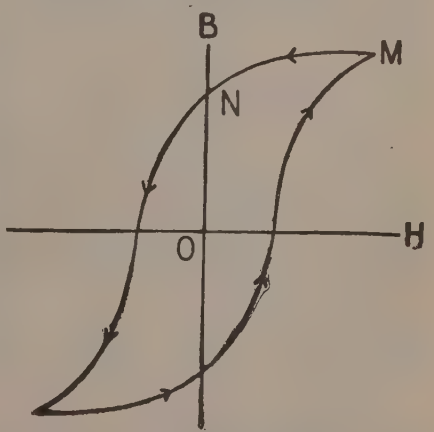

FIG. 6.

reduced is called hysteresis, and the hysteresis loop as shown is of practical importance because its area enables one to find the work converted into heat when the magnetization is carried through one complete cycle. The line ON measured the residual magnetism, which is

semi-permanent, and will be greater in hard than in soft iron or steel. No matter where the process of magnetization is stopped a series of cyclic changes of the magnetic field always gives corresponding loops.

A theory due to Weber and later improved by Maxwell which is useful in the correlation of the various phenomena observed in the magnetic behavior of iron is at once suggested by a simple experiment. Take a magnetic steel needle and which shows distinct polarity. Upon being broken into two parts it will be found that instead of securing two isolated poles, that each piece possesses a plus and a minus pole practically identical with the poles of the original needle. Carry this process to any length and each little piece, however small, will be found to possess two poles, one positive and the other negative. If we assume that this process could be carried on to the smallest conceivable particle of the iron we should say that each molecule of the iron is by itself a magnet. We may further suppose that the molecular magnets in a neutral piece of iron are entirely devoid of regular arrangement as regards position of the poles; such a chaotic condition may be indicated roughly by Fig. 7. It may be supposed that these molecular

Fig. 7.

magnets are partly held in position by the action of forces analogous to friction, which also tend to hold them in any new position to a greater or less extent in case the original arrangement is disturbed. Under the action of a weak magnetic field these friction forces would prevent the turning of the molecular magnets into parallelism with the field lines. As soon as the field is strong enough to overcome this sort of friction we might expect the same tendency to arrangement of these minute magnets that is observed in the case of iron filings in the mapping of magnetic fields. As long as a considerable number of the axes of these molecular magnets make fairly large angles with the field lines the leverage by which turning is produced would be considerable; if however they approach parallelism with each other and the field lines, the effective twisting would be very materially reduced. This would correspond to the approximate saturation of the iron and no considerable change in position could be produced by increasing the field strength. The general arrangement may be indicated approximately in Fig. 8, where

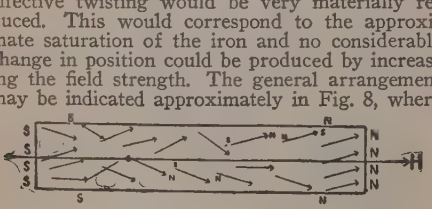

Fig 8.

it will be observed that there is a tendency for free positive poles to appear at one end, namely, where the field lines leave the iron, and for uncompensated negative poles to appear at the other end.

The facts in favor of this sort of explanation may perhaps be briefly summarized as follows: (1) the general shape of the magnetic curve is explained. (2) As friction or other molecular forces tend to prevent a return to the original chaotic condition after magnetization this arrangement would in part persist after removal from the field, or permanent magnetism would be explained. (3) Soft iron should be easier to magnetize and less permanent than hardened iron or steel. (4) Jarring as by blows tends to reduce friction and to assist in the process of magnetization and also to reduce permanent magnetism. (5) High molecular activity consequent on rise of temperature decreases magnetic action, in fact, at a dull red heat iron is non-magnetic. (6) Rapid reversals of magnetism involve work against molecular forces and the production of heat, this heat is proportional to the area of the loop. (7) A tube of iron filings or a set of pivoted magnets shows the same behavior in a rising or falling magnetic field as a solid bar. The precise agreement between experimental facts and the indications from theory shown above makes this conception extremely useful. Just why molecules of iron should be permanently endowed with magnetic properties is a subject for speculation which has been indulged in by numerous prominent scientists. It has been supposed for example that electrical currents flow around these molecules, that they consist of vortex rings or that small electrically charged parts are in vibration in such a way as to produce the phenomena of permanent molecular magnetism. The general usefulness of the hypothesis is in no way connected with the truth or falsity of such speculations any more than the facts regarding free fall are dependent on our view of gravitation.

The general statements noted above regarding magnetism of iron are of importance in the manufacture and utilization of magnets for various purposes. Where a considerable amount of permanent magnetism is undesirable, soft iron or steel is always used. For the manufacture of permanent magnets special steel is selected and hardened and is then magnetized by its insertion into a solenoid carrying a powerful electric current. Severe shocks or blows are frequently given in order to assist in the molecular rearrangement. The interaction of all the elementary magnets together with temperature changes and mechanical shocks will tend to weaken a magnet. This loss is very considerable at first but finally an almost permanent state is reached. When used in electrical measuring instruments magnets are artificially aged by subjecting them to considerable changes of temperature and a series of mechanical shocks. It should be noted in this connection that the permanence of the magnet will be somewhat increased by joining its poles, when not in use, by a piece of soft iron. The induced magnetism at the ends of the iron helps to hold the poles of the small molecular magnets in position, and counteracts the tendency of these poles to demagnetize the bar.

Aside from the extended use of permanent magnets in electrical instruments their practicable application is comparatively limited. The electro-magnet is widely used where it is desired to cause a temporary force action at a distance from the operator, as for example in the telegraph, etc. Powerful electro-magnets are now frequently used to lift large masses of iron during manufacturing processes. It may

be noted in this connection that the lifting force of a magnetic piece of iron depends on the square of the number of lines per unit area at the contact face. Only so large an area should be used in contact as can be very highly magnetized by the current available. In the construction of dynamos, motors and transformers, the magnetic quality of the iron used is of great importance. The total number of lines set up (flux) must be sufficient for the operations involved and saturation should not be approached in any part. Where the cross section may be made large, cast iron can be used, but where the flux must be concentrated, special soft iron or steel is required. All air gaps are made as small as mechanical and electrical considerations of construction will permit, in order that the required flux may be more easily set up

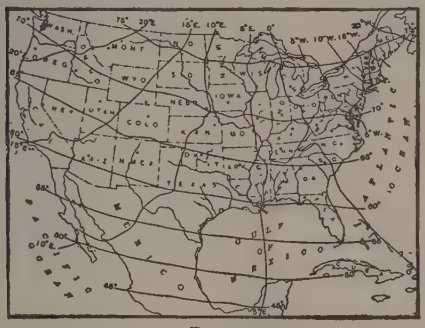

FIG. 9.

by the electro-magnets. Or as electrical engineers say, the magnetic "*reluctance*" is made small by use of properly proportioned iron parts and small air gaps in order that the *magneto-motive force* required may not be excessive.

Terrestrial Magnetism.— The statement usually made that a freely suspended magnet needle, remote from magnetic masses, tends to point north and south is not correct except for a few localities at certain times. The actual nature of the earth's magnetic field must be found by extended experiments which are being carried on by numerous observers largely under the direction of various governments. (See methods of magnetic measurements above). If a steel needle be suspended by a silk fibre and carefully balanced so as to hang horizontal and is then magnetized it will be observed to finally come to rest in a certain vertical plane and to be inclined to the horizontal. The angle between a horizontal line and the direction of the needle is called the dip, and the angle between the true north and south plane and that in which the needle lies is called the declination. The values of the dip, declination and intensity of the earth's field at a point are called the magnetic elements at that point. The use of the compass both by the surveyor and mariner over nearly the entire surface of the earth makes an accurate knowledge of these elements indispensable. In order to convey this information, in a practical way, recourse is had to maps on which places having the same declination, for example, are joined by lines. Such maps bring into view many interesting features as regards the earth's magnetism. For example, Fig. 9, published by the United States Coast and Geodetic Survey for 1900 shows that in northern Oregon, Idaho and Montana the compass pointed approximately 20 degrees east, while in the extreme northeastern part of Maine it pointed about 20 degrees west. Along an irregular line crossing Michigan, Ohio, North and South Carolina and passing east of Cuba the declination was 0, or the needle pointed due north. It is evident from an inspection of these maps that the poles of the earth considered as a magnet do not coincide with the geographic poles. The line of no dip follows the equator only approximately. North of this line the north end dips down, while at the south it is reversed. Some of the minor variations are no doubt caused by local causes, such as masses of magnetic material, but it is a general belief among observers that the earth's magnetism is largely due to outside agencies. Another very important point for the mariner, who depends on the compass to find his way in safety across trackless seas or the surveyor anxious to locate landmarks, is that these magnetic elements are continually changing even during the day, as well as month by month and year by year. In London during 232 years the declination changed 35 degrees. "A street one mile long laid out in London parallel to the compass direction in 1580 would have its terminus seven-tenths of a mile too far east according to the compass in 1812." Since 1812 the declination at London has changed from about 24 degrees west to 16 degrees west. In 1580 it was 11 degrees east. In fact it would seem that the magnetic poles of the earth are slowly vibrating. The periods of some of the components of this vibration are astronomical in origin — the day, the year, the lunar month, the sun-spot period, etc. The variation during the day must be taken into account in accurate work as a mile run in the morning and repeated in the afternoon may vary by 5 to 20 feet at its terminus. Sudden changes called magnetic storms also frequently occur, which seem to be associated with atmospheric electrical conditions, sun spots, etc. In order to secure data for the study of these complex phenomena, magnetic observatories are maintained where delicate instruments record, day and night, the countless fluctuations of the magnetic forces.

The problem of the navigator is still further complicated by the use of iron ships which are always sources of disturbance, both because of their permanent as well as their variable magnetism. The continual jarring and changes of temperature during a voyage enables the earth's field to continually change the distribution of magnetism in the vessel. The means to be used for the correction of this deviation have received the attention of many skilful investigators. The limits of this article will hardly allow a discussion of the matter which may be found in special books noted at the end.

The contrast between the state of knowledge regarding magnetism before 1600 and its present development is one of the most striking indications of the growth of scientific investigation. Instead of vague speculations, partial truths veiled in mysticism, more or less direct references to dogma and the supernatural, we have organized knowledge based on experience and constantly checked by experiment and ap-

plication. The number of those who believe in "magnetic" healing is constantly on the decrease. The relations between magnetism and other fields of physical research are constantly being investigated and no one believes the end is at hand. It may well be that the delicately poised magnetic needle in some future interpretation of its countless movements will give us a knowledge of the invisible yet all-pervading agency which governs its fluctuations and lead us to a broader generalization of physical phenomena than we can formulate at present. (See ELECTRICITY; ELECTROMAGNETISM.) For the optical effects of magnets in rotating the plane of polarization of light see POLARIZED LIGHTS.

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MAGNETISM, Animal. See HYPNOSIS.

MAGNETITE, or **MAGNETIC IRON ORE,** native magnetic oxide of iron, Fe_3O_4. It sometimes has part of its iron replaced by titanium or magnesium, and occasionally by nickel. It is very abundant (the production of the United States in 1950 being 7,697,029 long tons, or over 7 per cent of the iron-ore production of the country). When pure it constitutes a valuable ore of iron, 72 per cent of its weight consisting of that metal. Magnetite crystallizes in the isometric system, commonly in octahedra, but also in dodecahedra, with striated faces. It also occurs, and very generally, in massive and granular forms. It is black in color, with a metallic or submetallic luster. It is brittle, and has a hardness of from 5.5 to 6.5; the crystals having a specific gravity of about 5.17. It may be readily distinguished by the fact that it is strongly magnetic. Specimens are found which manifest quite a strong, permanent magnetic polarity, this variety of the mineral being known as "lodestone." Magnetite occurs in vast beds in Canada and in the northern and eastern parts of the United States. Abundant deposits of it are also known in California and Washington. It is a common result of segregation in magmas during cooling. See IRON ORES; MAGNETIC SEGREGATION.

MAGNETO, a magnetoelectric machine, as a magneto alternator with permanent magnets, used to generate current for electric ignition in an internal-combustion engine (q.v.), and operated by the engine itself.

MAGNETOELECTRIC MACHINES. See ELECTROTHERAPEUTICS.

MAGNETOELECTRICITY. See ELECTROMAGNETISM.

MAGNETOMETER, in its customarily restricted sense, an instrument employed in observatories to determine the intensity of terrestrial magnetism. Essentially the instrument consists of a magnetic needle free to swing in a horizontal plane within a circular scale. The magnet may be supported on a fine vertical pivot, or by suspension on a fine untwisted silk thread. Bifilar suspension is more to be depended upon; the magnet is supported by two parallel threads and screws enable the tensions in the threads to be equalized and their distance asunder to be adjusted. For delicate readings the instrument has been highly refined, a mirror being attached to the magnet reflecting a beam of light upon a scale. To prevent possible oscillations due to air currents the magnet is closed within a box with glass sides, through which it may be observed. A tall tube above the box encloses the suspending thread. The unifilar magnetometer is set up with its magnet lying in the direction of the magnetic meridian. The bifilar instrument is set with the magnet at right angles to that meridian—a much more sensitive position. To fill the needs of traveling observers, portable magnetometers have been devised. These are more comprehensive, comprising within a single unit an astronomical telescope with a magnetometer—for the determination of both the magnetic declination and the horizontal intensity; and also a dip circle for the determination of inclination and total intensity. See MAGNETISM—*Terrestrial.*

Consult Joyce, J. W., *Manual on Geophysical Prospecting with the Magnetometer* (Washington 1948).

MAGNIFICAT. The words which Mary pronounced when she visited Elizabeth (Luke 1: 46–55) begin, *Magnificat anima mea dominum* (My soul doth magnify the Lord). Hence the whole of her thanksgiving on this occasion has been called the Magnificat. The present usage of the Roman Catholic Church is to chant or pronounce the Magnificat every day at vespers.

MAGNITOGORSK, măg-nē'tô-gôrsk, city of Soviet Russia, in the Chelyabinsk region in Asia, on the Ural River, 135 miles southwest of Chelyabinsk. Originally a small village of the steppe it underwent a tremendous development after the Soviet government began in 1929 the exploitation of the rich magnetic iron ore deposits of the near-by mountains and built huge plants for the production of iron and steel. Magnitogorsk soon became one of the Soviet leading metallurgical centers, with a steel mill which is one of the largest in the world. Heavy machinery is also manufactured. American engineers assisted in the preliminary planning of the city in 1929. Estimated population (1946) 200,000.

MAGNOLIA, măg-nōl'yà, town of Arkansas, the seat of Columbia County, 35 miles west of El Dorado, on the Louisiana and North West Railroad; altitude 312 feet. It lies in a farming region, rich in oil and gas deposits. Cotton ginning, gasoline refining, lumbering, and the production of cotton textiles, cottonseed oil, foundry products and soft drinks are the main industries. The Southern State College is located here. The town was settled in 1852 and was incorporated in 1855. Pop. (1950) 6,918.

MAGNOLIA, a genus of ornamental, deciduous or evergreen trees and shrubs of the family Magnoliaceae. The 35 species are natives

mostly of the United States, India, China and Japan. They are characterized by large, alternate entire leaves, large white, purple or pink, sometimes yellowish, solitary, terminal flowers, which are often highly fragrant; and cone-shaped, often red, decorative fruits. They are widely planted for ornament in parks and gardens; most of the deciduous species being tolerably hardy as far north as Massachusetts, some even farther north, but the evergreen kinds tender even at Washington, where, however, one species (*M. grandiflora*) can withstand the winters if in protected situations. The wood is close-grained, generally soft, spongy, light and satiny. It is little used because it is not durable, but in Japan one species (*M. hypoleuca*) is used for lacquering. The bark and the fruits of a few species were formerly employed as stimulants and tonics, but have fallen into disuse.

As a rule, magnolias thrive best in rather rich, fairly open, moist, peaty or sandy loams, but generally prove satisfactory upon any garden soil. A few, especially the beaver tree (*M. glauca*), which is also popularly known as sweet, swamp or white bay, are natives of very wet grounds and must be naturally well supplied with water, when planted for ornament. They may be propagated by means of layers, by grafts or by seeds planted as soon as ripe or stratified in sand and kept out of doors where they cannot become dry. The plants should be transplanted when the new growth is commencing, otherwise the operation is frequently unsuccessful.

The following species are among the most generally planted in the United States. The bull bay or big laurel (*M. grandiflora*) is found naturally from North Carolina to the Gulf States. It is a pyramidal, evergreen tree which often attains heights of 75 feet or more, and is especially conspicuous when in blossom, its fragrant white flowers often attaining a diameter of a foot. The swamp sassafras or sweet bay (*M. glauca*) ranges from the coast region of Massachusetts to Florida and irregularly southwestward to Texas. It reaches a height of 20 feet and bears fragrant cream-colored flowers. The cucumber trees (q.v.) are natives of the southeastern United States and are particularly attractive because of their pink fruits. Of the exotic species the yulan (*M. denudata*), a native of China, where it has been cultivated for more than a thousand years, and *M. coco, M. liliflora* and *M. hypoleuca* are popular, the first and last particularly. By crossing, hybridizing and selection a large number of choice horticultural varieties have been produced.

MAGOFFIN, mą-gŏf'ĭn, **Beriah,** American statesman: b. Harrodsburg, Ky., 18 April 1815; d. there, 28 Feb. 1885. He was graduated from Centre College (Danville, Ky.), in 1835, from the law school of Transylvania University (Lexington, Ky.) in 1838, entered the practice of law at Jackson, Miss., in 1839, but in the same year returned to Harrodsburg. In 1840 he became police judge, in 1848, 1856 and 1860 was a delegate to the Democratic national conventions, in 1850 was elected to the State senate of Kentucky and in 1859–62 was governor of Kentucky. He refused, 15 April 1861, to comply with Lincoln's call for 75,000 troops; in May 1861 by proclamation warned both the Confederate and Federal governments against occupying Kentucky soil, and the citizens of the State against entering hostilities; and in August requested Lincoln to withdraw United States troops. He vetoed a resolution of the legislature directing him to proclaim the evacuation of Kentucky by the Confederates; but the resolution was passed over his veto. In August 1862 he resigned his office and in 1867 was elected to the lower house of the State legislature.

MAGOG, mā'gŏg, Canada, town in Stanstead County in the province of Quebec, on Lake Memphremagog at its outlet, and on the Canadian Pacific Railroad, about 19 miles southwest of Sherbrooke. It has regular daily communications with Newport and other places in Vermont. Its industries include textile prints, lumber and butter and cheese making. Magog is a favorite resort for anglers. Pop. (1931) 6,302.

MAGOG. See Gog and Magog.

MAGOON, mă-goon, **Charles E.,** American lawyer and administrator: b. Steele County, Minn., 5 Dec. 1861; d. Washington, D. C., 14 Jan. 1920. He was educated at the University of Nebraska, was admitted to the bar in 1882 and engaged in the practice of law at Lincoln, Neb., in 1882–99. He was appointed judge-advocate of the Nebraska National Guard, with rank of major, and in 1899–1904 he was law officer of the Bureau of Insular Affairs at the War Office. He served as general counsel for the Isthmian Canal Commission in 1904–05, and was a member of the commission in 1905–06. He was governor of the Canal Zone from 25 May 1905 until 12 Oct 1906. He was also Envoy Extraordinary and Minister Plenipotentiary to Panama from 7 July 1905 until 12 Oct. 1906. He acted as provisional governor of Cuba from 12 Oct. 1906 until 28 Jan. 1909. Author of 'The Law of Civil Government Under Military Occupation' (1902).

MAGOT. See Barbary Ape; Macaque.

MAGPIE (originally *pie,* the pied or variegated bird, a bird of the genus *Pica,* closely related to the jays. The genus is distinguished by the extremely long wedge-shaped tail, the middle feathers of which equal the entire length of the head and body, while the outer feathers are less than half as long. The notorious magpie of Europe (*P. rustica*) is represented in North America by the variety *hudsonia,* which is rather larger but otherwise similar. The color is a lustrous black with a varied and changing iridescence and sharply contrasting white under parts and patches on the shoulders and wings, the latter being conspicuous as the bird flies. The yellow-billed magpie (*P. nuttalli*) of California is precisely similar except that the bill and a naked area at its base are yellow instead of black. Other species inhabit Asia and Africa. In America the common magpie is confined to the west, its range reaching from Alaska to Arizona and from the plains to the Cascade Mountains, being especially common in the Rocky Mountains. The magpie is a handsome bird of saucy, vivacious habits and is chiefly noted for its thieving habits and general rascality. It is always engaged in mischief, either in stealing brightly colored or glittering objects from the habitations of man or in robbing the nests of other birds, but because of its pert, merry manner is

usually forgiven for the former class of offenses. The caged birds seen in the East give but a faint idea of the beauty and activity of these birds in the wild state. Like the jays the magpies are omnivorous, but less strictly arboreal than the jays. The nest, which is built in a tree or bush, is very ingeniously and substantially constructed. It is a large domed structure protected outwardly by a thick, bristling layer of thorns and twigs, through which a narrow passage opening on one side leads to a deep cup plastered with mud and lined with fibres. Six to nine greenish drab eggs, much spotted and dashed with various shades of brown, are laid. The American magpie is occasionally taken young and made a pet, but it has not the reputation for talking and amusing, albeit thievish, manners, which has made the European bird a favorite from ancient times. Descriptions of its many interesting habits will be found in the books of Coues, Ridgway, Merriam, Cooper, Keyser and other writers upon the ornithology of the western United States.

MAGRATH, mą-grăth, **Andrew Gordon,** American Confederate governor: b. Charleston, S. C.; d. there, 9 April 1893. Magrath was the son of an Irish revolutionist of 1798 who escaped to South Carolina. He was educated at South Carolina College (1831) and at the Harvard Law School. He served two terms in the State legislature (1840–44), practised law in Charleston and in 1856 was made Federal district judge by President Pierce. In 1861 he resigned, was elected to the South Carolina convention which adopted the ordinance of secession and was then appointed Confederate judge. In December 1864 he became governor of South Carolina. After the war he was imprisoned for several months. He later resumed the practice of law in Charleston.

MAGRATH, William, American painter: b. Cork, Ireland, 20 March 1838. He emigrated to the United States in 1855, and was elected National Academician in 1876. He produced many excellent landscapes and his genre pictures are full of character. Among them may be mentioned 'The Road to Kenmair' (1871); 'The Reveillé' (1873); 'Rustic Courtship' (1877); 'On the Old Sod' (1879), which last is in the New York Metropolitan Museum; 'Paddy on his own Land' (1900); 'Sheep Pasture' (1903); 'The Killarney Country' (1910); 'The Bog of Allen, Ireland' (1911); 'Bog Lands' (1913). Deceased.

MAGRUDER, mą-groo'dẽr, **John Bankhead,** American soldier: b. Winchester, Va., 15 Aug. 1810; d. Houston, Tex., 19 Feb. 1871. He was graduated at West Point in 1830, served for a short time in the 7th Infantry, then in the artillery. In 1836 he was made first lieutenant, saw service in the Seminole War 1837–38 and became captain in 1846. He took an active part in the Mexican War, rising to the rank of lieutenant-colonel, 1847. In 1861, while in garrison at Washington, D. C., he resigned from the United States army, accepted a Confederate colonelcy and commanded the artillery at Richmond. In the same year he won the battle of Big Bethel (q.v.), and was made brigadier-general and major-general. Assigned to the Yorktown district, he fortified the Peninsula and with a force of 12,000 held it against the Army of the Potomac in April 1862. In the Seven Days' Battles (q.v.) he commanded the Confederate left. In October 1862 he was appointed commander of the Department of Texas. He recaptured Galveston 1 Jan. 1863, and broke the blockade of that port. After the war he served as major-general in the army of Maximilian in Mexico until the end of the empire, but finally in 1869 he settled at Houston for the rest of his life.

MAGRUDER, Julia, American novelist: b. Charlottesville, Va., 14 Sept. 1854; d. Richmond, Va., 9 June 1907. Her literary career began in 1885 with 'Across the Chasm,' published anonymously. She wrote 'A Magnificent Plebeian'; 'The Violet'; 'Miss Ayr of Virginia'; 'A Manifest Destiny'; 'Princess Sonia' (1895), etc.

MAGUAGA, Battle of. See DETROIT, SIEGE AND CAPTURE OF.

MAGUINDANAO, mä-gēn-dä'now, a tribe of Moros who inhabit the valley of the Rio Palangui, island of Mindanao; the Moros of the Sarangani Islands, and some of those of Davao Bay belong also to this group. See PHILIPPINE ISLANDS.

MAGYAR MUSIC. See HUNGARY, *Music.*

MAGYARS, mŏ'gyŏrz, the original name of the Hungarians, which they still use in preference to any other. See HUNGARY.

MAHA-KAŚYAPA, mä hä' käsh'yä pä, **Kassappa,** one of Buddha's first converts and one of his 80 great disciples who was favored by Buddha as his successor. After the death of Buddha he seems to have taken an active part in the work of organizing and propagating the faith. It was at his instance that the first Buddhist council of a general nature assembled. He gave considerable attention, according to tradition, to the organization and arrangement of the canonical books of the Buddhist faith. Playing such a prominent part at the dawn of the Buddhist religion, and being the beloved and trusted disciple of the master and, in a sense, his successor, it is natural that he should enter largely into the legendary and traditional religious lore of the Buddhists, as he does, in fact. Consult Bournouf, 'Indroduction à l'histoire du buddhisme indien' (Paris 1844); 'Le lotus de la bonne loi' (Paris 1852); Kern, 'Manual of Hindu Buddhism' (Strassburg 1896); Rhys, Davids, 'Buddhism' (London 1890).

MAHÂBHÂRATA. The name of this, the great national epic of the Hindûs, etymologically considered, consists of the word «mahâ,» meaning «great,» «mighty,» and «bhârata,» one of the several names of a powerful Indian tribe, but has reference more to the story itself, about «the great tale of the Bhâratas.» In the shape in which the Mahâbhârata has come down to us it is enormous in bulk, comprising some 100,000 *çloka* (couplets), and as its author is cited one Vyâsa. But the word «vyâsa» stands for «reviser,» «collector,» «editor,» and this alone, irrespective of the fact that no description, no biographical detail of this Vyâsa has existed, seems clearly to prove that the Mahâbhârata represents a gradual growth and gathering of poetic material finally given a collective name and figuring as an entity. In the poem itself the number of *çlokas* (distichs) is given at 24,000, while there is

rather strong literary proof that the original core was even much smaller than that, namely, counting but 7,000 *ślokas*. The total of the colossal remainder represents accretions and superimpositions that were at last included in the whole — many episodes, much legendary lore, lengthy and detailed ethical precepts, such as those addressed to the Kshatrias, the warrior caste, to guide their behavior to the other castes, and other material. Already in the 4th century A.D. the 'Mahâbhârata' was popularly held in the light of a code of laws as well; it was not alone the 'Iliad' and 'Odyssey' of the Hindû people combined, which youth studied and recited and learned by heart, but also a compendium of morals read aloud by the priests in the temples and shrines, at least fragments and selections from it. Thus we do know that the 'Mahâbhârata' is a work of great antiquity; but the exact period of its birth, the whole story of its genesis, we cannot even guess. It is certain, however, that the kernel of the epic, describing the war between the Kurûs (or Bhâratas) and the Pândavas, must have antedated the time of Kalidâsa by many centuries. The archaic language shows that. This simple tale gives us as heroes Duryôdhana, son of blind King Dhirtarâshtra, Drôna, Kama, Çalya among the Kurûs, and among the Pândavas the five sons of Pându, Ardjuna, Judishthira, Bhîma, and the Vishnuic incarnation, their wise counselor, Krishna, the ruler of Yâdava, the «spinner of all ruses and deceptions.» The circumstance that the five Pândava brothers have jointly but one wife, Drâupadî, and the fact that the caste, marriage and inheritance customs, as exemplified in the poem, are in strong contrast with later practices, of itself bespeaks great antiquity of this, the core of the epic. Brahmanism had not yet crystallized when it originated. At very different periods extraneous matter has been interpolated and amalgamated with this primary portion of the Mahâbhârata. In fact, all that ran riot in the earlier Hindû mind in the shape of folklore, legend and myth was, one after the other, added to the first text and gradually coalesced with it. Hence, too, the enormous size of this lay as we have it now. But even as it is, the Mahâbhârata is by no means a unit accepted by all. We see it subdivided in the north of India into 18 books (*Parvans*), sometimes including the 19th, the Harivamça; in the south it exists in 24 books, and the various chapters differ materially in sundry versions, both in text and size. The most comprehensive and enlightening critical work in this line has been done by the Danish philologist, Söre Sörensen, in his compendium on Hindû literature (Copenhagen 1843). A careful examination of the whole text unavoidably betrays the mixed origin of the Mahâbhârata, shows plainly the earmarks of having been worked over, revamped, added to, and that numberless scribes have probably been busy at this task for a period exceeding 10 or 12 centuries. The composite character of the poem is also shown by the different metres, contents and spirit. By some scholars, such as Hopkins and Dahlmann, the conclusion has been reached that there were earlier portions of the epic than now remain; perhaps, as Grierson holds, describing an initial struggle for the possession of northern India between the Aryan settlers and their foes. As it stands at present the poem — meaning its oldest core — is somewhat puerile, since it starts with an account of a gambling match, at which the Kurûs cheated the Pandûs, robbed them of the kingdom, and exiled them for 12 years. While spending this exile in the forests and groves, tales are told to while away the dreary hours. When the exile draws to a close the Kurûs are utterly routed during an 18 days' battle. This story furnishes the backbone; it is crude and in a literary sense sadly deficient, but it doubtless derives from the hoary past. The 20,000 stanzas of rules and instructions to the warrior caste are jumbled, often contradictory. From an artistic point of view the best parts of the whole are episodes like that of Damayânti and Nâla, of Savîtri, etc., which have been successfully dramatized. Like all of Hindû literature, even the best, there is a palpable lack of proportion. But there are eminently strong passages, scattered here and there in the whole and showing pathos, tenderness, descriptive powers. The student may be referred to a good summary of the poem, 'Mahâbhârata, the Epic of Ancient India,' condensed into English verse by Romesh Dutt (London 1898), to 'Geschichte der indischen Literatur' (Leipzig 1908), by M. Winternitz; to 'Das Mahâbhârata' (Kiel 1892–95), by Adolf Holtzmann; or to the English translation of the original work by a Hindû scholar, Protap Chandra Roy (Calcutta 1883).

WOLF VON SCHIERBRAND.

MAHADEVA, mą-hă-dā'vą, in Hindû mythology, a deity who shares the attributes of Siva in the Indian Trinity, Mahadeva being regarded as a generator as well as a destroyer.

MAHAFFY, mą-hăf'ĭ, **John Pentland,** Irish Greek scholar: b. Chapponaire, near Vevay, Lake Geneva, Switzerland, 12 July 1839; d. Dublin, Ireland, 1 May 1919. He was educated in Germany and at Trinity College, Dublin, from which he was graduated in 1859; and became professor of ancient history in the college in 1871. In 1873 he was Donnellan lecturer. His first publication was a translation of Kuno Fischer's 'Commentary on Kant' (1866); and on philosophical subjects he afterward issued several volumes. The greater number of his works, however, treat of the history, literature and everyday life of ancient Greece, among these being the following: 'Prolegomena to Ancient History' (1871); 'Greek Social Life from Homer to Menander' (1874); 'Greek Antiquities' (1876), a work much used in Continental schools; 'Rambles and Studies in Greece,' a record of antiquarian research (1876); 'Old Greek Education' (1879); 'History of Classical Greek Literature' (1880; 3d ed., 1891); 'Greek Life and Thought from Alexander to the Roman Conquest' (1887), a continuation of the work of 1874; 'The Greek World under Roman Sway' (1890), a continuation of the preceding; 'The Story of Alexander's Empire' (1890); 'Greek Pictures' (1890); and 'Problems in Greek History' (1892); 'The Progress of Hellenism in Alexander's Empire' (1905); 'The Silver Age of the Greek World' (1906); 'What have the Greeks done for Modern Civilization?' (1909). He wrote with special interest and authority of the post-Alexandrian period; and discovered interesting parallels between that and modern civilization. Among

his other writings are 'Twelve Lectures on Primitive Civilization' (1868); 'Report on the Irish Grammar Schools' (1880–81); 'The Decay of Modern Preaching' (1882), and 'The Art of Conversation' (1889); 'An Epoch in Irish History' (1904).

MAHALEB, a kind of European cherry (*Cerasus mahaleb*), whose fruit affords a violet dye and a fermented liquor. Its flowers and leaves are used by perfumers, and its wood by cabinet-makers. See CHERRY.

MAHAN, mą-hăn', **Alfred Thayer,** American naval officer: b. West Point, N. Y., 27 Sept. 1840; d. 1 Dec. 1914. He was graduated from the United States Naval Academy in 1859, and served during the Civil War, rising to the rank of lieutenant-commander in 1865. In 1885 he was promoted captain, and in 1886 was appointed president of the Naval War College at Newport, a position which he held till 1888, and again 1892–93. In 1893–95 he was commander of the *Chicago,* and in 1896 was retired after 41 years' active service at his own request. In 1898 during the war with Spain he was a member of the Naval Board of Strategy; and in 1899 one of the United States delegates to The Hague Peace Conference. In 1906 he was advanced to the rank of rear-admiral on the retired list. In 1890 he published his chief work, 'Influence of Sea Power upon History'; the continuation, 'Influence of Sea Power upon the French Revolution and Empire,' appeared in 1892; his other writings include 'The Gulf and Inland Waters' (1883); 'Life of Admiral Farragut' (1892); 'Life of Nelson' (1897), highly commended by English critics; 'The Interest of America in Sea Power' (1897), a compilation of his magazine articles; 'Lessons of the War with Spain' (1899); 'The Problem of Asia' (1900); 'The South African War' (1900); 'Types of Naval Officers' (1901); 'Retrospect and Prospect' (1902); 'Seapower in its Relations to the War of 1812' (1905); 'Some Neglected Aspects of War' (1907); 'From Sail to Steam' (1907); 'Naval Administration and Warfare' (1908); 'The Harvest Within' (1909); 'The Interest of America in International Conditions' (1910); 'Armaments and Arbitration' (1912); 'Major Operations of the Navies in the War of American Independence' (1913).

As a historian he made a distinct contribution to historical science as the first writer to demonstrate the determining force which maritime strength has exercised upon the fortunes of individual nations, and consequently upon the course of general history. Technically, his representative work, the 'Influence of Sea Power upon History,' is but a naval history of Europe from the restoration of the Stuarts to the end of the American Revolution. But the freedom with which it digresses on general questions of naval policy and strategy, the attention it pays to the relation of cause and effect between maritime events and international politics, and the author's literary method of treatment, place this work outside the class of strictly professional writings and make it a recognized leading authority. His prime object, in establishing the thesis that maritime strength is a determining factor in the prosperity of nations, was to reinforce his argument that the future interests of the United States require a departure from the traditional American policy of neglect of naval-military affairs. Captain Mahan was president of the American Historical Association in 1902–03; and received honorary degrees from several universities, including D.C.L. from Oxford and LL.D. from Cambridge (England), Harvard, Yale, Columbia and McGill universities.

MAHAN, Asa, American Congregational clergyman and educator: b. Vernon, N. Y., 9 Nov. 1800; d. Eastbourne, Sussex, England, 4 April 1889. He was educated at Hamilton College, Clinton, N. Y., and Andover Theological Seminary, and after holding pastorates at Pittsford, N. Y., and Cincinnati, Ohio, was president of Oberlin College 1838–50; and also professor of philosophy there. He was president of Cleveland University 1850–56; and of Adrian College, Michigan, 1860–71. After the last-named date he lived mainly in England. Among his works were 'Doctrine of Christian Perfection' (1839); 'System of Intellectual Philosophy' (1845); 'The Will' (1846); 'Science of Logic' (1857); 'Mental Philosophy' (1882); 'History of Philosophy' (1883).

MAHAN, Dennis Hart, American military engineer: b. New York City, 2 April 1802; d. near Stony Point, N. Y., 16 Sept. 1871. He was graduated at West Point in 1824, where in 1825 he was appointed assistant professor of mathematics and of engineering. He was stationed in Europe four years on professional duty and in 1832 returned to West Point as professor of military engineering, where he remained until his suicide, which was caused by temporary insanity. His textbooks are generally recognized authorities and include 'Treatise on Field Fortifications' (1836); 'Descriptive Geometry' (1864); 'Military Engineering' (1865); 'Permanent Fortifications' (1867); 'An Elementary Course of Civil Engineering' (1837, rewritten 1868), etc. Consult Abbot, H. L., 'in Biographical Memoirs of the National Academy of Sciences' (Vol. II, Washington 1886).

MAHAN, Milo, American Protestant Episcopal clergyman, brother of Dennis Hart Mahan (q.v.): b. Suffolk, Va., 24 May 1819; d. Baltimore, Md., 3 Sept. 1870. He was educated at Saint Paul's College, Flushing, L. I., and in 1845 was ordained in the Protestant Episcopal Church. He was called to the charge of Grace Church, Jersey City, N. J., in 1848, and became assistant at Saint Mark's, Philadelphia, in 1850. In 1857–64 he was professor of ecclesiastical history at the General Theological Seminary, New York. He became rector at Saint Paul's, Baltimore, Md., in 1864 and spent the remainder of his life there. Author of 'The Exercise of Faith' (1851); 'History of the Church During the First Three Centuries' (1860; enlarged to cover seven centuries, 1872); 'Palmoni, a Free Inquiry' (1864); 'The Comedy of Canonization' (1868); 'Collected Works' (3 vols., 1872–75).

MAHANADI, mä-hä-nŭd'ĭ, or **MAHANUDDY** ("The Great River"), a river in British India. In the upper part of its course it drains the fertile plain of Chhattisgarh in the Central Provinces; flows southeast and then east through the province of Orissa, past Sambalpur and Cuttack, into the Bay of Bengal by two mouths, after a course of about 530 miles.

During the rains it is navigable 30 miles from its estuary, but a large portion of its channel is dry during five or six months of the year, and since the opening of the Bengal and Nagpur Railroad it has been little used for navigation. It is estimated that the Mahanadi drains an area of nearly 44,000 square miles, and during the rainy season about 1,500,000 cubic feet of water passes every second through the Maraj gorge, which amount decreases in dry weather to 1,125 cubic feet. An extensive system of irrigation canals is connected with it. Diamonds are found in this river and in several of its tributaries.

MAHANOY (mä-hạ-noi') CITY, Pa., a borough in Schuylkill County; alt. 1,230 feet; 18m. SW. of Hazleton; on the Lehigh Valley, and the Reading railroads. It is situated in the anthracite coal mining region of the Mahanoy Valley; mining was begun here in the early 1860's. The borough's principal industrial products are shirts, hosiery, and other apparel; cigars, and beer. First settlement, by Emanuel Boyer, tavernkeeper, was in 1853; incorporation as a borough, 1863. The name is a Delaware Indian word meaning deer lick; it was originally applied to the creek. Government is by burgess and council. Pop. (1930) 14,784; (1940) 13,442.

MAHARAJAH, mạ-hä-rä'jạ, a title used in India; applied in courtesy to every rajah, or to any person of high rank or deemed holy.

MAHASEER, mä'hạ-sēr, a large and ravenous barbel (*Barbustor*) of India, which reaches six feet in length and in the early part of the rainy season afford the best sport known to the anglers of India and Ceylon, as they take a fly readily, and struggle with the gameness and energy of a salmon to get free, pleasantly taxing the skill of the angler to bring them to land without breaking rod and line. They spawn at the heads of the hill-rivers, and then descend before the young are hatched. The fry then have an opportunity to grow in comparative safety to a size which enables them, the following season, to descend the rivers and take care of themselves; otherwise they would be devoured in infancy by their elders.

MAHATMA, a Hindu word meaning "the great-souled one," and applied among the Brahmans to one who has attained the highest possible point of spiritual enlightenment. It is also the name of a high priest or "wise leader" of the theosophists

MAHĀYĀNA ("The Great Vehicle"), the name of one of the principal divisions of Buddhism (q.v.). It originated in northern India about the beginning of the Christian era through a gradual synthesis of tendencies already manifest in earlier Buddhism, possibly with some admixture of ideas from the West.

In its philosophy the Mahāyāna goes beyond primitive Buddhism's denial of the real existence of a soul or ego, and maintains the doctrine of the utter unreality of all experience. This is expressed in the formula "everything is void," which is interpreted by the Madhyamaka, or sceptical, school as meaning that it is impossible either to affirm or to deny anything concerning reality, whereas the Vijnānavādins, or idealists, declare "the void" to be pure thought, without distinction of subject or object. Both schools admit that the illusion of the phenomenal world is invincible for even the wisest man, and that only the Buddhas are perfectly free from it, so that the practical validity of experience is not impaired.

The idea of the Buddha, or "Enlightened One," has received a great extension in the Mahāyāna, and the human traits of the historic Gautama have been lost in the radiance of divinity. There are countless Buddhas throughout the worlds, and they manifest themselves through infinite periods of time in the various heavens, as well as by appearing on earth in the guise of human teachers. In their function of enlightening all creatures they are aided by the celestial Bodhisattvas, or Buddhas-to-be, who are more actively beneficent. Among the Buddhas the most worshiped is Amitābha, "He of Boundless Light," the ruler of the Western Paradise called Sukhāvatī, "Happy Land." This deity, who is quite unknown in the earlier Buddhism, is presumably of solar origin. The merciful Avalokiteśvara and Manjuśrī, the fount of wisdom, are especially prominent Bodhisattvas. The belief in female Bodhisattvas, such as Tārā and the Chinese Kwan-yin, is a later development, as is also the notion of a "primordial Buddha," or First Cause. All this luxuriant polytheism is harmonized with the doctrine of "the void" through the belief that a Buddha has three "bodies" or modes of being, the "body of the Law," identical with the void, the "body of bliss," an appearance manifested to the celestial beings, and the "body of fabrication," the illusory form of an earthly Buddha such as Gautama.

The Mahāyānist belief in the powerful and merciful Buddhas and Bodhisattvas is accompanied by a new conception of the religious life. Instead of the older self-centred system of monastic discipline, by which the individual was to obtain final deliverance, Nirvāna, at the close of his present existence, the Mahāyānists made it their goal to become Buddhas themselves, after practising all the virtues through numberless existences, for the sake of the salvation of all beings. Everyone who consecrates himself to this aspiration is a Bodhisattva, or potential Buddha, although he will not attain the rank of a celestial Bodhisattva until toward the last of the 10 stages in his career. Self-sacrifice, rather than self-restraint, is therefore the keynote of the ethics of the Mahāyāna, and though the institution of monasticism is preserved, the discipline is relaxed, and laymen also may follow the career of a Bodhisattva. Prayer and confession of sins to the Buddhas are commanded, and forgiveness is believed to be secured through their superabundant merits.

The broadly human quality of the Mahāyāna religion involved a certain sacrifice of the distinctive features of Buddhism, and its later development, particularly in the form of the Tantra (q.v.) system, shows a gradual approximation to the contemporary Hinduism. Hence in India the Mahāyāna ultimately gave way to the Vedānta philosophy and the popular religions of Vishnu and Siva; but it still survives in the countries to the north and east, whither it had been carried by missionary activity. In Tibet and Mongolia it has assumed the form of Lamaism (q.v.), while in China and Japan it shows more of its primitive character, although

in the latter country especially it has split into numerous sects, some of which hold a decidedly theistic belief.

MAHDI, mä-dē′ (Arab. he who is guided in the right path). The title of a coming messiah of the Moslems who will establish the reign of justice on earth. The mahdi must be a descendant of the prophet; he must be proclaimed mahdi against his will at Mecca at a time when there is strife after the death of a caliph; and his advent shall coincide with that of Antichrist, after whom Jesus will descend in Syria and the reign of righteousness be inaugurated. This is the orthodox view, but in Iran and Asia Minor there have been many pretenders to the title from the time of the first generation after Mohammed. According to the Shi'ite sect, the mahdi has already appeared in the person of the 12th imam, who disappeared about 874 and is concealed in some secret place until the end of the world. The most notable of recent mahdis was the Sudanese sheik Mohammed Ahmed (1843?–1885). During 1880–1884 he proclaimed a mission to free Egypt from the foreign yoke and acquired an ascendancy over the Sudanese peoples. Gen. Charles George Gordon, sent to withdraw the British garrisons, was shut up in Khartoum, besieged by Mohammed Ahmed, and killed. The latter died in the same year, and his tomb was destroyed in 1898.

MAHE, mä-ā′, island in the Indian Ocean, largest of the Seychelles group, 600 miles northeast of the northernmost point of Madagascar. It has a length of 17 miles and breadth of 4 to 7 miles, the area being 55 square miles. Much of the island is mountainous, in most places the hills rising nearly perpendicularly from the sea; the highest point has an elevation of 2,993 feet. Victoria, capital of the British colony of Seychelles and its chief seaport, is located on the northeast coast of the island. Mahé was named for Mahé de la Bourdonnais, governor of Mauritius in 1742, when the island was annexed to France; the British took possession in 1794. Pop. (est.) 22,000. See also SEYCHELLES.

MAHE, settlement, French India, formerly known as MAYYALI. It is located on the Malabar coast 40 miles north of Calicut, and is the only possession of France on the west coast of India. The area is 23 square miles. The town of Mahé, at the mouth of a river of the same name, has no trade or industry of importance. First occupied by the French in 1725, the settlement was seized by Great Britain on several occasions prior to 1817, when it was restored to France. The Union of India renewed in 1952 its demand that Mahé be ceded to it. Pop. (1948) 18,293.

MAHICAN, mä-hē′kăn (meaning wolf), an Algonquin tribe of American Indians formerly occupying the Hudson River valley. They were closely related to the Delawares and the Mohegans, the collective tribes being known as the *Loup* or Wolf Indians. At one time there was a settlement of 40 villages near the site of the present city of Albany, N. Y. The assaults of the Iroquois and the white settlers diminished the tribe until the remnants of the race became merged with the Delawares. In 1736 those who still remained in Massachusetts, whither they had removed some years before, came together as a unit at Stockbridge and assumed the name of Stockbridge Indians. Later they removed to New York. See also MOHEGAN INDIANS.

MAHJONG, mä′jŏng′, or **MAH-JONGG.** The Chinese game known as mahjong is played with dominoes made of ivory and bamboo. There are usually four players at a table, each one acting for himself, as there are no partners. The dominoes, which number 136, are arranged in three suits, and there are four sets of each. One consists of three honors, red, white, and green; another represents the four winds, north, south, east, and west. The third is more elaborate, consisting of three sets of nine dominoes which are named characters, circles, and bamboos. The object of each player is to obtain the highest scoring hand.

MAHLER, mä′lĕr, **Gustav,** Austrian composer and conductor: b. Kalischt, Bohemia, July 7, 1860; d. Vienna, May 18, 1911. From 1897 to 1907 he was director of the Imperial Opera, in Vienna, and thereafter he conducted in the United States for three seasons, notably at the Metropolitan Opera House, New York City, and with the New York Philharmonic. Besides ten symphonies, he composed two operas, many songs, and much chamber music.

MAHMUD I, mä-mōōd′, sultan of Turkey: b. Constantinople, 1696; d. 1754. The son of Mustafa II, in 1730 he succeeded his uncle, Ahmed III, on the throne. He continued the war against Persia until 1736, when peace was made, and shortly became involved in war with Russia and Austria; Turkey recovered Belgrade by the treaty concluded in that city in 1739. His brother succeeded him as Osman III.

MAHMUD II, sultan of Turkey: b. July 20, 1785; d. July 1, 1839. The son of Abdul-Hamid I, in 1808 he ascended the throne in succession to Mustafa IV, his brother, who had been deposed and assassinated. He carried on war against Russia from 1809 until 1812 when, by the Treaty of Bucharest, Moldavia and most of Wallachia were restored to the Ottoman government. In 1814 he quelled a Serbian revolt, and from 1821 to 1829 he attempted to suppress the Greeks in their struggle for freedom; France, Britain, and Russia went to the aid of the Greeks, and in 1829 he was compelled to conclude the Treaty of Adrianople, recognizing Greek independence. He became involved in war with Mehemet Ali (Mohammed Ali), his viceroy in Egypt, in 1831, when the latter despatched Ibrahim to conquer Syria; it was only with Russian aid that the Egyptians were stopped in 1833. A second rebellion of Mehemet Ali, in 1839, was followed by a defeat of the Turks at Nizib shortly before the sultan's death. His successor was his son, Abdul-Medjid I (Abdul Mejid).

MAHMUD OF GHAZNI, mä-mōōd′, gŭz′nē, Moslem sultan of Ghazni, southwestern Asia: b. Oct. 2, 971; d. 1031. He was the son of Subuktigin, who founded the Ghaznevid dynasty in 977 at Ghazni, in central Afghanistan 92 miles southwest of Kabul. Succeeding his father in 997, he extended a relatively small Afghan kingdom as far as Iraq and the Caspian, and in the course of 17 invasions of India from 1001 onward he penetrated as far as the Ganges and central Gujarat (Guzerat). His earlier expeditions into India

were directed against successive rajas of Lahore. In 1005 he seized Multan (Mooltan), and in 1010, after subduing Ghor (Ghur), in the Hindu Kush, he resumed his conquests in India. For a time these were interrupted by his conquest of Transoxiana, effected in 1016. At the head of a large army, he invaded India once more in 1018, and the next year plundered Mathura (Muttra) and captured Kannauj (Kanauj). In his famous campaign of 1024 he invaded Gujarat and sacked the great temple at Somnath (Patan Somnath), the magnificence of which filled him with awe. He is said to have carried off immense treasures in diamonds and precious stones and to have sent to Ghazni the famous "Gates of Somnath" (later recovered and deposited in the arsenal at Agra). During 1026 he ravaged the Punjab, which became an outlying province of his kingdom, and in 1029 he led an expedition into Persia. *Shah Namah* (1010), the great epic poem of Firdausi (q.v.), was dedicated to Mahmud of Ghazni, who gave him but a meager reward.

MAHMUD SHEVKET PASHA, mä-mo͞od' shĕf-kĕt' pä-shä', Turkish army officer and statesman: b. Baghdad, 1855 or 1858; d. Constantinople, June 11, 1913. At the age of 24 he came under the influence of Baron Kolmar von der Goltz, the German general reorganizing the Turkish Army, who sent him to purchase war material in Germany and France. After 10 years' sojourn in western Europe he returned home with advanced ideas. He joined the Young Turk cause in 1908, and the next year he commanded a force which marched from Salonika, headquarters of the movement, to Constantinople and effected the deposition of Sultan Abdul-Hamid II. In 1912, during the First Balkan War, he was appointed minister of war, and in 1913, as grand vizier (premier), he was forced to conclude a disastrous peace. In the midst of attempts to settle differences with Great Britain and France, he was assassinated by political opponents while motoring to the sultan's palace.

MAHOE, mä-hō', name of an important fiber plant, *Hibiscus tiliaceus* or linden hibiscus, lemon hibiscus, or corkwood, a member of the mallow family. It is a handsome woody shrub or small tree with large lemon-yellow flowers and entire broadly cordate leaves like linden. Low banks of tidal rivers is its favorite habitat and it is widely distributed over tropical America, Polynesia, and the shores of the Indian Ocean. In some of the Pacific islands it grows spontaneously in large areas which have been abandoned after previous cultivation. The bark contains a strong flexible fiber used for many purposes, especially by the aborigines who also used the wood for making fire in the primitive fashion. The dark green heart wood is very tough and durable. The plant has remarkable properties of renewing fertility of soil which has been exhausted by crops. The mahoe is considered indigenous to America, and apparently on account of its useful character it was distributed widely over the islands and shores of the Pacific and Indian oceans before the arrival of Europeans. The etymology of its names in various regions gives some important clues as to the history of its distribution.

MAHOGANY. A popular name for the timber of several unrelated trees, among which are various species of eucalyptus (q.v.), natives of Australia, and members of the family Myrtaceae; two species of *Cercocarpus,* of the family Rosaceae, *C. montanus* being known as valley mahogany and *C. ledifolius* as mountain mahogany in the Rocky Mountain region where they are native and are mainly used for fuel. African mahogany (*Khya senegalensis*), East Indian mahogany (*Soymida febrifuga*), and *Cedrela toona,* an East Indian tree equally well known also as the toona, all belong to the family Meliaceae, but are less important timber trees than the true mahogany (*Swietenia mahagoni*) of the same family. This species is a native of tropical America, occasional small specimens being found in extreme southern Florida. It was formerly abundant in the West Indies, attaining heights of 150 feet or more in Jamaica, but on account of the demand it is now scarce. Cuba and Hispaniola formerly supplied the choicest, and Honduras the low grades; now practically all comes from Central America. The wood is generally some shade of brown, fine grained, easily polished, and durable except under lateral strain. It is highly valued for furniture, musical instruments, interior house-finishing, and the like, and is one of the most popular woods of the world. Formerly it was used for shipbuilding but now very little. The tree, which sometimes attains heights exceeding 100 feet, and diameters of six feet, has abruptly pinnate leaves with usually four pairs of leaflets, and small white or yellowish flowers in axillary or nearly terminal panicles. As an ornamental tree it is planted in southern Florida and southern California in rich soil. A few other related species of this genus are occasionally found in commerce.

MAHOMET. See MOHAMMED.

MAHON, mä-ôn', or **PORT MAHON,** seaport, Spain, in the Balearic Islands (Baleares Province), capital of the island of Menorca (Minorca). It is situated on the east coast, at the head of a bay which forms one of the best harbors on the Mediterranean. The town contains a handsome church, consistorial palace, theatre, museum, and library. There is a brisk coasting trade in the exports of Menorca, primarily brandy, wine, dried fruits, and agricultural products; grains, manufactured goods, coffee, sugar, and tobacco are imported. Mahon is believed to have been founded by the Carthaginian general Mago, whence its ancient name of Portus Magonis. The Moors occupied it from the 8th to the 13th centuries, and in 1535 it was pillaged by Barbarossa II. The seaport was occupied by the English from 1708 until 1756, when it was taken from them by the French after a memorable siege. It was restored to the English in 1763; and in 1783 it was awarded to Spain by the treaty terminating the War of American Independence. Pop. (1941 est.) 17,459.

MAHONE, mä-hōn', **William,** American Confederate officer: b. Southampton County, Va., Dec. 1, 1826; d. Washington, D.C., Oct. 8, 1895. After graduating at the Virginia Military Institute in 1847 he became a civil engineer. During the American Civil War he fought for the Confederacy, serving at the battles of Malvern Hill, Second Manassas, and the Wilderness, and becoming brigadier general in 1864. The war over, he became president of the Norfolk and Tennessee Railroad and was a principal organizer (about

1878) and leader of the Readjusters (q.v.), chiefly a faction of the Democratic party in Virginia who favored the forcible readjustment of the State debt on terms involving conditional or partial repudiation. Mainly by the supporters of this movement, he was elected in 1880 to the United States Senate, where, however, he acted with the Republicans, making the vote of the Senate a tie and disappointing the Democrats of their expected majority. By this and other acts of his senatorial career he lost favor with his constituents and was not re-elected.

MAHONY, mäh'ō-nĭ, **Francis Sylvester,** Father Prout,» Irish author: b. Cork 1804; d. Paris, 1866. Educated at a Jesuit seminary at Amiens, he studied theology at Paris, was admitted into the Order of the Jesuits and taught for some time in a Jesuit college in Ireland, but for some irregularities was deprived of the position of a member of the order. He received clerical ordination and officiated for a short time at Cork and in London, but soon adopted the profession of literature. In 1834–36 he contributed the 'Prout Papers' to *Fraser's Magazine,* published as the 'Reliques of Father Prout' in 1836. In 1846 he became Rome correspondent to the London *Daily News,* his letters being afterward republished as 'Facts and Figures from Italy' (1847). In his later years he was Paris correspondent for the *Globe.* The 'Reliques of Father Prout' in a revised and enlarged form were published in 1860, and 'Final Reliques' in 1876. In 1881 Charles Kent published a collective edition with a memoir. He will be longest remembered by his poem 'The Bells of Shandon.'

MAHRATTAS, mą-răt'ąz, a native Hindu race, supposed to be descendants of the Persians, and occupying a large tract of central and western India. They have always been a distinct nation or people, and still consider themselves as such, even though now largely under British or Mohammedan jurisdiction. They came into prominence about the middle of the 17th century, when the chief, Sevaji extended his conquests in various directions, had himself crowned king in 1674 and established the Mahratta Empire. After his death long minorities and the incompetency of the sovereigns caused the powers of the state to fall into the hands of the *Peshwa* or Prime Minister, who became the acknowledged head of a Mahratta confederacy. The first trouble with the British broke out in 1775 and was not settled until 1782. This happened during the administration of Warren Hastings (q.v.). The next outbreak came in 1803–05 and resulted not only in the acquisition of territory by the British but also in strengthening their power. Meanwhile the confederacy had held together till 1795, but internal wars and disturbances reduced the *Peshwa* to the position of a British dependent, and Scindia, Holkar and the Rajah of Berar were able to take the position of independent sovereigns. The confederacy came to a final end in 1818, after the third collision wherein the Peshwa himself took up arms against the British, and Scindia, Holkar, the Guicowar of Baroda, and the Rajah of Kolapore became dependent princes under British protection. The state of Gwalior came under British control in 1844. Though devout worshipers of Brahma, no distinction of caste exists among them. Consult Grant-Duff, 'History of the Mahrattas' (Bombay 1863); Kincaid, C. A. and Parasnis, R., 'A History of the Maratha People' (Vol. I, London 1919); Ranade, 'Rise of the Maratha Power' (ib. 1900); 'Imperial Gazetteer of India' (Oxford 1909).

MAI, Angelo, än'jā-lō mā'ē or mī, Cardinal, Italian classical scholar: b. Schilpario, near Bergamo, Italy, 7 March 1782; d. Albano, 8 Sept. 1854. His abilities attracted the notice of Father Mozzi, a Jesuit, who instructed him in Latin, Greek and mathematics. On the establishment of a Jesuit college at Colorno, in the duchy of Parma, he accompanied Father Mozzi thither in 1799, and a few years afterward was made professor of Latin and Greek in the Jesuit college at Naples (1804). He was transferred to Milan (1808), where he became an associate of the Ambrosian College, and one of the curators of the Ambrosian Library. One special department to which he devoted himself was the examination of the palimpsests (q.v.) and through his industry in deciphering these, two volumes of fragments of Cicero's orations, of Lysimachus and of Isæus, a fragment of the 'Vidularia' (a lost comedy of Plautus), and a collection of the letters and other writings of Cornelius Fronto, the preceptor of Marcus Aurelius, were recovered and given to the world. In 1819 he was appointed chief keeper of the Vatican Library at Rome, and discovered beneath a manuscript of Saint Augustine's 'Enarationes in Psalmos' obliterated fragments of Cicero's treatise 'De Republica,' amounting to about a fourth of the original, which he published in 1822 with a critical commentary. A colossal work was then undertaken by Mai, the editing of the various unpublished manuscripts in the Vatican, sacred and profane. It comprises 10 quarto volumes, under the title of 'Scriptorum Veterum Nova Collectio e Vaticanis Codicibus Edita' (1828–38), and consists of numerous fragments, previously believed to be lost, of the ancient historians, such as Polybius, Diodorus Siculus, Dionysius of Halicarnassus, Dion Cassius, Appian and others, besides the various writings of the Fathers. In 1838 he was created a cardinal. A new collection, 'Spicilegium Romanum,' was published in 10 volumes between 1839 and 1844, and a patristic series, called 'Nova Patrum Bibliotheca,' issued between 1845 and 1853, closed his list of publications. Consult his life by G. Poletto (Siena 1887); also Prina, B., 'Biografia del cardinale Angelo Mai' (Bergamo 1882); Sandys, J. E., 'A History of Classical Scholarship' (Vols. I, III, Cambridge 1908).

MAIA, mā'ya, in Greek mythology, the eldest daughter of Atlas and Pleione. She was placed with her six sisters among the stars, where they have the common name of *Pleiades.* The Romans also worshiped a Maia, who was also called *Majesta,* and was afterward identified with the daughter of Atlas. The Tusculans called their principal deity *Majus.* The month of May is said to have received its name from them.

MAID OF ATHENS, immortalized by Lord Byron, was Theresa Macri, who 25 years after Byron's poem was written had lost her beauty, lived in a hovel in dire poverty and had reared a large family.

MAID MARIAN, a name given Matilda, daughter of Fitz-Walter, baron of Bayard and Dummow. She eloped with Robert Fitz-Ooth, an outlaw, and lived with him in Sherwood Forest. It is supposed that she was married by Friar Tuck to Fitz-Ooth, who was more commonly called Robin Hood (q.v.).

MAID OF THE MIST, (1) the name of a small steamboat used on the Niagara River below the Falls, to carry passengers close to the cataract. (2) A name given to the heroine of Sir Walter Scott's 'Anne of Geierstein.'

MAID OF ORLEANS, a name given Jeanne d'Arc (1412–31). See JOAN OF ARC.

MAIDEN, or **THE WIDOW,** an instrument of capital punishment used in Scotland during the 16th century, the prototype of the French guillotine (q.v.). It consisted of an upright frame and a broad piece of iron a foot or more wide, sharp on the lower part and loaded above with lead. At the time of execution this was pulled up to the top of the frame, in which was a groove on each side for it to slide in. The prisoner's neck being fastened to a bar underneath, on a sign given the cutting iron was let loose, and the head instantly severed from the body. Its first victim is said to have been Thomas Scott, executed 3 April 1565, one of the agents in the assassination of Rizzio. In 1581 it was used in the execution of the Earl of Morton, the alleged inventor.

MAIDEN QUEEN, in England, a popular title bestowed upon Queen Elizabeth.

MAIDENHAIR FERN. See FERNS AND FERN ALLIES.

MAIDENHEAD, England, market town and municipal borough in Berkshire, on the Thames, 24 miles west of London, on the Great Western Railway. It is an ancient town and was formerly known as Maydenhutt, or Maydenhith, and while its stone bridge which takes the London road over the Thames dates only from 1772 there are records of earlier bridges as early as 1297. It was incorporated as a guild to maintain the bridge by Henry VI, in 1451. It had formerly a large carrying trade in malt, meal and timber but it is now principally a residential town and pleasure resort for boating parties. The Wednesday market is still held under the charter of Queen Elizabeth, dating from 1582. Pop. about 17,000.

MAIDSTONE (Saxon MEDWEGESTUN) England, municipal and Parliamentary borough and the county town of Kent, 34 miles east-southeast from London, on the banks of the Medwey. The town consists chiefly of four principal streets, which cross each other at the market-place, with smaller ones branching off at right angles. Its fine old Collegiate Church of All Saints is supposed to be of the 14th century, and is one of the largest parish churches in England. It has historical associations with the rebellions of Jack Cade and Sir Thomas Wyatt, and was stormed by the Parliamentarians under Favifase in 1648. It has excellent educational institutions; schools, libraries, science and art institutions, museums, play grounds and parks. The chief industries are paper-making (for which there are several large mills), brewing, iron founding and the manufacture of agricultural implements. It is the centre of a great hop district, the cultivation of hops having been carried on since the seventeenth century. Corn markets and cattle markets are still held every week. From ancient Saxon times until 1830 malefactors were executed on Penenden Heath, now enclosed as a public recreation ground. Pop. 42,000.

MAIDU PEOPLE, an aboriginal Pujunan group of Indians of northern California, of which the chief tribe, the Concow, inhabited the region of the Upper Sacramento River. Their descendants are to be found in the Round Valley Reservation. Their communities comprised rough dwelling-places or hogáns built of boards, large circular halls or town-houses for assemblies and ceremonials and wicker storehouses for the winter supply of acorns which with piñons formed their staple food supplies. Their clothing was of the scantiest description; the chief of their numerous dances was the acorn dance; and they had a secret male society in which the initiatory age was 12. Consult Dixon, R. B., 'Maidu' (in Boas, 'Handbook of American Indians,' Washington 1911); id., 'Maidu Texts' (in American Ethnological Society Publications, Vol. IV, Leyden 1912).

MAIGNAN, Albert, äl-bär mā-nyän, French painter: b. Beaumont, Sarthe, 14 Oct. 1845; d. Paris, 29 Sept. 1908. He studied at Paris under Nöel and developed a strong and original manner in historical and landscape painting. At the Salon of 1879 he was awarded a first class medal. Amongst the most striking of his pictures are 'Dante's Meeting with the Countess Matilda' (1881) now in the Luxembourg; and 'Assault on Pope Boniface VIII at Anagni' in the New York Metropolitan Museum of Art.

MAIGRE, mā'gèr, or **MEAGRE,** a large European drum-fish (*Sciæna aquila*), common in the Mediterranean, where it forms one of the most important local food-fishes. It may attain a length of six feet, and its flesh has always been a favorite with epicures. Yarrell says that anciently on account of its large size it was always sold in pieces, and that the fishermen of Rome were accustomed to present the head, considered the finest part, as a sort of tribute to the three local magistrates who acted for the time as the conservators of the city.

MAIL-SHELL. See CHITON.

MAILDUN, mal'doon, **MAELDUIN,** or **MAELDUNE,** hero of Irish romance, 'Voyage of Maildun.' He was the son of Ailill Ocar Aga, of the tribe of Owenaght of Ninus, in County Clare, and before his birth his father was killed by pirates. He grew up handsome and accomplished, but had scarce reached manhood before he set sail with a crew of 60 men to find his father's murderer. For three years and seven months he voyaged on the Western Ocean seeing marvels such as no eyes had seen before. At length he found the murderer of his father, but pardoned him his wrong in gratitude to the great mercy of God who had delivered him from so many perils. Consult Joyce, P. W., 'Old Celtic Romances' (tr. from Gaelic, 3d ed., New York 1898); Tennyson, 'The Voyage of Maeldune.'

MAILLY, William, American Socialistic journalist: b. Pittsburgh, Pa., 22 Nov. 1871; d. 4 Sept. 1912. He was educated in the common schools of Scotland and England, and in 1895–

96 was editor of the Birmingham *Labor Advocate*. He returned to the United States and in 1898 organized the Social Democratic party of New York. He edited the *Social Democrat* at Haverhill, Mass., in 1899–1900; was associate editor of *The Worker* in New York in 1901 and in 1906–07; and managing editor of New York *Evening Call* in 1908–09. He was one of the organizers of Social Democrat, later Socialist, party at Chicago in 1898; organizer and secretary of the Socialist party of Massachusetts in 1902; and in 1905–06 he was a member of the National Executive Committee of the Socialist party.

MAIMON, mī'mŏn, **Salomon,** German philosopher: b. near Mir in Minsk, 1754; d. Siegersdorf, Lower Silesia, 22 Nov. 1800. He was trained for a rabbi, but having become acquainted with the philosophy of Maimonides, he made his way to Berlin, and studied modern philosophy, languages and some science. Besides cultivating his own mind, and teaching a little, he wrote some philosophical treatises and literary hack-work. Yet he had Mendelssohn, the philosopher, among his friends, was admired by Kant and attracted the attention of Goethe. This he owed to his 'Attempt at a Philosophy of Transcendentalism' (1790), in which he set out to supplement Kant's system with truths gleaned for the most part from Spinoza, Leibnitz, Hume, Locke and others. Consult Witte, 'S. Maimon' (Berlin 1876).

MAIMONIDES, mī-mŏn'ĭ-dēz, properly Moses Ben Maimon Ben Joseph (Arabic, Abu Amram Musa ibn Maimun Obeid Allah al Kortobi), Jewish scholar: b. Cordova, Spain, 30 March 1135; d. 13 Dec. 1204. At an early period he developed a taste for the exact sciences and for philosophy. He read with zeal not only the works of the Mohammedan scholastics, but also those of the Greek philosophers in such dress as they had been made accessible by their Arabian translators. In this way his mind, which by nature ran in logical and systematic grooves, was strengthened in its bent; and he acquired that distaste for mysticism and vagueness so characteristic of his literary labors. He went so far as to abhor poetry, the best of which he declared to be false, since it was founded upon pure invention — and this too in a land which had produced such noble expressions of the Hebrew and Arab muse. It is strange that this man, whose character was that of a sage, and who was revered for his person as well as for his books, should have led such an unquiet life, and have written his works so full of erudition with the staff of the wanderer in his land. For his peaceful studies were rudely disturbed in his 13th year by the invasion of the Almohades, or Mohammedan Unitarians, from Africa. They not only captured Cordova, but set up a form of religious persecution which happily is not always characteristic of Islamic piety. Maimonides' father wandered to Almeria on the coast; and then (1159) straight into the lion's jaws at Fez in Africa,— a line of conduct hardly intelligible in one who had fled for the better exercise of the dictates of conscience. So pressing did the importunities of the Almohad fanatics become, that together with his family Maimonides was compelled to don the turban, and to live for several years the life of an Arabic Marrano. This blot upon his fair fame — if blot it be — he tried to excuse in two treatises, which may be looked upon as his "Apologia pro vita sua": one on the subject of conversion in general (1160), and another addressed to his coreligionists in southern Arabia on the coming of the Messiah. But the position was untenable and in 1165 we find Maimonides again on the road, reaching Accho, Jerusalem, Hebron and finally Egypt. Under the milder rule of the Ayyubite caliphs, no suppression of his belief was necessary. Maimonides settled with his brother in old Cairo or Fostat, gaining his daily pittance first as a jeweler, and then in the practice of medicine, the while he continued in the study of philosophy and the elaboration of the great works upon which his fame reposes. In 1177 he was recognized as the head of the Jewish community of Egypt, and soon afterward was placed upon the list of court physicians to Saladin. When he died, his body was taken to Tiberias for burial.

Perhaps no fairer presentation of the principles and practices of rabbinical Judaism can be cited than that contained in the three chief works of Maimonides. His clear-cut mind gathered the various threads which Jewish theology and life had spun since the closing of the Biblical canon, and wove them into such a fabric that a new period may fitly be said to have been ushered in. The Mishnah had become the law-book of the Diaspora; in it was to be found the system of ordinances and practices which had been developed up to the 2d century A.D. In the scholastic discussions in which the Jewish schoolmen had indulged their wit and their ingenuity, much of its plain meaning had become obscured. At 23 Maimonides commenced to work upon a commentary to this Mishnah, which took him seven years to complete. It was written in Arabic, and very fitly called 'The Illumination'; for here the philosophic training of its author was brought to bear upon the dry legal mass, and to give it life as well as light. The induction of philosophy into law is seen to even more peculiar advantage in his 'Mishnah Tōrah' (Repeated Law). The scholastic discussions upon the Mishnah had in the 6th century been put into writing, and had become that vast medley of thought, that kaleidoscope of schoolroom life, known by the name of Talmud. Based upon the slender framework of the Mishnah, the vast edifice had been built up with so little plan and symmetry that its various ramifications could only be followed with the greatest difficulty and with infinite exertion. In turn, the Talmud had supplanted the Mishnah as the rule of life and the directive of religious observance. Even before the time of Maimonides, scholars had tried their hand at putting order into this great chaos; but none of their efforts had proved satisfactory. For 10 years Maimonides worked and produced this digest, in which he arranged in scientific order all the material which a Jewish jurist and theologian might be called upon to use. Though this digest was received with delight by the Jews of Spain, many were found who looked upon Maimonides' work as an attempt to crystalize into unchangeable law the fluctuating streams of tradition. The same objection was made to his attempt to formulate into a creed the purely

theological ideas of the Judaism of his day. His 'Thirteen Articles' brought on a war of strong opposition; and though in the end, the fame of their author conquered a place for them even in the Synagogue Ritual, they were never accepted by the entire Jewry. They remained the presentation of an individual scholar.

But his chief philosophical work, his 'Guide of the Perplexed' (Dalālat al Hāirin), carried him still further: and for centuries fairly divided the Jewish camp into two parties. The battle between the Maimonists and anti-Maimonists waged fiercely in Spain and Provence.

In the 'Guide of the Perplexed' Maimonides has also produced a work which was "epoch-making in Jewish philosophy. It is the best attempt ever made by a Jew to combine philosophy with theology. Aristotle was known to Maimonides through Al-Farābi and Ibn Sinâ (Avicenna); and he is convinced that the Stagyrite is to be followed in certain things, as he is that the Bible must be followed in others. In fact, there can be no divergence between the two; for both have the same end in view,—to prove the existence of God. The aim of metaphysics is to perfect man intellectually; the same aim is at the core of Talmudic Judaism. Reason and revelation must speak the same language; and by a peculiar kind of subtle exegesis — which provoked much opposition, as it seemed to do violence to the plain wording — he is able to find his philosophical ideas in the text of the Bible. But he is careful to limit his acquiescence in Aristotle's teachings to things which occur below the sphere of the moon. He was afraid of coming into contact with the foundations of religious belief, and of having to deny the existence of wonders. The Bible teaches that matter was created, and the arguments advanced in favor of both the Platonic and Aristotelian views he looks upon as insufficient. The Jewish belief that God brought into existence not only the form but also the matter of the world, Maimonides looks upon much as an article of faith. The same is true of the belief in resurrection. He adduces so little proof for this dogma that the people of his day were ready to charge him with heresy.

Maimonides is able to present 25 ontological arguments for his belief in the existence, unity and incorporeality of God. What strikes one most is the almost colorless conception of the Deity at which he arrives. In his endeavor to remove the slightest shadow of corporeality in this conception, he is finally led to deny that any positive attributes can be posited of God. Such attributes would only be "accidentia"; and any such "accidentia" would limit the idea of oneness. Even attributes which would merely show the relation of the Divine Being to other beings are excluded; because he is so far removed from things non-Divine, as to make all comparison impossible. Even existence, when spoken of in regard to him, is not an attribute. In his school language, the "essential" of God involves his "existentia." We have therefore to rely entirely upon negative attributes in trying to get a clear concept of the Deity.

If the Deity is so far removed, how then is he to act upon the world? Maimonides supposes that this medium is to be found in the world of the spheres. Of these spheres there are nine: "the all-encompassing sphere, that of the fixed stars, and those of the seven planets." Each sphere is presided over by an intelligence which is its motive power. These intelligences are called angels in the Bible. The highest intelligence is immaterial. It is the *noûs poietikós*, the ever-active intellect. It is the power which gives form to all things and makes that which was potential really existent. "Prophecy is an emanation sent forth by the Divine Being through the medium of the active intellect, in the first instance to man's rational faculty and then to his imaginative faculty. The lower grade of prophecy comes by means of dreams, the higher through visions accorded the prophet in a waking condition. The symbolical actions of the prophets are nothing more than states of the soul." High above all the prophets Maimonides places Moses, to whom he attributes a special power, by means of which the active intellect worked upon him without the mediation of the imagination. The psychological parts of the 'Guide' present in a Jewish garb the Peripatetic philosophy as expounded by Alexander of Aphrodisia. Reason exists in the powers of the soul, but only potentially as latent reason (*noûs húlikos*). It has the power to assimilate immaterial forms which come from the active reason. It thus becomes acquired or developed reason (*noûs epiktetos*); and by still further assimilation it becomes gradually an entity separable from the body, so that at death it can live on unattached to the body. In ethics Maimonides is a strong partisan of the doctrine of the freedom of the will. No one moves him, no one drives him to certain actions. He can choose, according to his own inner vision, the way on which he wishes to walk. Nor does this doctrine involve any limitation of the Divine power, as this freedom is fully predetermined by the Deity. But Maimonides must have felt the difficulty of squaring the doctrine of the freedom of the will with that of the omniscience of God; for he entrenches himself behind the statement that the knowledge of God is so far removed from human knowledge as to make all comparison impossible. Again, in true Aristotelian style, Maimonides holds that those actions are to be considered virtuous which follow the golden mean between the extremes of too much and too little. The really wise man will always choose this road; and such wisdom can be learned; by continued practice it can become part of man's nature. He is most truly virtuous who has reached this eminence, and who has eliminated from his own being even the desire to do wrong.

The daring with which Maimonides treated many portions of Jewish theology did not fail to show its effect immediately after the publication of the 'Guide.' His rationalistic notions about revelation, his allegorizing interpretation of Scripture, his apparent want of complete faith in the doctrine of resurrection, produced among the Jews a violent reaction against all philosophical inquiry, which lasted down to the times of the French Revolution. Even non-Jews looked askance at his system. In Montpellier and in Paris, his own Jewish opponents, not content with having gotten an edict against the use of the master's writings, obtained the aid of the Church (for the 'Guide' had been translated into Latin in the 13th century), and had it publicly consigned to the flames. But all

this was the only further evidence of the power which Maimonides wielded. The Karaites copied it; the Kabbalah even tried to claim it as its own. Many who were not of the house of Israel, as Thomas Aquinas and Albertus Magnus, acknowledged the debt they owed the Spanish rabbi; and Spinoza, though in many places an opponent, shows clearly how carefully he had studied the *Guide of the Perplexed.*

Consult Yellin, D., and Abrahams, I., *Maimonides* (Philadelphia 1903); Guttmann, J., *Moses ben Maimon,* 2 vols. (Leipzig 1908, 1914); Munz, J., *Moses ben Maimon* (Frankfurt 1912); Husik, I., *History of Mediaeval Jewish Philosophy* (New York 1916); Singer, C., *The Legacy of Israel* (Oxford 1927).

MAIN, mān, **Hubert Platt,** American composer and editor: b. Ridgefield, Conn., Aug. 17, 1839; d. Newark, N. J., Oct. 27, 1925. His father, Sylvester Main had written hymns for many years and the younger Main began at an early age, composing his first hymns at the age of fifteen. He was educated in the public schools. After working for a few years as a clerk and editor in New York, Main became employed in the company that developed into Biglow & Main, an enterprise in which his father was the junior partner. Main assisted in the compilation of more than 500 publications of Biglow & Main, being for 59 years an editor of song collections and other publications for church, Sunday school and college use, and became recognized as an expert hymnologist. His own work consisted of more the 1,000 hymns and sacred songs, as well as a great amount of secular music. With the collaboration of other writers of hymns and songs, Main was the author of *The Victory* (1870); *Christian Songs* (1872); *The Alleluia* (1880); *Harvest Gems* (1896); *Gems of Song for the Sunday School* (1901); *Gloria Deo* (1901); *Devotional Songs* (1903); *Hallowed Hymns* (1907); *Bixby's Home Songs* (1909); *Hebrew Hymnal* (1910); Ode Book, *Eastern Star* (1911); *Mission Hymnal* (1911–1914); *Quartettes and Choruses—Male Voices* (1912); *Hamilton College Songs* (1915). He also compiled *A Dictionary of American Musicians and Poets.*

MAIN, mān, a river of Germany, which has its source in the northeastern part of Bavaria, about 13 miles northwest of Bayreuth. It flows northwest to the border of Bavaria and then makes a succession of remarkable zigzags, continuing, however, in a westerly direction, till it reaches the border of Hesse, which it enters. It then flows circuitously west and joins the Rhine a little above the town of Mainz, after a course of over 300 miles. The principal cities which it passes are Wurzburg, Aschaffenburg, and Frankfurt. It is navigable for about 200 miles. By means of Ludwigs Canal (Ludwigs-Donau-Main-Kanal) navigation to the Danube is possible.

MAIN CURRENTS IN AMERICAN THOUGHT, An Interpretation of American Literature from the Beginnings to 1920, by Vernon Louis Parrington, in 3 volumes, the first two of which were published in 1927 and the following year won the Pulitzer Prize for history; the last volume, in fragment form, completed only to 1900, was edited by Professor E. H. Eby and published posthumously in 1930.

Volume 1, *1620–1800, The Colonial Mind,* examines those ideas which have become traditionally recognized as American, how and from where they came, and what influence they exerted in determining our characteristic ideals and institutions. The author describes the pressure of American environment on the 17th and 18th century European ideals from which resulted the overthrow of aristocracy and monarchy and the development of the principle of democracy. Volume 2, *1800–1860, The Romantic Revolution in America,* is concerned with the influence of French romantic theories, the rise of capitalism, and the transition to an industrial from an agricultural state. Social progress in terms of the emergent middle class was the predominant philosophy. Volume 3, *1860–1920, The Beginnings of Critical Realism in America,* is the author's analysis of the decay of the romantic optimism and the source of that decay is laid to three causes: the stratifying of economics under the system of centralization; the evolvement of a mechanistic science; and the development of a philosophy of skepticism which is resulting in the questioning of the ideal democratic spirit.

The author's main purpose, as a liberal thinker, was first to examine and understand in a true scholarly spirit the various points of view expressed in American literature, being guided by historical significance rather than aesthetic judgment, before offering his personal critique. Three phases of his method become apparent: he treats the literature of America as the outgrowth of racial strains, environment, and period; to this treatment he applies the theory of economic determinism as a means for a true understanding; and, he considers American literature as American thought, that is, the literature of a country is the reflection of its thought which in turn has been the result of economic forces acting on political, social, and religious institutions. Parrington, famous for his ability to reduce his thesis to a single phrase, sentence, or expressive figure, has summarized our intellectual history in three phases: "Calvinistic pessimism, romantic optimism, and mechanistic pessimism."

MAIN CURRENTS IN NINETEENTH CENTURY LITERATURE (*Hovedstrømninger i det 19. Aarhundredes europaeiske Litteratur*). This great work of Georg Brandes (1842–1927, q.v.) established its Danish-Jewish author's reputation as one of the greatest champions of freedom of inquiry and freedom of thought in the last quarter of the 19th century. Its six volumes consist of the following separate studies: *The Literature of the French Emigrés* (1872); *The Romantic School in Germany* (1873); *Reaction in France* (1874); *Naturalism in England* (1875); *The Romantic School in France* (1882); *Young Germany* (1890).

An English translation of the *Main Currents* was published 1901–1905. A partisan of French revolutionary ideals, an ardent admirer of his friends Taine, Renan, and John Stuart Mill, he sought in these volumes, based on lectures, to liberate Scandinavia from its provincial prejudices. He was an inveterate foe of romanticism.

MAIN STREET, a novel by Sinclair Lewis (q.v.), published in 1920. The following year it was dramatized by Harvey O'Higgins and Harriet Ford.

The central figure of the story is Carol Milford, an attractive, quick-minded, college educated librarian from the Twin Cities. Of a mercurial temperament and possessed by some-

what vaporous cultural enthusiasms, she allows herself to marry Will Kennicott, a phlegmatic, small town physician, and as his wife she attempts to reform both the unsightly material fabric and the provincial spirit of the raw Minnesota community in which Kennicott has established his not unlucrative practice. In the course of her crusade, Carol acquires a handful of sympathetic allies; Vilda Sherwin, an erotic, sharp tongued school teacher; the ineffectual yet perceptive lawyer, Guy Pollock, who has tarried too long in Gopher Prairie and become permanently infected by what Lewis calls the "village virus"; and Miles Bjornstam, odd job man extraordinary, who is a combination of resident agnostic, "radical," and gadfly.

Balked by Main Street's hostility, intolerance, smugness, and ignorance, and by its worship of dullness made God, Carol lives out the years before World War I in a state of uncertainity, satisified neither by marriage nor by parenthood. Somewhat in despair she drifts into an abortive love affair. Flight to wartime Washington with her child and the two years spent there give her an opportunity to review her life and her relations with her community. In the end her patient husband takes her back to Gopher Prairie, which she ultimately comes to accept as a place where, as she says of herself, she may not have won a single victory nor even have fought the good fight, but where, in spite of everything, she has steadfastly kept faith.

Originally conceived as a novel on the theme of the "village virus," with Guy Pollock as the fatally infected protagonist, *Main Street* underwent a long period of incubation in its author's mind. His sixth serious novel, it was written more to please himself than either his publisher or his hitherto modest public, and there is reason to believe that few, if any, expected it to be the very great popular success that it was, much less one of the foremost novels of the 1920's at home and abroad. As was the case with certain of its successors, notably *Babbitt* (q.v.) and *Arrowhead* (q.v.), *Main Street* caught a wave of inarticulate discontent and rode it in swelling triumph up the beach. That particular wave of national self-criticism has since subsided; yet detailed, acidulous, and authentic literary embodiment lives on in the mimic-history of Carol Kennicott. The argument of the book has elevated the concept of the universal Main Street into a social symbol, and its considerable artistry can still leave with the responsive reader the wistful, lingering essence of a life which is seen as permanently settled, its onetime elixir evaporated, the motionless, cloudy sediment of day to day existence alone remaining.

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MAINE, mān, SIR **Henry James Sumner**, British jurist: b. Kelso, Roxburghshire, Scot., Aug. 15, 1822; d. Cannes, France, Feb. 3, 1888. He was educated at Cambridge where he later served as regius professor of civil law from 1847 to 1854. He was in India as legal member of the council, 1862–1869. On his return, he was appointed professor of jurisprudence at Oxford in 1869 and held this post till 1878. He was appointed master of Trinity Hall, Cambridge, 1877, and professor of international law at Cambridge, 1887–1888. Among his more noted works were *Ancient Law* (1861), *Village Communities in the East and the West* (1871); *Early History of Institutions* (1875); *Early Law and Custom* (1883); and *International Law* (1888). Consult Duff, M. E. G., *Sir Henry Maine: a Brief Memoir of his Life* (New York 1892).

MAINE, the name given as early as 1622 to distinguish the mainland from the islands. It was called in the Mason and Gorges patent of 1629, "the Mayn Land of New England," and in the great charter of 1606 to the Plymouth Company, "Province of Main." As a province of Massachusetts, it was admitted to the union as the 23d state in 1820. Popularly known as the "Pine Tree State," it is one of the New England group of North Atlantic states and the most easterly state of the union. It is bounded on the north by Quebec and New Brunswick, provinces of Canada, and on the east by New Brunswick and the Atlantic Ocean, on the south by the Atlantic Ocean, and on the west by the State of New Hampshire and the Province of Quebec. Its greatest extent is from north to south, its greatest length about 322 miles, and its greatest width about 207 miles. Maine is as large as all the rest of the New England group, lacking 385 square miles, and it is the 38th in size among the states of the union.

State flag.

Land area	31,040 square miles
Water area	2,175 square miles
Total area	33,215 square miles
Latitude	43° 4′—47° 28′ N.
Longitude	66° 57′—71° 7′ W.
Altitude	sea level to 5,268 feet
Population (1950)	913,774
Capital city—Augusta; Pop. (1950)	20,913
Admitted as a state	March 15, 1820
Bird	Chickadee, approved April 6, 1927
Flower	White pine cone and tassel, adopted 1895
Motto	*Dirigo* (I direct)
Nickname	Pine Tree State
Song	*State of Maine Song*, adopted 1937
Tree	No official tree

State seal.

Physical Characteristics. — *Topography.* — While its northeastern and a portion of its southwestern boundary lines are straight, its others

are irregular, especially its coastline, which, fringed by islands, is indented by numerous bays, giving it a shore length of over 2,000 miles, though a direct line drawn from its two extremities would be but about a tenth of its real length. This irregular coastline, bold and rugged from its eastern extremity until it reaches Penobscot Bay, becoming lower as it approaches the south, is most picturesque throughout its entire length, much of it being bordered by sandy beaches and thick forests reaching to the water's edge. There are more good harbors on the coast of Maine than on that of any other state on the Atlantic seaboard.

There are two general mountain slopes in Maine, the highest part extending across the state from north of the source of the Magalloway River in the west, northeast to Mars Hill. South of the main divide is Mount Katahdin, 5,268 feet in height; Mount Abraham, 3,388; Saddleback, 4,116, and Mount Blue, 3,187 feet in height, all in Franklin County. There is no long range of mountains in the state.

Climate.—The climate is cold a considerable part of the year; snow covers the ground from three to five months. The summers are short; even in the southern part of the state there is not more, usually less, than five months for the maturing of crops. The extensive forests have been a protection against cold weather, and with the good river drainage and the sea breezes have tended to make the climate healthful. A fair average of the mean temperature in January is 15°F.; in May 52°F.; in July 68°F.; in October 51°F.; in December 22°F. The average temperature in the whole state is in summer about 62.5°F. and in winter 20°F.

Geology.—The nature of the geological formation of Maine shows that it belongs to one of the oldest parts of the United States. The marks of the glacial period may be plainly traced in several parts of the state; the changes in extent and form of the river beds and lakes are shown by the rock formation of the vicinity and the nature of the deposits which the glaciers brought from the mountains to the valleys. The northern portion of the state belongs to the Devonian period, and the region about Penobscot Bay to the Silurian. In the southern part of the state are fossiliferous clays. There are a number of low ridges which evidently were once portions of mountain ridges, but which usually formed angles with the two great ranges that at one time extended across the state.

Rivers, Shoreline, and Lakes.—That portion of the state north of the main divide is drained almost wholly by the Saint John River and its tributaries, and the part south of the main divide is drained chiefly by the Androscoggin, Kennebec, Penobscot, and Saint Croix rivers. The basin of the Saint John River has an area of about 7,425 miles. The headwaters of this river are in the northwestern part of Maine and the eastern part of Quebec, and it flows north by east for some distance past St. Francis on the north to the extreme northeastern boundary of the state, where it turns and flows generally southeast through New Brunswick to the Bay of Fundy. The largest Maine tributaries of the Saint John are the Aroostook and the Allagash. The waters of a large number of the lakes of Maine find their outlet through the Saint John. The rivers south of the main divide flow generally south to the ocean. The source of the Kennebec is about 2,000 feet above the sea, of the Penobscot over 2,300 feet, of the Androscoggin about 3,000 feet, and of the Saco in the southwest nearly 2,000 feet. They, together with their tributaries, are swiftly flowing streams, in many places passing over rocky beds which form rapids and falls and furnish extensive waterpower. (See section on *Natural Resources.*)

Old Orchard Beach and other famous beaches are a feature of the shoreline at the southern tip of the state; from Portland northeast along the coast there are hundreds of islands and a rugged, rock-bound coast, deeply indented with inlets and bays. The largest island is Mount Desert, on which is located the town of Bar Harbor, a well known summer resort. Portland, on Casco Bay, is the principal port; other ports and harbors include Bath, Rockland, Belfast, Searsport, Bangor, and Eastport.

Maine is justly famed for her hundreds of beautiful ponds and lakes, the paradise of the summer camper and the fisherman. Among the best known are the Rangeley Lakes, near the New Hampshire line, Sebago Lake, near Portland, and Moosehead, in the central portion of the state. The last named is about 40 miles long, being the longest lake wholly within the boundaries of a state of the United States. Many Maine lakes bear Indian names, as Nicatous, Pocumcus, Cobboseecontee, Mattawamkeag, Mattamiscontis. There are said to be 2,465 lakes in the state.

Political Divisions.—*Cities.*—Portland is the center of the only metropolitan area in Maine. Situated on Casco Bay, it is a trading and transportation area, with some light industry such as pottery and canning. South Portland, included in the area, was a shipbuilding city during both world wars. Casco Bay was the center of extensive naval operations during World War II. Auburn is the leading shoe manufacturing city of Maine, while Lewiston, Saco, Wilton, Old Town, and several others are known as textile centers. Sanford is known for its auto upholstery, carpets, and Palm Beach cloth. Millinocket, Madison, Old Town, Westbrook, and Augusta are known for a variety of paper products. Old Orchard, Scarboro, and York are principally summer resorts, along with many of the smaller towns with fewer than 2,500 persons. Eastport is the center of sardine packing, and the most easterly city in the United States. Waterville is the home of Colby College, Lewiston of Bates College, Brunswick of Bowdoin College, while Orono is the site of the University of Maine. Caribou, Fort Fairfield, Presque Isle, and Houlton are trading centers for the vast potato industry of Aroostook County. Norway is said to have the world's largest snowshoe factory and also the largest dowel mill. For population of cities and towns see back of state map.

Counties.—Maine has 16 counties which, with their county seats, are as follows:

County	County Seat
Androscoggin	Auburn
Aroostook	Houlton
Cumberland	Portland
Franklin	Farmington
Hancock	Ellsworth
Kennebec	Augusta
Knox	Rockland
Lincoln	Wiscasset
Oxford	South Paris
Penobscot	Bangor
Piscataquis	Dover-Foxcroft

County	County Seat
Sagadahoc	Bath
Somerset	Skowhegan
Waldo	Belfast
Washington	Machias
York	Alfred

The People.—*Origins.*—The population of Maine is chiefly representative of English, Scotch-Irish, French, and German stock. The earliest settlers were the English at Kittery, soon to be joined by some Scotch-Irish. Farther north, around Waldoboro, German families from Brunswick and Saxony settled in the 1740's. Irish settlers gave Limerick its name. French Protestants settled along the coast. Swedish settlers were brought over in 1870 to take up farms in the northeastern part of the state, forming the colony of New Sweden. There are only two tribes of Indians now represented in Maine, the Penobscots and the Passamaquoddies, who live chiefly on reservations.

Growth and Trends.—On April 1, 1940, Maine had a population of 847,226, an increase of 49,803, or 6.2 per cent over its 1930 population of 797,423. During World War II the population declined, due to losses to the armed forces and out of state war industries. The census estimate for 1948 was 900,000. The first census of Maine was taken in 1790 and returned a population of 96,540. The population has increased with every census since that time, except that of 1870, passing 100,000 between 1790 and 1800, 200,000 between 1800 and 1810, 300,000 between 1820 and 1830, 500,000 between 1830 and 1840, 700,000 between 1900 and 1910, 800,000 between 1930 and 1940, and 900,000 between 1940 and 1950. The population on April 1, 1950, was 913,774, representing an increase of 66,548, or of 7.9 per cent over the 1940 population. The density of population in 1950 was 29.4 inhabitants per square mile. Residents of rural areas numbered 441,774 (48.3 per cent) of the total. Fourteen of the 16 counties gained in population between 1940 and 1950, and Cumberland County, with an increase of 15.9 per cent, and York (13.3 per cent) and Penobscot (11.4 per cent) counties had the most rapid growths. There are 11 cities with populations of 10,000 or more, one (York) having reached this size since 1940. The largest towns, and the only two over 10,000 population are Sanford (15,177) and Brunswick (10,996). In 1950 there were a total of 21 incorporated and 73 unincorporated places of 1,000 inhabitants or more. According also to the 1950 census, females outnumbered males 459,629 to 454,145 and whites outnumbered nonwhites 910,847 to 2,927.

Famous Men and Women.—Maine has many native-born sons and daughters who are particularly worthy of mention. Among those in the literary field are: Jacob Abbott (Hallowell, 1803–1879), who wrote chiefly juveniles, including the popular Rollo books; Henry Wadsworth Longfellow (Portland, 1807–1882), a poet of outstanding distinction; Charles Farrar Browne (Waterford, 1834–1867), humorist, who wrote under the pseudonym of Artemus Ward; Harriet Prescott Spofford (Calais, 1835–1921), novelist and short-story writer; Sarah Orne Jewett (South Berwick, 1849–1909), who excelled in her stories of New England life; Thomas Bird Mosher (Biddeford, 1852–1923), publisher, who devoted his life to the publishing of choice editions, and *The Bibelot,* a monthly periodical; Edwin Arlington Robinson (Head Tide, 1869–1935), poet, and winner of the Pulitzer Prize three times; Kenneth Roberts (Kennebunk 1885–), one of the best writers of American historical romance; Mary Ellen Chase (Blue Hill, 1887–), educator and author; Edna St. Vincent Millay (Rockland, 1892–1950) writer chiefly of verse; and Robert Peter Tristram Coffin (Brunswick, 1892–) poet, essayist, and biographer.

Some of those who became famous in the world of art are: Benjamin Paul Akers (1825–1861), sculptor, born in Saccarappa, now Westbrook, whose *Dead Pearl Diver* described in Hawthorne's *The Marble Faun* is his best known work; Franklin Simmons (1839–1913), sculptor, born in Lisbon, now Webster, whose bronze statue of Longfellow is in Portland; Frederic Porter Vinton (Bangor, 1846–1911), portrait painter, having for subjects such men as Charles Francis Adams, Wendell Phillips, and William D. Howells; Benjamin Foster (North Anson, 1852–1926), landscape painter, and Waldo Peirce (Bangor, 1884–), artist, who is represented in many of the best art galleries.

In other fields of the artistic world we have: John Knowles Paine (Portland, 1839–1906), music teacher and composer; Annie Louise Cary (Wayne, 1842–1921), singer, who became one of the most celebrated of opera and concert contraltos; Lillian Nordica, pseudonym of Lillian Norton, (Farmington, 1859–1914), operatic soprano; and the two actresses, born in Rockland, Maxine Elliott (1871–1940) and her sister, Lady Forbes-Robertson (1874–), whose real names were Jessie and May Gertrude Dermot.

Others of note are: Rufus King (Scarboro, 1755–1827), statesman, who was a member of the Continental Congress, the federal Constitutional Convention, the Massachusetts ratification convention, and was minister to Great Britain twice; Dorothea Lynde Dix (Hampden, 1802–1887), humanitarian, known particularly for her work for the betterment of the treatment of the insane; Neal Dow (Portland, 1804–1897), temperance advocate, drafted Maine prohibition law and saw it passed; Hannibal Hamlin (Paris Hill, 1809–1891), political leader, member of the U.S. House of Representatives and Senate, governor of Maine, and vice president of the United States during the Civil War; Henry Varnum Poor (Andover, 1812–1905), economist, and founder of Poor's *Manual of the Railroads of the United States;* George Palmer Putnam (Brunswick, 1814–1872), who became head of a large book-publishing business; Melville Weston Fuller (Augusta, 1833–1910), jurist, became chief justice of the United States Supreme Court and also a member of the Permanent Court of Arbitration at The Hague; Thomas Brackett Reed (Portland, 1839–1902), lawyer and legislator, member of the U.S. House of Representatives and twice speaker of the House; Hiram Stevens Maxim (Sangerville, 1840–1916), inventor, best known for his invention of a recoil-operated machine gun; Hudson Maxim (Orneville, 1853–1927), inventor, and an expert in explosives; and Frank Andrew Munsey (Mercer, 1854–1925), publisher and owner of the New York *Evening Sun* and *Evening Telegram,* also *Munsey's Magazine.*

Natural Resources.—*Wild Life.*—The wild animals of Maine include the moose, white-tailed or Virgina deer, black bear, beaver, red fox, otter, mink, weasel, flying, red, and gray

squirrels, snowshoe hare, porcupine, muskrat, woodchuck, and wildcat. Canada geese, black duck, wood duck, woodcock, ruffed grouse, pheasant, and many other game birds are found in the state. The American eagle is found in Maine, as well as several varieties of gulls, hawks, and owls. Crows, starlings, and grackles migrate to Maine in large numbers, and songbirds in great variety spend part or all of the year there. Robins, bluebirds, orioles, catbirds, bobolinks, bluejays, kingbirds, kingfishers, sandpipers, several types of sparrows, thrushes, woodpeckers, flycatchers, and swallows are among the more common varieties. Loons abound on Maine lakes, where their eerie and haunting calls can often be heard in the night. (See also section *Fisheries* under *Production and Manufactures.*)

Plants.—Trees and plants common to northeastern United States flourish here. Common trees include: alder, American elm, white, yellow, and gray birch, white and red (Norway) pine, white, black, and red oak, beech, hemlock, cedar, maple, ash, spruce, fir, tamarack, poplar. Wild shrubs and grasses abound, and among its prolific ferns are the royal, ostrich, Christmas, evergreen wood fern, rock fern, marsh fern, lady fern, spinulose, cinnamon, and New York. The wild flowers of the state are numerous, from the trailing arbutus and flowering dogwood of early spring to the goldenrods and asters of late summer and fall. Wild roses are common, and in the ponds grow yellow pond lilies, white water lilies, and pickerelweed, and in the wet and moist places, pitcher plants, marsh marigolds, cardinal flowers, rose pogonias, calopogons, and the graceful meadow lilies and meadow rue. In the woods one finds the dainty, fragrant twinflower, and bloodroot, anemone, purple, yellow, and white violets, ladies slippers, goldthread, groundnut, bunchberry, checkerberry, Indian pipe, and partridge berry, to name only a few. The commoner field flowers include white and oxeye daisies, yellow and orange hawkweed, buttercups, and Queen Anne's lace. Edible wild berries include the blackberry, raspberry, huckleberry, low and high bush blueberry, cranberry, and strawberry.

Minerals.—A variety of semiprecious stones and minerals are found in Maine, including small amounts of gold. Tourmalines, aquamarines, beryls, and garnets are among the semiprecious stones, found chiefly in Oxford County. Iron and manganese are found in low grade ores. Slate, granite, silica, feldspar, mica, peat, cement, and lime are produced commercially; also clay, gravel, and crushed rock.

Clear cold water, sometimes with mineral content, pours forth from many springs in Maine, and numerous ponds and lakes are spring-fed. Poland Spring (Poland), Underwood Spring (Falmouth Foreside), and Sieur de Monts Spring (Acadia National Park) are among the best known springs.

Forests.—Maine became known as the "Pine Tree State" because of the large extent of the pine forests which once existed within its limits. The majestic "mast pine," furnished for many British and American ships, is now a thing of the past, although pine trees still grow in large numbers. The greater part of the state, perhaps two thirds in area, is wooded, with most of the northern and central areas not only wooded but lacking permanent settlements.

Soil.—The soil of Maine shows the effects of the glacial period, the greater part of the state being till, glacial debris, or heavy clay. The old lake beds, now dry land, and river margins are largely alluvial and in these limited areas the soil is very fertile, and extensive agricultural lands result, as in the Aroostook potato area.

Waterpower.—Among the state's resources, waterpower takes high rank. From many lakes and swift-flowing streams hydroelectric power may be obtained. Fear of outside interests and possible export of power from Maine led the state (1909) to enact the Fernald Act, prohibiting export of hydroelectric power. Efforts made in following years to obtain a modification of this policy have failed. An interesting idea was the plan of Duncan C. Cooper to utilize the enormous power generated by the tides of the Bay of Fundy. The flow of the tide is so great that it was estimated that power could be generated sixteen hours of every twenty-four. Originally proposed as an international project (the Passamaquoddy Tidal Power Development Project), it was later modified to be built without Canadian participation. The Franklin D. Roosevelt administration constructed Quoddy Village and began on the dams (1933–36). However, Congress refused appropriations in 1936 and work was abandoned after some millions were expended.

Parks, Preserves, and Reservations.—Although small, the Acadia National Park provides a unique combination of lake, mountain, forests, and rugged shoreline. Established by act of Congress (1916), and enlarged by gift and purchase, the park is situated chiefly on Mount Desert Island, with one section occupying the nearby mainland (Schoodic Peninsula). The motor road leading to the summit of Mount Cadillac (alt. 1,532 ft.) is famous for its extensive panoramas of land, sea, and islands. In addition to the usual roads, trails, camp sites, and park guides, there is an archeological museum with relics of early Maine Indian culture.

Among the several state parks, the most noted is Baxter State Park, named after the donor, ex-Governor Percival P. Baxter. This area embraces Mount Katahdin, highest peak in Maine, and several other mountains and extensive wild forest lands. Birds, animals, and wild flowers are protected in the national and state parks.

There are three Indian Reservations in Maine, one at Indian Island (Old Town), and two in Washington County. Under state guardianship there reside about 578 Indians of the Penobscot Indians tribe (originally called Tarratines or Tarrateens) at Old Town, and 653 of the Passamaquoddy Indians tribe in Washington County.

The establishment of St. Croix Island (7 acres), in St. Croix River, as a national monument was authorized on June 7, 1949. It commemorates the first French settlement in America. In 1604, prior to the settlement of Jamestown, Va., or Plymouth, Mass., an expedition led by the French explorer, Sieur de Monts and his lieutenant, Samuel Champlain, landed on the island and spent the winter there.

Other Points of Interest.—As Maine grew from the coast inward, many large mansions of the colonial period and later were built along the coast. One of the earliest of these is the William Pepperell House (1682) at Kittery Point. The Sparhawk House (1742) at Kittery was built by Sir William Pepperell, son of William Pepperell. It is considered an outstanding ex-

The Maine State House at Augusta

Courtesy Maine Development Commission

Elms and white clapboard houses, as at Kennebunk Port, give Maine streets their individual, New England quality.

MAINE

Above: The state's most important agricultural product is the famous Maine potato, a number of which are here being harvested near Caribou, Aroostook County, in the northern part of the state.

Left: Portland Head Light at Cape Elizabeth near Portland, one of the Atlantic's most famous lighthouses.

Below: The region near Parsonsfield, York County, with its rolling, wooded hills and an occasional farm, is typical of the southern part of Maine.

Courtesies: Top, Maine Development Commission; center, Boston and Maine Railroad; bottom, Maine Development Commission

MAINE

1950 Total Population 913,774

Abbot Village□(E5) 462
Acton□ (B8) 473
Addison□ (H6) 846
Albion□ (E6) 992
Alexander□ (H5) 282
Alfred◉□ (B9) 1,112
Allagash□ (F1) 680
Allens Mills (C6) 175
Alna□ (D7) 350
Alton□ (F5) 314
Amherst□ (G6) 151
Andover□ (B6) 756
Anson□ (D6) 2,199
Appleton□ (E7) 671
Argyle□ (F5) 133
Ashdale (D8) 60
Ashland□ (G2) 2,370
Ashville (G7) 100
Athens□ (D6) 725
Atkinson□ (E5) 400
Atlantic (G7)
Auburn◉ (C7) 23,134
AUGUSTA (D7) 20,913
Aurora□ (G6) 91
Ayers (J6)
Bailey Island (D8) 175
Bancroft□ (H4) 165
Bangor◉ (F6) 31,558
Bar Harbor□ (G7) 3,864
Bar Mills (C8) 800
Baring□ (J5) 157
Bath◉ (D8) 10,644
Bay Point (D8)
Bayside (F7)
Beals□ (H7) 590
Beddington□ (H6) 26
Belfast◉ (F7) 5,960
Belgrade□ (D7) 1,099
Belgrade Lakes (D6) 450
Belmont□ (E7) 258
Bemis (B6)
Benedicta□ (G4) 225
Benton□ (D6) 1,421
Berry Mills (C6) 100
Berwick□ (B9) 2,166
Bethel□ (B7) 2,367
Biddeford (C9) 20,836
Biddeford Pool (C9)
Bingham□ (D5) 1,354
Birch Harbor (H7)
Birches (B6)
Blaine□ (H2) 1,118
Blanchard□ (D5) 75
Blue Hill□ (F7) 1,308
Bolsters Mills (B7) 115
Boothbay□ (D8) 1,559
Boothbay Harbor□ (D8) 2,290
Boundary (H3) 100
Bowdoinham□ (D7) 1,039
Bowerbank□ (E5) 20
Boyd Lake (F5)
Bradford□ (F5) 793
Bradford Center(F5) 150
Bradley□ (F6) 786
Bremen□ (E8) 409
Brewer (F6) 6,862
Bridgewater□ (H3) 1,279
Bridgton□ (B7) 2,950
Brighton□ (D5) 106
Bristol□ (E8) 1,476
Brooklyn□ (F7) 546
Brooks□ (E6) 747
Brooksville□ (F7) 751
Brookton□ (H4) 206
Brownfield□ (B8) 612
Brownville□ (E5) 1,964
Brownville Jct. (E5) 1,086
Brunswick□ (C8) 10,996
Bryant Pond (B7) 500
Buckfield□ (C7) 899
Bucks Harbor (J6) 160
Bucksport□ (F6) 3,120
Burkettville (E7) 100
Burlington□ (G5) 425
◉ County Seat

Burnham□ (E6) 706
Buxton□ (C8) 2,009
Buxton Center (B8)
Byron□ (B6) 96
Calais (J5) 4,589
Cambridge□ (E5) 326
Camden□ (F7) 3,670
Camp Ellis (C9)
Canaan□ (D6) 785
Canton□ (C7) 746
Cape Neddick (B9)
Cape Porpoise (C9) 400
Capens (D4) 1
Caratunk□ (C5) 96
Cardville (F5) 200
Caribou□ (G2) 9,923
Carmel□ (E6) 996
Carrabassett (C5) 10
Carroll□ (G5) 288
Carry Pond (C5)
Carthage□ (C6) 339
Cary□ (H4) 278
Casco□ (B7) 881
Castine□ (F7) 793
Cedar (J5)
Center Belmont(E7)
Center Lovell (B7)
Center Montville (E7) 175
Centerville□ (H6) 63
Chapman□ (G2) 381
Charleston□ (F5) 771
Charlotte□ (J5) 252
Chebeague Isl. (C8) 300
Chelsea□ (D7) 2,169
Cherryfield□ (H6) 904
Chester□ (F5) 255
Chesterville□ (C6) 588
Chesuncook (D3) 18
China□ (E7) 1,375
Chisholm (C7) 1,135
Citypoint (E7)
Clark Island (E8) 175
Clarks Mill (B8)
Clayton Lake (E2) 6
Cleveland (G1) 200
Cliff Island (C8)
Clifton□ (G6) 193
Clinton□ (D6) 1,623
Columbia□ (H6) 352
Columbia Falls□ (H6) 550
Cooper□ (H6) 128
Coopers Mills (E7) 239
Corea (H7) 156
Corinna□ (E6) 1,752
Cornish□ (B8) 795
Cornville□ (D6) 563
Costigan (F5) 158
Cranberry Isles□ (G7) 228
Crawford□ (H5) 83
Crescent Lake (C7)
Criehaven (F8) 60
Crouseville (G2) 400
Crystal□ (G4) 373
Cumberland Center□ (C8) 2,030
Cumberland Mills (C8)
Cundys Harbor(D8) 80
Curtis Corner (C7)
Cushing□ (E7) 376
Cutler□ (J6) 483
Daigle (G1)
Damariscotta□ (E7) 1,113
Danforth□ (H4) 1,174
Danville (C7)
Darkharbor (F7)
Davidson (F4) 45
Dayton□ (B8) 502
Deblois□ (H6) 59
Dedham□ (F6) 374
Deer Isle□ (F7) 1,234
Denmark□ (B8) 447
□Population of Township

Dennistown□ (C4) 24
Dennysville□ (J6) 345
Derby (E5) 500
Detroit□ (E6) 492
Dexter□ (E5) 4,126
Dixfield□ (C6) 2,022
Dixmont□ (E6) 631
Dorman (H6)
Dover—Foxcroft◉□ (E5) 4,218
Dover South Mills (E5)
Dresden Mills (D7) 100
Dry Mills (C8) 220
Dryden (C6) 800
Dyer Brook□ (G3) 219
Eagle Lake□ (F1) 1,516
E. Andover (B6) 150
E. Baldwin (B8)
E. Blue Hill (G7) 200
E. Boothbay (D8) 500
E. Brownfield (B8) 130
E. Corinth (F5) 450
E. Dixfield (C6) 242
E. Dixmont (E6)
E. Dover (E5) 67
E. Eddington (F6) 300
E. Franklin (G6) 78
E. Hiram (B8) 350
E. Holden (F6)
E. Jackson (E6)
E. Knox (E7)
E. Lebanon (B9)
E. Limington (B8) 150
E. Livermore (C7) 500
E. Lowell (G5)
E. Machias□ (J6) 1,101
E. Madison (D6) 692
E. Millinocket□ (F4) 1,358
E. New Portland(D6) 43
E. Orland (F6)
E. Otisfield (B7) 50
E. Parsonfield (B8) 175
E. Peru (C7)
E. Pittston (D7) 1,050
E. Poland (C7) 490
E. Sebago (B8)
E. Stoneham (B7) 300
E. Sullivan (G6) 250
E. Sumner (C7) 114
E. Union (E7) 190
E. Vassalboro (D7) 200
E. Waterboro (B8) 175
E. Waterford (B7) 175
E. Wilton (C8) 450
E. Winn (G5) 75
Easton□ (H2) 1,664
Eastport (K6) 3,123
Eaton (H4) 120
Eddington□ (F6) 664
Edgecomb□ (D8) 447
Edmunds□ (J6) 288
Eliot□ (B9) 2,509
Ellsworth◉ (F6) 3,936
Ellsworth Falls(G6) 500
Elms (B9)
Emery Mills (B9) 150
Enfield□ (F5) 1,196
Etna□ (E6) 458
Eustis□ (B5) 763
Exeter□ (E6) 734
Fairbanks (C6) 200
Fairfield□ (D6) 5,811
Fairfield Center(D6) 150
Falmouth□ (C8) 4,342
Farmington◉□ (C6) 4,677
Farmington Falls (D6)
Fayette□ (C7) 397
Five Islands (D8) 200
Forest City (H4) 27
Forest Station (H4) 30
Fort Fairfield□(H2) 5,791
Fort Kent□ (F1) 5,343

Fort Kent Mills (F1) 175
Fortunes Rock (C9) 82
Frankfort□ (F6) 578
Franklin□ (G6) 709
Freedom□ (E7) 466
Freeport□ (C8) 3,280
Frenchboro (G7) 104
Frenchville□ (G1) 1,528
Friendship□ (F7) 772
Frye (B6) 150
Fryeburg□ (A7) 1,926
Gardiner (D7) 6,649
Garland□ (E5) 581
Georgetown□ (D8) 510
Gerard (C5) 20
Gilbertville (C7) 100
Gilead□ (B7) 140
Glen Cove (E7) 200
Glenburn□ (F6) 694
Goodrich (H2)
Goodwins Mills(B8) 200
Goose Rocks Beach (C9) 135
Gorham□ (C8) 4,742
Gouldsboro (H7) 1,168
Grand Isle□ (G1) 1,230
Grand Lake Stream□ (H5) 294
Grants (B5) 9
Gray□ (C8) 1,631
Great Pond (G6) 40
Great Works (G6)
Green Lake (F6) 40
Greene□ (C7) 974
Greenville□ (D5) 1,889
Greenville Jct. (D5) 780
Grindstone (F4) 60
Grove (J5) 125
Guerette (G1)
Guilford□ (E5) 1,842
Haines Landing(B6)
Hale (B6) 60
Hallowell (D7) 3,404
Hamlin□ (H1) 430
Hampden□ (F6) 3,608
Hampden Highlands (F6)
Hancock□ (G6) 755
Hanover□ (B7) 211
Harmony□ (D6) 709
Harpswell Center (D8) 100
Harrington□ (H6) 853
Harrison□ (B7) 1,026
Hartford□ (C7) 381
Hartland□ (D6) 1,310
Haynesville□ (G4) 185
Hebron□ (C7) 829
Hermon□ (F6) 1,728
Highland Lake(C8)
Highpine (B9) 125
Hinckley (D6) 250
Hiram□ (B8) 804
Hodgdon□ (H3) 1,162
Holeb (C4) 54
Hollis Center (B8) 230
Hope□ (E7) 504
Houghton (B6)
Houlton◉□ (H3) 8,377
Howland□ (F5) 1,441
Hudson□ (F5) 455
Hulls Cove (G7) 450
Indian River (H6)
Intervale (C8) 45
Island Falls□ (G3) 1,237
Isle Au Haut□ (F7) 82
Islesboro□ (F7) 529
Islesford (G7) 150
Jackman□ (C4) 964
Jackman Station (C4) 980
Jacksonville (J6) 300
Jay□ (C7) 3,102
Jefferson□ (D7) 1,215
Jemtland (G1) 100

Jimpond (B5) 8
Jonesboro□ (J6) 459
Jonesport□ (H6) 1,727
Katahdin Iron Works (E5) 15
Keegan (G1) 1,100
Kellyland (H5) 23
Kenduskeag□ (E6) 387
Kennebago Lake (B5)
Kennebunk□ (B9) 4,273
Kennebunk Beach (C9) 125
Kennebunk Port□ (C9) 1,522
Kents Hill (D7) 170
Kezar Falls (B8) 1,400
Kineo□ (D4) 40
Kingsfield□ (C6) 963
Kingman□ (G4) 358
Kingsbury□ (D5) 35
Kittery□ (B9) 8,380
Kittery Depot (B9) 1,220
Kittery Point (B9) 1,137
Knox□ (E6) 445
Kokadjo (E4)
La Grange□ (F5) 511
Lake Moxie (D5)
Lake View□ (F5) 23
Lambert Lake (H4)
Lamoine□ (G7) 443
Lebanon□ (B9) 1,499
Lee□ (G5) 610
Leeds□ (C7) 797
Leeds Junction (C7) 54
Levant□ (F6) 706
Lewiston (C7) 40,974
Liberty□ (E7) 497
Lille (G1)
Limerick□ (B8) 961
Limestone□ (H2) 2,427
Limington□ (B8) 851
Lincoln□ (G5) 4,030
Lincoln Center (G5)
Lincolnville□ (E7) 881
Lincolnville Center (E7)
Linneus□ (H3) 777
Lisbon□ (C7) 4,318
Lisbon Center (C7) 300
Lisbon Falls (D7) 2,155
Litchfield□ (D7) 953
Little Deer Isle (F7) 350
Littleton□ (H3) 1,001
Livermore□ (C7) 1,313
Livermore Falls□ (C7) 3,359
Locke Mills (B7) 380
Long Island (C8) 350
Long Pond (C4) 84
Longcove (E8)
Loon Lake (B5) 10
Lovell□ (B7) 640
Lowell□ (F5) 192
Lubec□ (K6) 2,973
Ludlow□ (G3) 361
Machias◉□ (J6) 2,063
Machiasport□ (H6) 781
Macwahoc□ (G4) 131
Madawaska□ (G1) 4,900
Madison□ (D6) 3,639
Madrid□ (B6) 162
Mainstream (D6)
Manchester□ (D7) 664
Mapleton□ (G2) 1,367
Mariner (C8)
Mars Hill□ (H2) 2,060
Masardis□ (G3) 523
Matagamon (F3) 3
Matinicus□ (F8) 188
Mattawamkeag□ (G4) 803
Maysville (G2) 150
Mc Kinley (G7)
Mechanic Falls□ (C7) 2,061

All railroads are numbered as per accompanying list, making possible quick and accurate identification of each line.
RAILROADS
2 Aroostook Valley
3 Bangor & Aroostook
4 Belfast & Moosehead Lake
20 Boston & Maine
30 Canadian National
31 Canadian Pacific
84 Grand Trunk
89 Maine Central
90a Quebec Central
91 Sanford & Eastern
QUEBEC
MAINE
ST. LAWRENCE RIVER
ST. LAWRENCE
APPALACHIAN
ATLANTIC
PENOBSCOT
KENNEBEC
ST. JOHN
ST. CROIX
Edmundston
Madawaska
Frenchville
Grand Isle
Fort Kent
St. Agatha
St. Francis
Van Buren
St. Leonard
Grand Falls
Eagle Lake
Stockholm
Jemtland
Limestone
Caribou
Washburn
Fort Fairfield
Aroostook Jc.
Plaster Rock
Presque Isle
Mapleton
Ashland
Easton
Mars Hill
Squa Pan
Blaine
Bridgewater
Bristol
Centreville
Hartland
Monticello
Littleton
Houlton
Woodstock
Hodgdon
Patten
Island Falls
Sherman
Sherman Mills
Millinocket
Grindstone
Medway
Danforth
Orient
Canterbury
Harvey
Moosehead
Greenville
Jackman
Megantic
Lake Megantic
Lake Moxie
Montmagny
St. Raphael
Notre Dame du Rosaire
Ste. Euphemie
St. Charles
St. Anselme
Beauce Jc.
Tring Jc.
St. Jean Port Joli
L'Islet
Lac Frontière
Lac Frontiere
Chaudiere River
Penobscot River
Allagash River
St. John River
Aroostook River
Fish River
Machias River
Saint Francis
Little Black R.
Great Black R.
Meruimticook L.
Lake St. Francis
Long Lake
Connor
Michaud
Soldier Pond
Ouellette
Cross L.
Guerette
Plaisted
Allagash
Square L.
Eagle L.
St. Froid L.
Winterville
Quimby
New Sweden
Madawaska
Lyndon
Perham
Fish Lake
Portage
Portage Lake
Crouseville
Sheridan
Chapman
Phair
Round Pond
Musquacook Lakes
Clayton Lake
Umsaskis L.
Round Mt. Pond
Chemquasabamticook Lake
Pleasant L.
Spider L.
Munsungun L.
Millinocket L.
Eagle L.
Baker L.
Allagash L.
Shallow Pond
Chamberlain L.
Caucomgomoc Lake
Loon L.
Black Pond
St. John Pond
Webster Br.
Chesuncook
Chesuncook Lake
Sourdnahunk L.
Harrington L.
Penobscot L.
Seboomook Lake
Seboomook
North East Carry
Lower Carry Pond
Ragged L.
Rainbow L.
Spencer Pond
Spencer Mt.
Nahmakanta L.
Pemadumcook Lake
Kokadjo
Lower Roach Pond
Moose River
Brassua L.
Kineo
Rockwood
Long Pond
Moose L.
Capens
Sugar Island
Tarratine
Moosehead
Jackman Station
Attean Pond
Parlin Pond
Holeb
Moose Boston Ranch
Skinner
Gerard
Spencer Stream
Dead R.
Wilson Ponds
Greenville Jc.
Onaway
Shirley Mills
Willimantic
Brownville
Brownville Jc.
Katahdin Iron Works
Houston Pd.
Schoodic Lake
Seboomook L.
Endless L.
Mattamiscontis L.
Mattawamkeag L.
Nollesemic
Kingman
Matawamkeag
Chester
Winn
Prentiss
Carroll
Lincoln Cen.
Lincoln
Springfield
Lee
Cg. Lincoln
Seboeis L.
Pleasant L.
Lake
Upper Roach Pond
Lower Roach Pond
Millinocket Lake
Shin Pond
Matagamon
Seboeis Lake
Scraggly L.
Umcalcus Lake
Smyrna Mills
Ludlow
Oakfield
New Limerick
Dyer Brook
Pleasant L.
Mattawamkeag L.
Cary
N. Amity
Linneus
Otis
Debec
Newburgh
Millville
Nadeauville
Ketuick R.
Becaguimec R.
Nashwaak R.
Southwest Miramichi R.
Chaudiere R.
Serpentine R.
Trousers L.
Gulquac L.
Clearwater Brook
Long L.
Tobique R.
Tobique River
Salmon River
Munsungun
Seboeis
Umcalcus
Scraggly
Matagamon
Shin Pond
Patten
Crystal
Sherman
Stacyville
Davidson
Haynesville
Wytopitlock
Monarda
Benedicta
Orient
Selden
N. Bancroft
S. Bancroft
Weston
Second Eel L.
First Eel L.
Skiff L.
George
Bolton L.
Magaguadavic Lake
Forest City
Vanceboro
Forest Sta.
Brookton
Lambert Lake
McAdam
Oromocto Lake
Kedron L.
Watt
Topsfield
Waite
Musquash
W. Musquash
Pleasant
Macwahoc
Nollesemic
Kingman
Matawamkeag
Mattawamkeag L.
Seboeis L.
Endless L.
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Prentiss
Carroll
Lincoln Cen.
Lincoln
Springfield
Lee
Cg. Lincoln
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Pleasant L.
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Lower Roach Pond
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Shin Pond
Matagamon
Seboeis Lake
Scraggly L.
Umcalcus Lake
Smyrna Mills
Ludlow
Oakfield
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Mattawamkeag L.
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N. Amity
Linneus
Otis
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Becaguimec R.
Nashwaak R.
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Trousers L.
Gulquac L.
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Tobique R.
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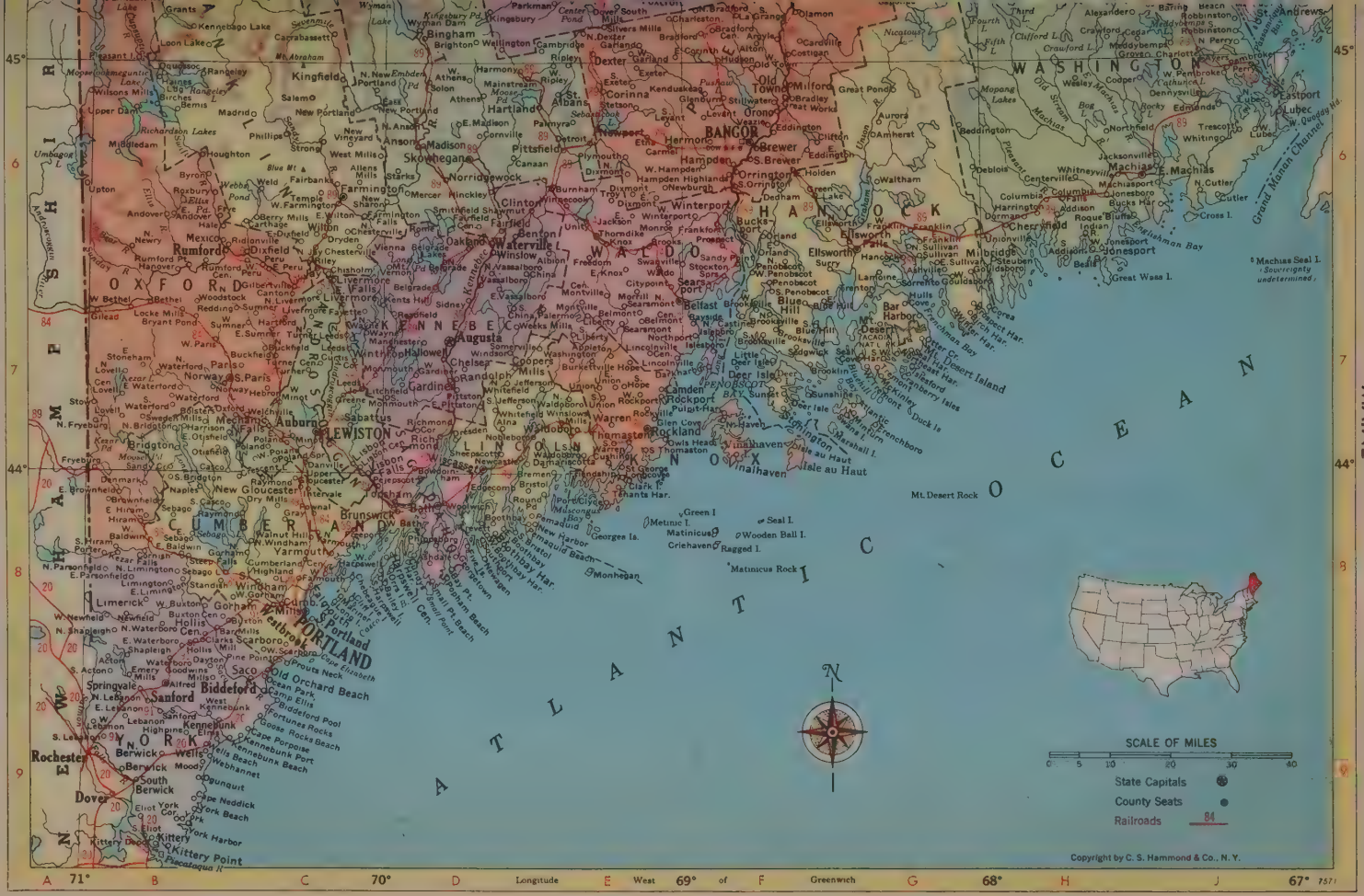
First Eel L.
Skiff L.
George
Bolton L.
Magaguadavic Lake
Forest City
Vanceboro
Forest Sta.
Brookton
Lambert Lake
McAdam
Oromocto Lake
Kedron L.
Watt
Topsfield
Waite
Musquash
W. Musquash
Pleasant
Macwahoc
Nollesemic
Kingman
Matawamkeag
Mattawamkeag L.
Seboeis L.
Endless L.
Mattamiscontis L.
Katahdin Iron Works
Houston Pd.
Schoodic Lake
Onaway
Brownville Jc.
Lake
Seboeis
Pleasant L.
Spencer Stream
Dead R.
Wilson Ponds
Greenville Jc.
Onaway
Shirley Mills
Willimantic
Brownville
Brownville Jc.
Katahdin Iron Works
Houston Pd.
Schoodic Lake
Seboomook L.
Endless L.
Mattamiscontis L.
Mattawamkeag L.
Nollesemic
Kingman
Matawamkeag
Chester
Winn
Prentiss
Carroll
Lincoln Cen.
Lincoln
Springfield
Lee
Cg. Lincoln
Seboeis L.
Pleasant L.
Lake
Upper Roach Pond
Lower Roach Pond
Millinocket Lake
Shin Pond
Matagamon
Seboeis Lake
Scraggly L.
Umcalcus Lake
Smyrna Mills
Ludlow
Oakfield
New Limerick
Dyer Brook
Pleasant L.
Mattawamkeag L.
Cary
N. Amity
Linneus
Otis
Debec
Newburgh
Millville
Nadeauville
Ketuick R.
Becaguimec R.
Nashwaak R.
Southwest Miramichi R.
Chaudiere R.
Serpentine R.
Trousers L.
Gulquac L.
Clearwater Brook
Long L.
Tobique R.
Tobique River
Salmon River


MAINE
ATLANTIC OCEAN
PORTLAND
BANGOR
AUGUSTA
LEWISTON
Biddeford
Sanford
Saco
Old Orchard Beach
Kittery
York
Rockland
Camden
Belfast
Waterville
Skowhegan
Machias
Eastport
Calais
Mt. Desert Rock
Matinicus Rock
Monhegan
SCALE OF MILES
0 5 10 20 30 40
State Capitals
County Seats
Railroads
Copyright by C. S. Hammond & Co., N. Y.
Longitude West 69° of Greenwich
71°
70°
68°
67°
45°
44°

Meddybemps□ (J5). 109
Medford□ (F5)..... 191
Medford Center(F5) 25
Medway□ (G4)..... 725
Mercer□ (D6)..... 348
Mexico□ (B6).....4,762
Michaud (F1).....
Middledam (B6)..... 25
Milbridge□(H6).....1,199
Milford□ (F6).....1,435
Millinocket□ (F4)...5,890
Milltown (J5).....
Milo□ (F5).....2,898
Minot□ (C7)..... 750
Minturn (G7)..... 134
Monarda (G4)..... 250
Monhegan□ (E8).... 75
Monmouth□ (D7)...1,683
Monroe□ (E6)..... 593
Monson□ (E5)..... 855
Monticello□ (H3)...1,284
Montville□ (E7)..... 466
Moody (B9).....
Moose River□ (C4). 203
Moosehead (D4)..... 17
Morrill□ (E7)..... 306
Mt. Desert□ (G7)...1,776
Mt. Vernon□ (D7).. 653
Naples□ (B8)..... 747
New Gloucester□ (C8) 2,628
New Harbor (E8).... 500
New Limerick□(G3) 543
New Portland□(C8) 733
New Sharon□ (C6). 755
New Sweden□ (G2). 827
New Vineyard□(C6) 447
Newagen (D8).....
Newburgh□ (F6)..... 599
Newcastle□ (D7).....1,021
Newfield□ (B8)..... 355
Newport□ (E6).....2,190
Nobleboro□ (D7)... 654
Norcross (F4)..... 46
Norridgewock□ (D6) 1,784
N. Amity (H4)..... 250
N. Anson (D6).....1,000
N. Bancroft (D4)..... 71
N. Belgrade (D7)... 200
N. Berwick□ (B9)...1,655
N. Bradford (F5)..... 25
N. Bridgton (B7).....
N. Brooksville (F7). 190
N. Buckfield (C7)....
N. Cutler (J6).....
N. Dexter (E5)..... 60
N. Dixmont (E6).....
N. East Carry (D4). 13
N. Ellsworth (G6)...
N. Fryeburg (B7)..... 200
N. Gorham (C8)..... 500
N. Haven□ (F7)..... 410
N. Islesboro (F7).....
N. Jay (C6)..... 550
N. Lebanon (B9).....
N. Leeds (C7)..... 47
N. Limington (B8)... 150
N. Livermore (C7)... 145
N. Lovell (B7)..... 85
N. Lubec (J6)..... 150
N. Lyndon (G2)..... 200
N. New Portland(C6) 350
N. Newry (B6)..... 100
N. Parsonfield (A8). 67
N. Penobscot (F7)... 150
N. Perry (J5).....
N. Raymond (C8).... 50
N. Searsmont (E7)... 150
N. Shapleigh (B8).... 90
N. Sullivan (G6)..... 850
N. Turner (C7)..... 232
N. Vassalboro (D7).1,000
N. Waldoboro (E7).
N. Waterboro (B8).. 500
◉ County Seat

N. Waterford (B7)... 450
N. Wayne (C7).....
N. Whitefield (D7).. 200
N. Windham (C8).... 500
N. Yarmouth□ (C8) 942
Northeast Harbor (G7) 700
Northfield□ (H6)... 75
Northport□ (E7)..... 574
Norway□ (B7).....3,811
Norway Lake (B7).. 150
Oakfield□ (G3).....1,009
Oakland□ (D6).....2,679
Ocean Park (C9).....
Ogunquit (B9)..... 800
Olamon (F5)..... 600
Old Orchard Beach□ (C9) 4,707
Old Town (F6).....8,261
Onawa (E5)..... 25
Oquossoc (B6).....
Orient□ (H4)..... 176
Orland□ (F6).....1,155
Orono□ (F6).....7,504
Orrington□ (F6).....1,895
Orrs Island (D8)..... 450
Otisfield□ (B7)..... 599
Otter Creek (G7)....1,000
Ouellette (G1).....
Owls Head□ (F7)... 784
Oxbow□ (G3)..... 189
Oxford□ (C7).....1,569
Palermo□ (E7)..... 511
Palmyra□ (E6)..... 965
Paris□ (B7).....4,358
Parkman□ (D5)..... 590
Passadumkeag □ (F5) 331
Patten□ (F4).....1,536
Pejepscot (D8).....
Pemaquid (E8).....
Pemaquid Beach(E8)
Pembroke□ (J6)..... 998
Penobscot□ (F7)..... 699
Perham□ (G2)..... 572
Perkins□ (F4)..... 5
Perry□ (J6)..... 613
Peru□ (C6).....1,080
Phair (G2)..... 150
Phillips□ (C6).....1,088
Phippsburg□ (D8)...1,134
Pine Point (C8)..... 650
Pittsfield□ (E6).....3,909
Pittston□ (D7).....1,258
Plaisted (F1)..... 300
Pleasant Island (B5)
Pleasant Pond (D5). 11
Plymouth□ (E6)..... 496
Poland□ (C7).....1,503
Poland Sprg. (C7)... 500
Popham Beach (D8)
Port Clyde (E8)..... 350
Portage□ (G2)..... 542
Porter□ (B8).....1,052
Portland◉ (C8).....77,634
Pownal□ (C8)..... 752
Prentiss□ (G5)..... 315
Presque Isle□ (H2).9,954
Princeton□ (H5)..... 865
Prospect□ (F6)..... 392
Prospect Harbor (H7) 270
Prouts Neck (C9).....2,000
Pulpit Harbor (F7).. 25
Quimby (F2).....
Randolph□ (D7).....1,733
Rangeley□ (B6).....1,228
Raymond□ (B8)..... 620
Readfield□ (D7).....1,022
Red Beach (J5).....
Redding (B7)..... 11
Richmond□ (D7)....2,217
Richmond Corner (D7) 43
Ridlonville (C6).....2,000
□Population of Township

Riley (C6)..... 175
Ripley□ (E5)..... 389
Robbinston□ (J5).... 554
Robinsons (H3)..... 350
Rockland◉ (E7).....9,234
Rockport□ (E7).....1,656
Rockville (E7)..... 265
Rockwood (D4)..... 300
Rome□ (D6)..... 420
Roque Bluffs□ (H6) 80
Round Mountain(B5) 3
Round Pond (E8).. 500
Roxbury□ (B6)..... 348
Rumford□ (B6).....9,954
Rumford Center (B7) 300
Rumford Point (B6) 200
Sabattus (C7).....1,216
Saco (C9).....10,324
St Agatha□ (G1)....1,512
St. Albans□ (E6)....1,035
St. David (G1).....1,000
St. Francis□ (E1)....1,384
St. George□ (E7).....1,482
St. John□ (F1)..... 569
Salem□ (C6)..... 67
Sandy Creek (B7).....
Sandy Point (F7)..... 250
Sanford (B9).....15,177
Sangerville□ (E5)....1,161
Saponac (G5)..... 25
Scarboro□ (C8).....4,600
Seal Cove (G7).....
Seal Harbor (G7).... 400
Searsmont□ (E7)..... 558
Searsport□ (F7).....1,457
Sebago□ (B8)..... 577
Sebago Lake (B8).... 846
Sebec□ (E5)..... 442
Sebec Lake (E5)..... 7
Sebec Station (E5)... 23
Seboeis□ (F5)..... 70
Seboomook□ (D4)... 18
Sedgwick□ (F7)..... 614
Selden (H4)..... 25
Shapleigh□ (B8)..... 531
Shawmut (D6).....1,200
Sheepscott (D7)..... 100
Sheridan (F2)..... 310
Sherman□ (G4).....1,029
Sherman Mills (G4)1,030
Sherman Station (F4) 400
Shin Pond (F3)..... 17
Shirley Mills (D5)... 250
Sidney□ (D7)..... 918
Silvers Mills (E5)... 55
Sinclair (G1)..... 800
Skinner (B4).....
Skowhegan◉□ (D6)7,422
Small Point Beach (D8) .....
Smithfield□ (D6).... 354
Smyrna Mills (G3)... 650
Soldier Pond (F1)...
Solon□ (D6)..... 746
Somerville□ (D7)... 227
Sorrento□ (G7)..... 201
S. Acton (B9)..... 200
S. Addison (H6)..... 170
S. Bancroft (G4).....
S. Berwick□ (B9)...2,646
S. Blue Hill (F7)..... 141
S. Brewer (F6).....
S. Bridgton (B8)..... 125
S. Bristol□ (D8)..... 631
S. Brooksville (F7).. 140
S. Casco (B8)..... 150
S. China (D7)..... 310
S. Deer Isle (F7)..... 85
S. Eliot (B9).....1,331
S. Exeter (E6)..... 25
S. Harpswell (C8).... 300
S. Hiram (B8)..... 250
S. Hollis (B8)..... 30

S. Hope (E7)..... 125
S. Jefferson (D7)....
S. La Grange (F5)... 150
S. Lebanon (A9).....
S. Levant (E6)..... 110
S. Liberty (E7)..... 47
S. Lincoln (G5)..... 164
S. Monmouth (D7)..
S. Orrington (F6).... 300
S. Paris◉ (C7).....2,067
S. Penobscot (F7)....
S. Portland (C8).....21,866
S. Robbinston (J5)...
S. Sanford (B9)..... 600
S. Thomaston□ (E7). 654
S. Union (E7).....
S. Waldoboro (E7)..
S. Warren (E7).....
S. Waterford (B7)....
S. Windham (C8).....1,569
Southport□ (D8)..... 435
Southwest Harbor□ (G7) 1,534
Spencer (C5).....
Springfield□ (G5)... 414
Springvale (B9).....2,745
Squa Pan (G2)..... 75
Stacyville□ (F4)..... 679
Standish□ (B8).....1,786
Starks□ (D6)..... 421
Steep Falls (B8)..... 480
Stetson□ (E6)..... 434
Steuben□ (H6)..... 784
Stillwater (F6)..... 800
Stockholm□ (G1)... 641
Stockton Springs□ (F7) 949
Stonington□ (F7)....1,660
Stow (A7)..... 147
Stratton (B5)..... 560
Strong□ (C6).....1,036
Sugar Island (D4)... 4
Sullivan□ (G6)..... 762
Sumner□ (C7)..... 526
Sunset (F7).....
Sunshine (G7)..... 120
Surry □(F7)..... 448
Swans Island□ (G7) 468
Swanville□ (E6)..... 437
Sweden□ (B7)..... 212
Sweden (G2).....
Tarratine (D4)..... 8
Temple□ (C6)..... 284
Tenants Harbor(E8) 400
The Forks□ (D5)..... 45
Thomaston□ (E7)....2,810
Thorndike□ (E8)..... 534
Topsfield□ (H5)..... 231
Topsham□ (D8).....2,626
Tremont□ (G7).....1,115
Trenton□ (G7)..... 358
Trescott□ (J6)..... 362
Trevett (D8)..... 350
Troutdale (D5)..... 25
Troy□ (E6)..... 553
Turner□ (C7).....1,712
Turner Center (C7).
Union□ (E7).....1,085
Unionville (H6)..... 150
Unity□ (E6).....1,014
Upper Dam (B6).....
Upper Frenchville (G1) 500
Upper Gloucester (C8) 150
Upton□ (B6)..... 105
Van Buren□ (G1)...5,094
Vanceboro□ (H4)..... 497
Vassalboro□ (D7)....2,261
Veazie□ (F6)..... 776
Vienna□ (D6)..... 231
Vinalhaven□ (F7)....1,427
Waite□ (H5)..... 117
Waldo□ (E7)..... 324
Waldoboro□ (E7)....2,536

Walnut Hill (C8)..... 25
Waltham□ (G6)..... 154
Warren□ (E7).....1,576
Washburn□ (G2).....1,913
Washington□ (E7).. 722
Waterboro□ (B8).....1,071
Waterford□ (B7)..... 828
Waterville (E6).....18,287
Wayne□ (D7)..... 459
Weshannet (C9).....
Weeks Mills (E7)..... 100
Welchville (C7).....
Weld□ (C6)..... 361
Wellington (D5)..... 252
Wells□ (B9).....2,321
Wells Beach (C9).....
Wesley□ (H6)..... 149
W. Athens (D6)..... 175
W. Baldwin (B8).....
W. Bath□ (D8)..... 578
W. Bethel (B7)..... 250
W. Boothbay Harbor (D8) .....
W. Brooksville (F7). 140
W. Buxton (B8)..... 350
W. Enfield (F5).....
W. Falmouth (C8)....1,500
W. Farmington (C6) 500
W. Franklin (G6)..... 115
W. Gardiner□ (D7). 946
W. Garland (E5)..... 50
W. Gorham (C8).....
W. Gouldsboro (G7) 105
W. Hampden (E6)....
W. Harpswell (C8).. 100
W. Jonesport (H6).. 850
W. Kennebunk (B9)
W. Lebanon (B9)..... 150
W. Lubec (J6).....
W. Mills (C6)..... 50
W. Minot (C7)..... 300
W. Newfield (B8)..... 175
W. Old Town (F6).. 35
W. Paris (B7)..... 800
W. Pembroke (J6)... 500
W. Penobscot (F7)...
W. Peru (C7)..... 300
W. Poland (C7).....
W. Ripley (E6).....
W. Rockport (E7)... 200
W. Scarboro (C8).....1,500
W. Seboois (F4).....
W. Sumner (C7)..... 101
W. Tremont (G7).... 250
W. Winterport (E6). 30
Westbrook (C8).....12,284
Westfield□ (G2)..... 557
Weston□ (H4)..... 248
Wheelock (F1).....
Whitefield□ (D7).....1,030
Whiting□ (J6)..... 354
Whitneyville□ (H6). 227
Willimantic□ (E5)... 189
Wilsons Mills (B6).. 80
Wilton□ (C6).....3,455
Windsor□ (D7)..... 740
Winn□ (G5)..... 497
Winnecook (E6)..... 35
Winter Harbor □ (G7) 568
Winslow□ (D6).....4,413
Winslows Mills(E7) 200
Winterport□ (F6).....1,694
Winterville□ (F2).... 373
Winthrop□ (C7).....3,026
Wiscasset◉□ (D7)...1,584
Woodland□ (H5).....1,292
Woolwich□ (D8).....1,344
Wyman Dam (D5).. 451
Wytopitlock (G4).... 352
Yarmouth□ (C8).....2,669
York□ (B9).....3,256
York Beach (B9)..... 500
York Corners (B9)... 100
York Harbor (B9)... 750

ample of Georgian architecture. In South Berwick is the beautiful home of Sarah Orne Jewett, built about 1780. It is particularly noteworthy because of its Doric portico and its central hall and stairway. Wiscasset is a charming small town with beautiful old homes built by sea captains and shipping merchants. Many of these houses are open one day in August to the public. The Wedding Cake House in Kennebunk is too ornate to be considered an example of good architecture, but it represents the scroll-saw era. The carved wooden trimmings give the effect of a paper lace valentine which seems appropriate as the house, so the story goes, was decorated by a sea captain for his bride who was deprived of her wedding cake by his sudden order to sea.

Production and Manufactures.—*Agriculture.*—The soil of a large portion of the state, over four fifths, is covered with forest and wood lots. The most fertile farm lands are in the Aroostook basin. According to the U.S. Bureau of the Census, the average farm contained 108.3 acres (1940), and only about 5 per cent of the farms were tenant occupied. Potatoes constitute the largest crop, Maine producing more potatoes than any other state (73,340,000 bu. estimated in 1948). Oats constitute the only grain crop of importance. Apples form an important crop and blueberries are significant, many being canned or frozen. Market gardening flourishes in limited areas, and dairying and poultry raising have come to be important sources of income. Sweet corn and peas of excellent quality are raised for canneries and freezing plants. Considerable hay is cut for stock feed. The canned corn industry originated with Isaac Winslow, who invented the process in 1838–1839. On March 8, 1853, he applied for a patent for preserving fresh green corn by a hermetically sealing process.

Farm values in Maine have reflected the inflationary periods following both World Wars, but have risen less than in most of the United States. Using 1912–1914 values as 100, Maine farmlands rose to 142 in 1920, were 94 in 1933–1935, rising slowly to 135 in 1946, while the national index rose to 152. (1946 figures as of Nov. 1, 1946.)

Fisheries.—Sea and shore fisheries of Maine provide a livelihood for considerable numbers as well as recreation for many more. Shellfish of commercial value include scallops, crabs, clams, lobsters, mussels, shrimps. The scallop industry is declining in importance. The commissioner of sea and shore fisheries estimated that 30,685,291 pounds of shellfish were taken in 1947, with a value to the fishermen of $8,943,321. The more important species of fish were: cod, haddock, hake, pollock, redfish, flounder, shad, whiting, mackerel, tuna, alewives, herring, smelts. Redfish and whiting are seldom eaten in Maine, while smelts, mackerel, and haddock are esteemed locally, although all varieties are exported. In quantity and value herring comes first, redfish, second. The larger herring are smoked, pickled, or used as bait, while the smaller ones are canned as sardines, Maine and California being the leading states in this respect. Lubec, Eastport, and a number of other coastal communities are known for their sardine canneries. The total poundage of fish taken in 1947 reached 150,747,978, valued at $3,442,449. Maine carries on a research and propagation program, notably in the case of the lobster, where a cooperative federal-state plan is operated.

Related to fisheries is the sea moss industry, relatively new in Maine, but which is expected to be of permanent value. In 1944 and 1945 a half million pounds was harvested annually from rocks along the coast. This plant possesses valuable food and chemical content, and does not require cultivation if the roots are not destroyed. It is "raked" and grows again before another season.

Forests.—Although a large portion of Maine is devoted to the growing of wood, pulp, and lumber, the character and utilization of the forest stand has changed considerably from the 19th to the 20th century. Pine and spruce were the trees most commonly exported in "long lumber." As the old growth was cut off, less valuable softwoods were utilized, such as poplar for wood pulp, and fir and hemlock for pulp and lumber. In the 20th century hardwoods have been more extensively used than before, especially for spools, dowels, furniture, sporting goods (skis, snowshoes, sleds), toys, and novelties. The state has many small mills and factories engaged in making the above products. At the same time, pulp and long lumber continue to figure prominently in the state, large quantities being cut during the emergency of World War II, and the building material and paper shortage that prevailed afterward. Maine led the nation in white pine cut in 1944 by producing 295,723,000 board feet, about 24.4 per cent of the total cut. With the growing scarcity of accessible old growth trees, both private owners and the state government have placed emphasis on conservation and reforestation.

LAND AREA OF MAINE

Census figures of 1940 as revised by Maine Forest Service 1945

Item	Acres
Developed areas	248,183
Barren land	710,552
Agricultural areas	2,123,688
Federal forest areas	100,177
Maine Forestry District (Wild land townships)	10,000,000
Organized towns forest land	6,683,000
Total forest land	16,783,177
Grand total	19,865,600

It will be seen from the table that over half the state is "wild land," that is, has no local government and few permanent inhabitants. The land owners are assessed a "forestry district" tax for the fire protection and other services performed by the state in this area by the Maine Forest Service. The organized towns and cities cooperate with the state in guarding and servicing the organized towns forest land which makes up about one third of the state.

Disease and insect research and control are carried on by state and federal agencies. White pine blister rust has been brought under control since it was first discovered in the state in 1916. Beech scale was estimated by the Maine Forest Service as having killed 21 per cent of the beech in the state with 17 per cent more dying (1946). In the same year the bronze birch borer (*Agrilus anxius*) was estimated to have left 76 per cent of the valuable white and yellow birch stands dead or dying since entering Maine from New Brunswick in 1939. The Maine Hardwood Association is assisting the state in research and control measures. The forest service tries to prevent and limit fire damage by a program of education and action. Fire lookout towers are located at strategic points, and forest wardens use telephone, "walkie talkie," and mobile radio,

trucks, and airplanes as part of their equipment in fighting fires. The majority of fires are known to be caused by human carelessness, mainly from campfires and cigarettes. The following table summarizes damage for the years indicated.

FOREST FIRE DAMAGE IN MAINE
(Forest Commissioner's Report)

Year	Number	Acreage	Damage
1942	225	4,993	$ 11,633
1943	129	7,168	$ 39,910
1944	408	24,203	$278,867
1945	214	4,950	$ 62,583
1946	576	10,327	$ 95,932

Minerals.—See under *Natural Resources.*

Manufactures.—The extensive waterpower has been a great aid in developing manufacturing industries. Shipbuilding was among the first of the manufacturing industries of the state. The first vessel built in Maine was the *Virginia.* She was built by the Popham colony 1607–1608, and, under command of Capt. James Davis, sailed from Plymouth with the Somers and Gates colony for Jamestown, June 1, 1609. Bath was the chief shipbuilding center of the United States for over 100 years and is yet a shipbuilding center of importance. Prior to the construction of steel vessels, the Maine forests supplied a large amount of the timber used in ocean vessels built in the United States and nearly half the ocean vessels of the nation, up to 1900, were made in Maine. The manufacturing of cotton and woolen goods began the latter part of the 18th century and has been continued. Lewiston is the chief center of cotton manufacturing. Biddeford and Saco are extensively engaged in manufacturing cotton goods. Woolen mills are scattered throughout the state. Nearly all the factories are located near the coast, or in localities where abundant waterpower and good transportation lessen the cost of production and shipping.

Samuel Waldo, Thomas Westbrook, and Richard Fry were pioneers in the paper industry of Maine, having built a mill at Presumpscot Falls, Falmouth, in 1731, and a second mill at Stroudwater in 1733. At this time there were but three paper mills in the country, two being in Philadelphia and one in Milton, Mass. Robert Hallowell Gardiner and John Savels built the third mill about 1810. In 1816, Harris and Cox Brothers built a mill at North Yarmouth, and the same year another mill was built at Union by Joseph Day which was destroyed by fire in 1843. In 1823, George Cox and Company built a mill at Vassalboro which was burned in 1848 and not rebuilt. In 1845, Day and Lyon built a paper mill at Congin (now Cumberland Mills, Westbrook) which was burned in 1852, and was rebuilt by the S. D. Warren Paper Company on the site of the old mill. The paper industry in Maine received a great impetus by the introduction of wood pulp. Wood pulp was first produced in this state in 1868–1869. The second pulp mill was established in 1872 at Yarmouth. Sulphite pulp was first produced in Maine in 1889. Other sulphite, soda pulp, and ground wood mills have followed in rapid succession since these dates.

There is no coal and only a small amount of iron in the state and, as a result, the manufacturing industry is dependent upon waterpower. Fortunately the abundance of timber and the extensive waterpower available have to a great extent overcome the handicap of lack of coal. The leading industries are paper and wood pulp manufacture; cotton goods; woolen goods; boots and shoes; lumber and timber products; canning and preserving fish; canning and preserving fruits and vegetables; and foundry and machine shop products. Shipbuilding once so important now occupies a subordinate place.

Vacation Industry.—Thousands of tourists and vacationists flock to Maine, especially in the summer, and sportsmen continue to come well into the fall for the fishing and hunting seasons. The Maine Development Commission estimates that hotels, retail stores, and others profit by trade and employment given by these visitors from out-of-state. Maine's many lakes and streams abound in black bass, pickerel, salmon, and trout. Salt water fishing along the coast offers striped sea bass, Atlantic salmon, tuna, and more lowly varieties such as rock cod, cunner, and flounder.

Many miles of the Appalachian Trail offer sport for hikers and mountain climbers. Camping, canoeing, swimming, boating, golfing, and skiing are among the popular sports available, as well as beautiful and varied scenery and spots of historic interest. Fall hunting offers black bear, ducks, ruffed grouse, and other birds and animals. The Virginia deer is killed to the number of many thousands each year by native and out-of-state hunters. Caribou, once common, has become extinct, and small numbers of moose are protected by law.

Transportation and Communication.—The bulk of Maine's important export trade is funneled through Portland, by ship, rail, or truck. Some Maine potatoes are exported by boat from Searsport via the Bangor and Aroostook Railroad. Tariff barriers prevent free exchange of goods with Quebec, Novia Scotia, and New Brunswick, but American tourists bring back considerable quantities of goods, and there is some commerical exchange of goods, as well as a certain amount of illicit trade made possible by Maine's long boundary adjacent to Canada. Bangor is second to Portland as a distribution and trading center. One commercial airline enters Maine (Northeast Airlines) and uses airports at Portland, Augusta, Bangor, and Presque Isle. Bangor Air Base, built for defense purposes during World War II, was converted to an army fighter base in 1947, and the City of Bangor acquired the nearby airport at Old Town for commercial planes to use. Many primary and auxiliary airports built or improved by the army and navy for World War II have been abandoned for military purposes, as at Brunswick and Sanford (navy), Presque Isle and Houlton (army). The army commenced construction of a huge bomber base at Limestone during 1947, from which long-range bombers might range across the Arctic to various countries in Europe and Asia.

Highways of the state total 21,958 miles. Electric railways and narrow gauge steam lines have virtually disappeared from the state, but steam railroad mileage totals 2,778 (chiefly Boston and Maine, Maine Central, Bangor and Aroostook, Canadian Pacific and Canadian National railroads). Local, interstate, and international bus and truck services are extensive in number and coverage. There is some general waterborne shipping in and out of Portland, potatoes are shipped from Searsport, and coal, oil, and pulpwood are brought into various Maine ports,

but on the whole the importance of seaborne cargo and passenger traffic has declined greatly since the 19th century. The New England Telephone and Telegraph Company and its subsidiaries reach nearly all communities in Maine, with dial service being installed gradually. The Western Union Telegraph Company has about the same coverage, with central offices at hand or available by telephone throughout the state. Electric power, lacking in many rural sections, is gradually being extended.

Economic and Financial Factors.—*Banks.*—The 33 national banks in Maine reported, as of June 30, 1948, total assets of $244,456,000 and total deposits of $221,289,000. State banks, as of the same date, numbered 63, with total assets of $547,268,282 and deposits totaling $457,208,752. The Maine banking department supervises savings banks, trust companies, and building and loan associations.

Finance.—The financial condition of the state for the fiscal years 1947–1948 and 1948–1949 follows:

	Year Ending *June 30, 1949*	Year Ending *June 30, 1948*
Total revenues	$58,156,895.53	$54,394,957.12
Total expenditures	58,063,521.82	51,993,381.27
Excess of revenues over expenditures	93,373.71	2,401,575.85
Bonded debt	10,221,500.00	11,925,500.00

Taxation.—The major sources of state revenue in 1948–1949 were: gasoline and motor vehicle taxes, 30.81 per cent; federal subsidies, 17.63 per cent; liquor and beer revenues, 11.92 per cent; state tax on cities and towns, 8.29 per cent; public utility taxes, 4.76 per cent; cigarette and tobacco taxes, 3.89 per cent. Maine has no sales or income tax. Local governments (cities, towns and special districts) are financed largely from local taxes on real estate and personal property, plus state aid for education and highways.

Government.—The state constitution was adopted by the people in town meetings, Dec. 6, 1819, and Maine was admitted to the Union as a state March 15, 1820. To amend the constitution requires a state convention or a two-thirds vote of both houses of the legislature, followed in either case by a majority vote at the next regular election. All changes have been by legislative proposal, the 63d and 64th amendments having been accepted by the voters in 1944. The original constitution is not basically altered by the sixty-four amendments. It cannot be changed directly by the voters, as there is no constitutional initiative provision.

Executive.—There have been over 50 governors of Maine. The term of governors and legislators was one year until the biennial election was adopted by amendment 23 in 1879. Tradition allows a governor one re-election, and since 1879 no incumbent has served more than two terms. The governor is the only state official elected by the voters; there is no lieutenant governor, and department heads are appointed by the governor and council or elected by the legislature. In the 20th century (up to 1949) there has been no legislature controlled by the Democrats, and but three Democratic governors, of whom only one served two terms. (See table).

The governor of Maine has the veto power but no pocket veto or item veto. He is further limited by the constitutional and legislative powers of the governor's council of seven persons, who are elected biennially by the houses of the legislature by joint ballot, one from each of seven council districts. The governor's council meets at his call (regularly every two weeks in practice) and advises him on many matters. It has the power to confirm or reject nominations for appointive office, including heads of departments and judges. It also has fiscal and electoral powers, and sits with the governor as a board of pardons. In case of vacancy in the office of governor, the president of the Senate and speaker of the House are respectively in line of succession. No department head is elected by the voters in Maine, but several are elected by joint ballot of the legislature: secretary of state, treasurer, attorney general, auditor, and commissioner of agriculture.

Legislature.—The legislature is composed of a Senate of 33 members and a House of Representatives of 151 members, all elected biennially on the second Monday in September. They meet in regular session on the first Wednesday of January in the odd-numbered years, the regular session lasting until the leaders see fit to adjourn, which is in late April or May. Special sessions may be called by the governor, who may deliver messages and suggest programs but cannot limit the time or subject matter of any session, regular or special. Senators are chosen

GOVERNORS

William King	Democrat	1820–1821
William D. Williamson (acting)	"	1821–
Benjamin Ames (acting)	"	1821–
Albion K. Parris	"	1822–1827
Enoch Lincoln	"	1827–1829
Nathan Cutler (acting)	"	1829–1830
Joshua Hall (acting)	"	1830–
Jonathan G. Hunton	"	1830–1831
Samuel E. Smith	"	1831–1834
Robert P. Dunlap	"	1834–1838
Edward Kent	Whig	1838–1839
John Fairfield	Democrat	1839–1840
Edward Kent	Whig	1840–1841
John Fairfield	Democrat	1841–1843
Edward Kavanagh (acting)	"	1843–1844
Hugh J. Anderson	"	1844–1847
John W. Dana	"	1847–1850
John Hubbard	"	1850–1853
William G. Crosby	Whig and Free Soil	1853–1855
Anson P. Morrill	Republican	1855–1856
Samuel Wells	Democrat	1856–1857
Hannibal Hamlin	Republican	1857–
Joseph H. Williams (acting)	"	1857–1858
Lot M. Morrill	"	1858–1861
Israel Washburn	"	1861–1863
Abner Coburn	"	1863–1864
Samuel Cony	War-Democrat	1864–1867
Joshua L. Chamberlain	Republican	1867–1871
Sidney Perham	"	1871–1874
Nelson Dingley	"	1874–1876
Selden Connor	"	1876–1879
Alonzo Garcelon	Democrat-Greenback	1879–1880
Daniel F. Davis	Republican	1880–1881
Harris M. Plaisted	Democrat-Greenback	1881–1883
Frederick Robie	Republican	1883–1887
Joseph R. Bodwell	"	1887–
Sebastian S. Marble (acting)	"	1887–1889
Edwin C. Burleigh	"	1889–1893
Henry B. Cleaves	"	1893–1897
Llewellyn Powers	"	1897–1901
John F. Hill	"	1901–1905
William T. Cobb	"	1905–1909
Bert M. Fernald	"	1909–1911
Frederick W. Plaisted	Democrat	1911–1913
William T. Haines	Republican	1913–1915
Oakley C. Curtis	Democrat	1915–1917
Carl E. Milliken	Republican	1917–1921
Frederic H. Parkhurst	"	1921–
Percival P. Baxter	"	1921–1925
Ralph O. Brewster	"	1925–1929
William T. Gardiner	"	1929–1933
Louis J. Brann	Democrat	1933–1937
Lewis O. Barrows	Republican	1937–1941
Sumner Sewall	"	1941–1945
Horace A. Hildreth	"	1945–1949
Frederick G. Payne	"	1949–1953
Burton M. Cross	"	1953–

by counties on a basis of population; representatives are elected from districts which consist of a city or one or more towns, with the rural areas receiving more weight than population alone would give, by means of the constitutional sliding scale or "rural gerrymander." Revenue bills originate in the House of Representatives; and impeachments also originate there, but the Senate judges the cases. The governor's veto may be overcome by a two-thirds vote of each house. An uncommon and useful feature of legislative procedure is the joint committee system, whereby all standing committees contain members from each house, thus expediting work and lessening the likelihood of disagreement and stalemate. Another good feature is the requirement that all bills be reported out of committee, preventing "pigeonholing" or "pickling in committee." The state has three representatives in Washington.

Judiciary.—There are three levels of courts in Maine: at the top the supreme court, next the superior and probate courts, and municipal and trial justice courts at the bottom. The only judges who are elected are the probate judges, one to each county, who are chosen for four-year terms. Their work is mainly the probating of estates, and the salary varies from county to county. All other judges are appointed by the governor and council, with the municipal judges serving four years, all others having seven-year terms. Trial justices and municipal courts hear a variety of petty criminal cases and a smaller number of civil cases. The municipal courts also serve as juvenile courts. Appeals from a trial justice court or municipal court go to the superior court of the county The lower courts hold preliminary hearings in important criminal actions, such as murder and manslaughter cases, to determine whether the suspect shall be held for the grand jury. If probable cause is found and the county grand jury indicts, the accused is brought before a superior court judge and a jury for trial. Civil actions of consequence start in the superior court. The supreme court has the usual function of deciding appeals on legal questions. It also has the less common duty of rendering advisory opinions when requested by the legislature or the governor. There are six judges on the supreme court, the five associate justices receive statutory salaries of $10,000, and the chief justice, $11,000; the superior court contains seven judges whose pay is fixed by the legislature at $9,500 and who are assigned by the chief justice of the supreme court to the terms of court in the various counties, one judge to a term. Each municipal court has one judge whose salary is fixed by statute, somewhat in accord with the volume of court business. Trial justices were put on salary in 1947 in place of the fee system formerly employed; their remuneration is fixed by the county commissioners in the respective counties. The pay in the lower courts is small, as it is considered to be a part time position. The attorney general is elected biennially by the houses of the legislature in joint session.

Public Health and Welfare.—Health and welfare agencies are combined in the department of the same name, which administers a variety of functions, including old age assistance, aid to dependent children, aid to the blind, mother's aid, and the work of district health officers and nurses. The commissioner of health and welfare is appointed by the governor and council. Many of the departmental functions are financed partially with federal funds. State hospitals and other institutions are headed by superintendents who are under the direction of the commissioner of institutional service, head of the department of institutional service, who is selected by the governor and council. There are thirteen state institutions, as follows: Augusta State Hospital, Augusta (insane); Bangor State Hospital, Bangor (insane); Pownal State School, Pownal (feeble minded); Central Maine Sanatorium, Fairfield (tuberculosis); Northern Maine Sanatorium, Presque Isle, (tuberculosis); Western Maine Sanatorium, Hebron (tuberculosis); Maine State Prison, Thomaston; Reformatory for Men, South Windham; Reformatory for Women, Skowhegan; School for Boys, South Portland; School for Girls, Hallowell; Maine School for the Deaf, Portland; Military and Naval Children's Home, Bath.

Social Legislation.—Unemployment compensation is in charge of the unemployment compensation commission of three members. Maine's workmen's compensation law is administered by an industrial accident commission of five members, of whom three are full time, the other two being ex officio (commissioners of labor and insurance). The law was broadened in 1945 to include occupational disease coverage. State employees are granted retirement and disability privileges under a retirement act passed in 1942. In 1947 the school teachers of the state were brought into the system under a new law, which gives them advantages not included in the former teachers' retirement act. The combined employees and teachers retirement system is managed by an unpaid seven-member board of trustees, which invests the funds contributed jointly by the state and the members, and lays down rules and policies which are carried out by a full-time secretary and his staff.

Suffrage and Elections.—With the exception of 1837 and 1840, the state went Democratic at state elections until 1852. In 1854, Anson P. Morrill was elected governor on the Republican ticket, and he was succeeded by a Democrat, but since 1882 there have been only three Democratic governors and only one (Brann, 1933–1937) survived for a second (two year) term. The Democratic party has not controlled a Maine legislature or governor's council in the present century, the three Democratic governors having been elected by "split-ticket" votes. Aliens and "untaxed Indians," (i.e., Maine Indians who as wards of the state are tax exempt and not entitled to vote), as well as paupers and persons under guardianship, are excluded from the franchise. Positive qualifications include: citizenship in the United States and the age of 21, residence in the state six months and in the voting area three months (city, town, or plantation), and the ability to pass a literacy test. Amendment 59 (1935) authorizes the use of voting machines, but the right remains almost unused, as the printed ballot is commonly employed in state, city, county, and national elections. Towns use the printed Australian ballot if the citizens so vote, otherwise they retain the older methods of oral voting, or non-Australian ballots of olden times. The primaries for state, county, and national elections are held in June in closed (party) primaries. Maine is the only state which elects United States senators and representatives in

September, along with state and county officials. This results in an additional election every presidential year, as the federal constitution requires the president and vice president to be voted on in November. For political reasons the state legislature has consistently refused to abandon the September election. Local election dates vary from place to place; city elections are generally in the winter, as set by the city charter, while towns hold their town meetings in the month of March, as their tax year begins on April 1. The statutory initiative and referendum took effect in 1909, by amendment 31 of the Maine constitution.

Local government.—In spite of the lack of home rule provisions in its constitution, the state allows local units much self-government. Cities must appeal to the legislature for their charters, but a new or revised charter is seldom denied, and, having passed the legislature, is then customarily submitted to the voters in a local referendum election. In the fields of education, highways, health, and welfare there is a considerable amount of state control and assistance, while local taxation and civil service are largely free from supervision. The basic feature of Maine town government is the annual town meeting, at which officers are elected, and taxes and appropriations are voted. Between town meetings, administration is handled by the board of selectmen, usually consisting of three persons, and such officers as tax collector, treasurer, assessors, overseers of the poor, and road commissioner. Maine cities are governed by the mayor and council or manager and council form of government, and a large number of towns have added the manager plan through a special town charter or the state enabling act. There are more town and city manager communities in Maine than in any other state (1947), including small communities as well as larger ones such as Portland, Bangor, and Auburn. Much of the state is surveyed into unorganized or wild land townships, which have no local government and little population. Besides cities, towns, and townships, there are a number of local units termed "plantations," lightly settled, and possessing a rudimentary local government somewhat like that of the towns. The sixteen counties serve chiefly as court and law enforcement areas. Each county elects a board of three county commissioners for overlapping terms. The voters also elect their sheriff, clerk of courts, register of deeds, county attorney, probate judge, and treasurer. Maine counties have little authority over roads and bridges, and none over education, welfare, or assessment of property, therein differing from the counties in many sections of the United States. The coroner has been replaced by a county medical examiner who must be a physician, and who is appointed by the governor, who also has power to remove the sheriff or the county attorney for cause, even though they are elected officers.

Education.—Public elementary and secondary education is free to all residents of the state between the ages of 5 and 21 years and compulsory for all between the ages of 7 and 15 years.

There is a school of education connected with the University of Maine, and departments of education in Bates, Bowdoin, Colby, and St. Joseph's Colleges. The State Teachers College at Farmington offers four years of training in the field of home economics, leading to the degree of bachelor of science in home economics, and three years of training in the field of elementary teacher training. Gorham State Teachers College at Gorham offers a four-year course leading to the degree of B.S. in elementary education and a four-year course in manual training leading to a degree in industrial arts. A junior high school teacher-training course is also offered at this institution. Aside from these two, the state has Washington State Normal School at Machias; Aroostook State Normal School at Presque Isle; and Madawaska Training School at Fort Kent, all of which offer teacher-training work. Eastern State Normal School at Castine was converted to the Maine Maritime Academy, which grants degrees to those who complete the course for maritime officers. There are a number of parochial schools in the state. Maine has about 60 institutes and academies doing work at the secondary school level.

Institutions of higher learning in the state, in addition to the University of Maine at Orono, include Bates College, a coeducational institution located at Lewiston; Bowdoin College (for men) at Brunswick; Colby College, coeducational, at Waterville; Nasson College (for women) at Springvale; Riker College, Houlton; St. Joseph's College (for women) in Portland; Bangor Theological Seminary (Congregational) and Northern Conservatory of Music, both located in Bangor. There are also three junior colleges—Westbrook Junior College, Portland; Portland Junior College, Portland; and Kent's Hill Junior College at Kent's Hill.

A public school fund was created in 1828. Certain parcels of land were set aside, and money received from these lands or the timber thereon formed the basis for a permanent public school fund. The interest on this fund plus biennial appropriations from other tax sources make up the resources for aiding the local governments in their public school program in Maine. In 1945, the legislature set the minimum salary of teachers at $1,000, and in 1947 increased the figure to $1,500.

Through a department of education, headed by a commissioner who is chosen by the State Board of Education, the state administers its teachers certification law, its curriculum supervision, and its school building standards. The school district system has given way to city and town jurisdiction over schools. Professional superintendents are certified after successfully meeting state standards as to education and training, and passing a written examination. They are paid partly by the state, and two or more small communities often join together in a "school union" under the guidance of one superintendent. The compulsory school law for children under 16 is enforced by local school officials and local truant officers. Since 1901 the state has, by legislative acts, provided special aid for instruction in institutes and academies. Towns not maintaining a "class A" secondary school must provide tuition for local pupils who wish to attend high schools in other communities. Summer schools are maintained in the state teacher training colleges, which operate under the jurisdiction of the commissioner of education.

Libraries.—The state maintains a free library for the legislature and general public in the state capitol at Augusta. The largest college

libraries in Maine are at Bowdoin and the University of Maine. Among the numerous local public libraries, the one at Bangor is outstanding and is said to be one of the best in the country serving a small city. Like most local libraries in Maine, it derives its major support from private benefactors, but receives some aid from the local taxpayers through their city government.

History.—Maine is supposed to have been visited by the earliest explorers: Gaspar Corte-Real in 1501 and Giovanni da Verrazano in 1524 reported a coast, the description of which corresponds with that of Maine. Estévan Gomez in 1525 sailed along the coast and named the Penobscot River, Rio de las Gamas, or Stag River. Sir John Hawkins, the famous Elizabethan seaman, explored the coast in 1565, and Sir Humphrey Gilbert in the voyage (1583) which cost his life was on his way to the Penobscot region, then known as Norumbega, to settle a colony under a patent from Queen Elizabeth. Barthelomew Gosnold, an Englishman (one of the founders of Jamestown), was visited by Martin Pring in 1603, by Sieur de Monts (Pierre du Guast) in 1604 and by George Weymouth in 1605. The first attempt to settle on the territory was made by the French under de Monts, who, having received a patent from the French king, planted a small colony on Neutral (St. Croix) Island in the Saint Croix River in 1604. The first colony settlement attempted by the English was at the mouth of the river Sagadahoc, now Kennebec, by George Popham and Raleigh Gilbert in 1607. A fort was erected and a number of buildings, and here the *Virginia,* the first vessel built in the country, was launched and subsequently formed one of the fleet of the Somers and Gates Colony in 1609. The colony at Sagadahoc was broken up by the death of Popham and great hardships endured by the colonists. They returned to England in the autumn of 1608. In 1613, French Jesuits established a mission on Mount Desert Island, but they were expelled by the English, under Sir Samuel Argall, the next year. In 1614, the coast was visited by John Smith from England, who found a few scattered settlers around Pemaquid Bay and on the Island of Monhegan, off the coast of that part of the state now included in Lincoln County. In 1616, Sir Ferdinando Gorges, "The father of American Colonization," who had sent Pring and Popham to Maine, sent his agent, Richard Vines, to Saco to remain during the winter to explore the country and test the climate. In 1620, the king of Great Britain made a division of the grand charter of 1606 and granted to the Plymouth Company in England, under the corporate name of the Council for New England, the whole country lying between 40° and 48° N., and to the Virginia Company the southern portion of the original patent. In August 1622, Gorges received a patent of territory between the Merrimac and Kennebec rivers, and the next year sent his son Robert as governor and lieutenant general of the country, accompanied by several councillors and a minister of the Church of England to establish worship. In 1629, another division of lands was made giving to Sir Ferdinando Gorges the country between the Piscataqua and Kennebec rivers, to which he gave the name of New Somersetshire, and the remainder to John Mason. The first court in the province was convened by William Gorges, nephew of Sir Ferdinando, at Saco, in March 1636. Charles I granted to Sir Ferdinando Gorges in 1639 a charter under which, in 1641, Gorges established the first chartered city in the United States, under the name of Gorgeana, and constituted it the capital of the province. What was then Gorgeana is now York. Its original name was Agamenticus. A fort was built here and efforts made to protect the people against the Indians. From 1630 to 1632 settlements were commenced in Saco, Biddeford, Scarboro, Cape Elizabeth, and Portland, all of which continued to prosper until the Indian War (King Philip's) of 1675, when they were overthrown. Massachusetts claimed a portion at least of the territory of Maine on the ground that its charter included the lands as far north as three miles above the source of the Merrimac; but those to whom other charters had been given resented her interference. In 1677, Massachusetts purchased from the heirs of Gorges all their interest in the province of Maine. A new charter, issued by William and Mary, in 1691 combined the provinces of Massachusetts, Plymouth, Acadia, Maine, and Sagadahoc into one province, called "The Royal Province of Massachusetts Bay." Maine was now a part of Massachusetts. Remote from the center of white settlements of any great size, Maine suffered from attacks by Indians, especially during the French and Indian wars. When King Philip's War was ended there were within its boundaries only five settlements.

Among the first soldiers in active service in the Revolutionary War were men from Maine, who fought as Massachusetts troops. A regiment from Maine was present at Bunker Hill. The British fleet, in 1775, attacked and destroyed Falmouth (now Portland). Off Machias was fought the battle in which the *Margaretta,* a British ship, was captured. At the close of the war Massachusetts still retained possession of the country and called it the District of Maine. The people of Maine were divided in their allegiance to Massachusetts; one party desired to remain a part of the Bay State and another party wanted independent statehood. The separatist movement gained ground during the War of 1812. Maine was admitted into the Union as a state March 15, 1820.

The northeastern boundary continued a source of dissension with Great Britain or between the people of Maine and New Brunswick until after the ratification of the Webster-Ashburton Treaty (q.v.) in 1842, which practically settled the eastern boundary between the United States and Canada. (See also BOUNDARIES OF THE UNITED STATES—*Northeastern Boundary;* MAINE BOUNDARY TREATY.)

For many years the liquor question was predominant and Maine took the lead in legislation regulating it. In 1821 a license law was passed and, in 1846, the first prohibitory law was passed, the sale of spirits being limited to medicinal and industrial purposes. This law was not well enforced and under the leadership of Neal Dow of Portland, ardent prohibitionist, the "Maine Law" of 1851 was enacted, prohibiting the manufacture and sale of intoxicating liquors. This law was repealed in 1858 but was reenacted later, becoming a part of the state constitution in 1884. Enforcement was always difficult and the constitutional amendment was finally repealed in September 1934.

Maine has always answered with a quick re-

sponse the call to national defense. In addition to sending men in World War II, Maine became the take-off base for much of our air force, as well as a shipbuilding center.

In 1879 a dispute arose as to the legality of the election of some of the members of the legislature and of the governor. For a time a disturbance was feared, but the militia preserved peace until the supreme judicial court rendered a decision making the Republican candidates legal members of the legislature. This state has had no serious internal troubles except the "Know-Nothing" agitation in 1854–1856, and the dispute about the legislature in 1879.

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MAINE, The. A battleship of the United States Navy, mysteriously destroyed by explosion in Havana Harbor, Cuba, on the night of Feb. 15, 1898. The revolt of the Cubans in 1895 against Spanish misrule had brought the island in 1897–1898 to the verge of ruin. General Weyler y Nicolau had been recalled and General Blanco y Erenas was sent as governor general to endeavor to bring order out of chaos, but his plans failed and January 1898 witnessed serious disturbances. The American government, believing the lives and property of American citizens in Havana in danger, the *Maine,* which had been for some time at Key West, was ordered to Havana and arrived at that port Jan. 24, 1898. She was piloted into the harbor by an official pilot of the Spanish government and was moored to a government buoy. The usual official and international calls and salutations were exchanged between the Spanish authorities and the commander of the *Maine,* Capt. Charles D. Sigsbee, and outwardly there was no evidence of the impending disaster. The *Maine* carried 26 officers and 328 men, all of whom were on board when the explosion took place, except an assistant engineer, two naval cadets and a gunner. Two officers and 250 men were killed at once and 8 men died afterward in hospital. Only 16 of the crew wholly escaped injury. Of the dead, 166 were buried in Colon Cemetery, and 25 at Key West. In 1899 the dead buried at Colon Cemetery were brought to the United States and buried at Arlington with military and naval ceremonies. A court of inquiry, Capt. W. T. Sampson presiding, was instituted and after a month's investigation expressed the opinion that the vessel was destroyed by the explosion of a submarine mine, but responsibility could not be fixed upon any person or persons. Shortly afterward war was declared. (See UNITED STATES—*The War With Spain*).

There was a very general demand throughout the United States that the *Maine* should be raised, and on May 9, 1910 Congress authorized operations and the matter was placed in charge of the War Department, and assigned specifically to the engineer corps of the army. An elliptical coffer-dam, composed of a series of huge contracted cylinders that were constructed of interlocking steel piles and filled with mud and stone, was placed around the wreck. It was a wonderful piece of engineering, reflecting great credit on every army engineer connected with its inception and execution. The coffer-dam was completed June 5, 1911, and the entire wreck exposed November 2 following. A joint army and navy board, of which Rear Admiral Charles E. Vreeland was president, was then sent to Havana to reinvestigate the wreck. It reported Dec. 15, 1911, confirming the verdict of the Sampson court except in the nonessential detail that the center of the explosion was a little farther aft than was reported by that court. The after half of the hull, all that was not shattered, was floated Feb. 13, 1912, 14 years, lacking two days, after the *Maine's* destruction. On March 16, 1912 this relic of the once powerful battleship was towed to sea, with attendant ceremonies, afloat and ashore, and sunk in 600 fathoms of water. Concurrently 34 coffins, estimated to contain the bones of 64 of the *Maine's* dead, were placed on board an American war vessel and dispatched to Arlington, where, on March 23, they were buried in the *Maine* plot.

MAINE, University of, a co-educational institution, situated at Orono, Me., about nine miles northeast of Bangor. The campus of more than 200 acres borders a branch of the Penobscot River. A part of the public educational system of the state, the university is a land-grant institution, originally established as the State College of Agriculture and the Mechanic Arts under the provisions of the Morrill Act of 1862, and opened in 1868. The original name was changed to the University of Maine in 1897.

The university includes the colleges of arts and sciences, agriculture, technology, and the school of education. The Maine Agricultural station was established as a division of the university of 1887. Graduate instruction is given in various departments and since 1923 graduate work has been a separate division. A college of law was opened in 1898, but was discontinued in 1920.

The summer session offers a wide variety of academic and educational courses. Extension work in agriculture, forestry, and home economics is carried on throughout the state, co-operatively with the United States Department of Agriculture. A limited amount of work in other fields is offered through extension courses given by

various departments. To provide permanently for the support of the university, the state legislature in 1929 passed an act levying a tax of one mill on the general property valuation of the state. The degree of B.A., with specification of the major subject, is conferred upon students completing a curriculum in the college of arts and sciences. The degree of B.S. is conferred upon completion, in accordance with requirements, of four years' work in the colleges of agriculture and technology. In the school of education the degrees of B.A. and B.S. in education are awarded. The degrees of M.S. and M.A. in education are granted for one year's graduate work completed with distinction.

Seventeen fraternities and six sororities have chapters at the university. Some of the fraternities maintain houses of their own. Other men live in university dormitories and private homes. Women live in dormitories, one of which is operated co-operatively, thereby substantially reducing these students' expenses for room and board.

Seven national honorary societies have chapters at Maine. One of them, Phi Kappa Phi, was founded at the University of Maine in 1900.

ARTHUR A. HAUCK,
President.

MAINE BOUNDARY TREATY. The year 1910 witnessed the final settlement of the long-standing dispute as to the boundary line between Maine and New Brunswick. Secretary of State Philander Chase Knox, acting for the United States, and Ambassador James Bryce, on behalf of Great Britain, signed a treaty which established the exact boundary of Maine for all time.

At the close of the Revolutionary War in 1783 the first attempt was made to fix a satisfactory boundary, but it resulted only in hopeless dissatisfaction. Scarcely a diplomat had been sent to this country from England but had been called upon to familiarize himself with the Maine-New Brunswick boundary situation; while the United States State Department had gone over the ground so many times that that performance had almost come to be regarded as one of the regular duties of the department.

Most boundary lines are fixed by nature; those which are not do not as a rule amount to a great deal, and an amicable settlement can usually be reached at once. With the Maine-New Brunswick line, however, neither of these conditions ever applied. This disputed line ran through Passamaquoddy Bay, along the little islands at the mouth of the Saint Croix River. As a result of its indefinite character there had been endless dispute and strife among the fishermen who frequented those parts; disputes which had had an industrial significance since both the Eastport and Lubec canneries sent their men to this point, and it made a vast deal of difference whether they were fishing in American or Canadian waters.

The source of all the trouble was the looseness with which the first treaty, that of 1783, was drawn up. Article 2 of that document reads: "And that all disputes which might arise in future on the subject of the boundaries of the said United States may be prevented, it is herein agreed and declared that the following are, and shall be, their boundaries, viz.: From the northwest angle of Nova Scotia, viz: That angle which is formed by a line drawn due north from the source of the St. Croix River to the Highlands; along the said Highlands which divide those rivers that empty themselves into the river St. Lawrence from these which fall into the Atlantic Ocean, to the northwestermost head of the Connecticut River," etc.

Thus, while the Saint Croix was plainly named as the beginning of the eastern boundary, the only point mentioned was the source of the river, and not a word was said about its mouth or the numerous islands of the great bay into which it empties. Moreover, there arose at once the question as to what was the Saint Croix River. The first action toward a settlement was taken in 1794 when John Jay was charged to adjust the matter. All he was able to accomplish, however, was a provision in his treaty of that year for the appointment of three commissioners to determine just what was the Saint Croix River. These commissioners met at Halifax in 1798 and determined the river, but neglected to mention its source and made no disposition of the islands at its mouth. Subsequently there were treaties, conventions and declarations between the United States and Great Britain relative to this subject in 1814, 1818, 1827, 1842, 1846 and in 1870, but in every instance there was something still left to be adjusted around the mouth of the river.

The Treaty of Ghent in 1814 provided for commissioners to settle the matter and they decided that Moose, Dudley, and Frederick islands belonged to the United States, while all the other islands, including Grand Menan, were the property of Great Britain. This was very good so far as it went, but it left unsettled the status of several small islands in the Saint Croix and of the line itself through the bay. The channel thus remained in dispute.

In addition to this, trouble soon arose over the boundary line northward and westward from the source of the Saint Croix. The original treaty had been exceedingly vague on this subject. As early as 1803 and 1807 attempts had been made to determine the line of the highlands by negotiation of draft treaties which were never ratified. The joint mixed commission provided for by the Treaty of Ghent worked on the problem for six years (1816–22). Costly frontier surveys were undertaken, and these occasioned further acrimonious disputes. The only agreement ultimately reached was to disagree, and the commissioners adjourned without resorting to the provision for selecting a friendly umpire.

Finally, in 1827, King William I of the Netherlands was named as referee to conclude the dispute. After failing for a long time to satisfy either party with any of his suggestions, he drew a line to suit himself, awarding part of the disputed territory to Maine and part to New Brunswick. The United States rejected this arrangement, while in the meantime the disturbances on the border kept becoming more and more serious. Operations of the 1830 census takers in the contested area created much feeling, and eight years later an American lumber dealer was thrown into jail by New Brunswick officials—the act having much to do with the precipitation of the Aroostook war. Although no blood was spilled in this it came very near to maturing into a third war with England. A joint occupation was agreed upon as a temporary compromise, before Daniel Webster and Lord Ashburton came together in 1842

and drew up the famous treaty which settled all dispute as to that particular part of the boundary line.

It has been related as an historical fact that in these negotiations both nations withheld maps which were unfavorable to their claims. The Americans had one which had been discovered but a short time before in Paris, and was supposed to have been drawn up by Benjamin Franklin, while in the possession of the English was one made by Richard Oswald, who was one of the commissioners who negotiated in the treaty which gave the United States its independence. Later both nations showed these maps to their own people in evidence of how conclusively they had got the best of the bargain. Up to the present time, however, the United States has always regarded the signing of this treaty of 1842 as a diplomatic triumph.

The treaty of 1842, however, made no mention of any part of the boundary south of the monument which had been erected at the source of the Saint Croix, and until Secretary Knox and Ambassador Bryce signed their treaty of 1910 the lower part of the line in places was still contested. But with the signing of this latest treaty and the final settlement of the whole chaotic matter no point now remains between the United States and Canada which is in the slightest dispute.

MAINS. See ELECTRICAL TERMS.

MAINTENANCE, in its legal signification, the interference by a person in litigation in which he is not primarily interested, by assisting either party with money or otherwise. It includes champerty (q.v.), which consists of maintenance for reward or for a share in the proceeds of the litigation promoted. An agreement of this kind is illegal and void and at common law is punishable as an offense tending to obstruct justice. To-day where the common law prevails the wrongful intention with which the assistance is given is regarded as the gist of the offense. In many jurisdictions maintenance is no longer recognized as a criminal offense and in many States is not regarded as a civil cause of action by the injured party against a maintainor of the suit against him. See CRIMINAL LAW and consult the authorities referred to under that title.

MAINTENON, măn-tē-nôn, **Françoise d'Aubigné,** MARCHIONESS DE, French queen: b. Niort, Poitou, 1635; d. Saint-Cyr, 1719. Her birthplace was the prison in which her parents were confined because of religious trouble. After her father's death in her 10th year she became the ward of her guardian and aunt, Madame de Neuillant, who gave her a somewhat limited education and through whose efforts she became converted to the Catholic faith at about the age of 14. She was then returned to her mother, whose income was insufficient for the child's support. Her humiliation did not embitter her bright and cheerful disposition, however, and when at 16 the famous wit and man of letters, Scarron, deformed, old and infirm as he was, became her husband, and she was soon the centre of the clever literary people who frequented his house. When Scarron died, her good sense and delightful disposition recommended her to many friends, who pointed her out to Louis XIV as a fitting person to take charge of the education of the children born to him by Madame de Montespan. She undertook the office of governess to the royal children, won their affection and respect as well as that of the king, who married her in 1685 when she was 50 and he 47. There can be no doubt that she exercised a beneficent influence over the king's private life. She was undoubtedly disinterested and charitable, her character above stain in a profligate age, and her mind clear and resolute in pursuing the course she thought to be right. She survived the king four years and died at the nunnery at Saint Cyr which she had changed into a place of education for the poor daughters of families, having enjoyed to the end all the honor and position of a royal widow. Consult Blennerhassett, C. J., 'Louis XIV and Madame de Maintenon' (New York 1911); Dyson, C. C., 'Madame de Maintenon: Her Life and Times, 1635–1719' (London 1910); Geffroy, 'Mme. de Maintenon d'après sa correspondence authentique' (Paris 1887); Noailles, 'Histoire de Mme. de Maintenon' (ib. 1848–58); Pilastre, E., 'Vie et caractère de Mme. de Maintenon' (ib. 1907).

MAINZ, mints, Germany, a town in the state of Hesse-Darmstadt, on the left bank of the Rhine, opposite the mouth of the Main, 20 miles by rail southwest of Frankfort. It was a fortress of the first rank and is an episcopal see and a river port. The town rises gradually from the Rhine in the form of an amphitheatre. A railway bridge spans the Rhine a little above its junction with the Main, and a stone bridge connects with the opposite suburb of Kastel. A handsome quay, 330 feet wide, extends along the Rhine for a considerable distance, and large modern harbors have been constructed. The principal edifices are the cathedral, recently restored, a vast building of the 11th century; the former electoral palace, now containing the city library (230,000 vols.), picture gallery, museum of Roman and Roman-German antiquities, etc., the old collegiate church of Saint Stephen, occupying the highest site in the town, the church of Saint Peter, the German House, or grand-ducal palace with the arsenal adjoining, the courts of justice, the government buildings, public hall, two new concert halls, central railway station, etc. One of the most interesting objects in the town is the house of Gutenberg which contained his first printing office. A bronze statue of Gutenberg, by Thorwaldsen, stands in an open space near the theatre. The great open-air resort is the *Neue Anlage,* outside the gates, consisting of extensive public gardens, and commanding fine views of the town and surrounding district. The manufactures consist chiefly of leather, furniture, hardware, carriages, carpets, tobacco, beer, chemicals, musical instruments, gold and silver wares, machinery, soap, hats, etc. The trade, particularly transit, is extensive. The principal articles are Rhenish wine, corn, flour, oil, coal and wood. Mainz owes its foundation to a Roman camp which Drusus pitched here. On the decline of the Roman power it was almost entirely destroyed, but was afterward rebuilt chiefly by Charlemagne, and became the first ecclesiastical city of the German Empire, of which its archbishop-elector ranked as the premier prince. Pop. (1933) 142,627.

MAIPO, mī'poo, **or MAIPU,** a river in Chile, having its rise in the Andes Mountains and flowing almost due west into the Pacific Ocean. It is 120 miles in length. The falls and rapids furnish valuable water power, which has not been utilized to any great extent. The city of Santiago is a few miles north of the river. On 5 April 1818 was fought on the banks of the Maipo the battle which decided the independence of Chile.

MAIR, mār, Charles, Canadian writer: b. Lanark, Ontario, 21 Sept. 1840; d. 1906. He was educated at Queen's University, Kingston, and entered journalism. He aided in quelling the Riel insurrections and was one of the organizers of the «Canada First» party. Among his works are 'Dreamland and Other Poems' (1868); 'Tecumseh,' a drama (1886).

MAISON CARRÉE, mā-zoṅ' ka'rā, Roman temple at Nîmes, France, the most perfect of its type remaining. It was probably built early in the Christian era, its inscription dedicating it to the adopted sons of Augustus, Gaius and Lucius Cæsar, although by some authorities its date is placed at about the 2d century. It is built on the plan of the Parthenon although its dimensions are smaller. It stands on a podium 11 feet high, measures 40×82 feet and is entered by a flight of 15 steps. There are 30 columns, of which 20 are in the side and rear walls while 10 form the portico. The temple now houses collections of antique sculpture and coins.

MAISONNEUVE, mā-zŏṅ-nèv, **Paul de Chomedey,** Sieur de, French colonizer: b. Champagne, France; d. Paris, 9 Sept. 1676. He enlisted in the French army at 13 and later organized a band of colonists with whom he landed at Quebec in 1641. In 1642 he founded Montreal and was for 22 years its governor but was absent for a time in 1652 when he returned to France to conduct to America a new party of settlers. He displayed great administrative ability, but through the jealousy of De Mésy, governor-general of Canada, was in 1664 recalled to France by De Tracy. Though no charges were made against him he found no possibility of reinstatement in office and resigned in 1669.

MAISTRE, mā'tr, **Joseph Marie,** Comte de, French philosopher and savant: b. Chambéry, 1 April 1754; d. Turin, 26 Feb. 1821. He was of French extraction and was a senator of Piedmont at the time of the French invasion (1792). He left his country in consequence of that event, and afterward followed his king to Sardinia. In 1803 he was sent Ambassador to Saint Petersburg, and returned finally to Turin in 1817. De Maistre was familiar both with Greek and Latin literature, and his writings in French have obtained the highest praise of critics. He was a conservative in politics, religion and philosophy, a supporter of absolute monarchy and of the infallibility of the Pope, His 'Mémoires politiques et correspondance diplomatique' (published posthumously, 1858), however, shows him in the light of a much more discerning and less uncompromising politician than his formal treatises, and indicates a large and liberal appreciation of the revolution which he opposed. As a diplomatist he exerted himself to effect the restoration of all his former possessions to his master, and to obtain the transfer of Genoa. Among his political writings are his 'Eloge de Victor Amadée III'; 'Considérations sur la France' (1796); 'Essai sur le principe générateur des constitutions politique' (1810), in which he maintains the divine origin of sovereignty; 'Du Pape' (1819); 'Soirés de Saint Petersborg' (1821; new ed., 1888); 'De l'Eglise gallicane' (1821–22); and 'Du Congrès de Rastadt' (the last with the Abbé de Padt). 'Quatre chapitres inédits sur la Russie par le comte Joseph de Maistre' was published by his son in 1859. Consult Descostes, 'Joseph de Maistre avant la révolution' (Paris 1893); Lescure, 'Joseph de Maistre et sa famille' (ib. 1893); Paulhan, F., 'Joseph de Maistre et sa philosophie' (1893).

MAISTRE, Xavier de, French soldier, essayist and novelist, brother of Joseph de Maistre (q.v.): b. Chambéry, October 1763; d. Petrograd, 12 June 1852. He served in the Piedmontese army when very young, and his literary career began with his writing, 'Voyage autour de ma chambre' ('Journey Around My Room,' 1794), while in prison at Turin for participation in a duel. When Savoy was annexed to France he went to Russia and there secured a commission in the army, where he rose to the rank of major-general. He lived for a time in Naples after the restoration of the Piedmontese dynasty, but eventually returned to his adopted country and died there. His style was graceful and his work was marked by strong delineation of character and exceptional descriptive power. (See Journey Around My Room). He also wrote 'Le Lépreux de la cité d'Aoste' (1811); 'Les prisonniers du Caucase' (1815); 'La Jeune Siberienne' (1815); 'Expédition nocturne' (1825). His complete works were published in three volumes (Paris 1825).

MAISUR, mī-soor'. See Mysore.

MAITIN, mī'tăn, **José Antonio,** Venezuelan poet: b. Porto Cabello, 1798; d. Choroni Venezuela, 1874. In 1824 he returned from Havana to his own country whence he had fled on account of persecution, and made his home in the valley of Choroni. In 1844 his best poems were collected and published with the title 'Echoes from Choroni,' and in 1851 a collected edition of all his works appeared.

MAITLAND, Edward, English mystic and writer: b. Ipswich, 27 Oct. 1824; d. Tonbridge, 2 Oct. 1897. He was educated at Caius College, Cambridge, and was destined for the ministry, but declined to take holy orders because of his incompatible religious beliefs. He was one of the «Forty-niners» in California and later went to Australia where he became a commissioner of Crown lands. He was married and widowed in Australia and in 1857 returned to England where he engaged in literary work of an humanitarian order. He made the acquaintance of Mrs. Anna Kingsford in 1874 and with her crusaded against materialism, vivisection and the use of animal food. In 1876 he announced that he had acquired a new sense which enabled him to see the condition of peoples' souls, as well as those of trees and animals, and likewise revived his memory of his own previous incarnations. He joined the Theosophical Society in 1883, but shortly afterward withdrew from

it and with Mrs. Kingsford founded the Hermetic Society which was of mystic rather than occult character. After the death of Mrs. Kingsford in 1888 he maintained that they remained in communication. In 1891 he founded the Esoteric Christian Union. He wrote for the *Spectator* and the *Examiner;* reviewed books for the *Athenæum;* and collaborated with Mrs. Kingsford in writing 'The Key of the Creeds' (1875), and 'The Perfect Way; or the Finding of Christ' (1882). Author of 'The Pilgrim and the Shrine' (1867); 'The Higher Law' (1869); 'By and By: an Historical Romance of the Future' (1873); 'Clothed with the Sun: Being the Book of the Illuminations of Anna (Bonus) Kingsford' (1889); 'The New Gospel of Interpretation' (1892); 'Anna Kingsford, Her Life, Letters, Diary and Work, By her Collaborator, with a Supplement of Post-Mortem Communications' (2 vols., 1896). After the completion of the 'Life' of Mrs. Kingsford, which, like most of his writings, was largely autobiographical, his mental powers failed rapidly.

MAITLAND, Frederic William, English historian: b. London, 28 May 1850; d. 19 Dec. 1906. He was graduated from Trinity College, Cambridge, and studied law; in 1884 was made reader of English law at Cambridge and from 1888 was professor of the same branch there. He read widely on legal history, founded the Selden Society in 1887 for the study of the history of English law and was a generally recognized authority. Among his works are 'Gloucester Pleas' (1884); 'History of English Law,' with F. Pollock (1895); 'Canon Law in England' (1898); 'English Law and the Renaissance' (1901), etc.

MAITLAND, J. A. Fuller. See FULLER-MAITLAND, J. A.

MAITLAND, Sir Peregrine, British soldier: b. Hampshire, England, 1777; d. London, 30 May 1854. He enlisted in the army in 1792 and was promoted rapidly, serving in Spain and at the battle of Waterloo, where he was a major-general. In 1818 he was appointed lieutenant-governor of Upper Canada and in 1828–34 was governor of Nova Scotia. He was made lieutenant-general in 1830 and commanded the Madras army, 1836–38. From 1843–47 he was governor and commander-in-chief at the Cape of Good Hope.

MAITLAND, Sir Richard, Lord Lethington, Scottish poet and antiquary: b. Scotland, 1496; d. Edinburgh, 20 March 1586. He was educated at Saint Andrews and was one of the great lawyers of his day, and although he became blind in 1561 was nevertheless made a member of the Privy Council, and in 1562 keeper of the great seal. His manuscript collection of early Scottish poetry is preserved at Magdalene College, Cambridge. A selection from his collection, together with his own poems, was published in 1786, and his poems were reprinted in 1830 by the Maitland Club, a literary organization founded in his honor in Glasgow in 1828.

MAITLAND, William, Scottish statesman: b. Scotland, about 1528; d. Leith, 9 June 1573. He was a son of Sir Richard Maitland, Lord Lethington (q.v.), and was educated at Saint Andrews and on the Continent. He early entered political life and was interested in the Knox reform movement; in 1558 he was appointed Secretary of State by Mary of Guise, and is commonly called «Secretary Lethington.» He was one of the commissioners who concluded the Treaty of Berwick and in 1560 was speaker of the Scottish Parliament. He was one of Mary's ministers on her return from France, but was suspected of having betrayed her to Queen Elizabeth. In 1563 Maitland conducted a prosecution for treason against Knox whom he had earlier supported, and in 1565 he became lord of the sessions but was removed from office for implication in Rizzio's murder; he was also connected with the murder of Darnley. He contrived Mary's escape from Lochleven but fought against her at Langside. After the assassination of Moray he became the leader of the queen's party and was active in her support. He joined Kirkcaldy at Edinburgh Castle, and encouraged him to hold out until the last. He was taken prisoner at its surrender and died in prison. Consult Skelton, 'Maitland of Lethington and the Scotland of Mary Stuart' (1887–88).

MAITLAND, Australia, town, in Northumberland County, in New South Wales, on the Hunter River, about 119 miles north of Sydney by rail. It is connected by railroad with Newcastle, about 15 miles distant. The Hunter River divides the town into East and West Maitland, two distinct municipalities, West Maitland being the larger. The Hunter River frequently overflows its banks and floods the town and surrounding country. Although serious devastation results, the soil has been enriched by this flooding, and so fertile is this section that Maitland is called the «garden of New South Wales.» Grapes, grains, tobacco and vegetables grow in abundance. Large coal fields are near the town. Considerable manufacturing is carried on, especially in West Maitland. Pop. of East and West Maitland, 12,000.

MAIZE. See CORN, INDIAN.

MAIZEROY, René, Baron (real name René Jules Jean Toussaint), French novelist: b. Metz, 2 May 1856. He was educated at the Jesuit College of Saint Clement, the Toulouse Lycée and the Saint Cyr Military School, becoming second lieutenant in the 53d regiment of Infantry. He resigned from the army in 1881 and entered upon a literary career. He contributed to *Le Gaulois, Figaro, Gil Blas, La Vie Moderne* and *Clarion,* and became a voluminous writer of fiction, also producing several pantomimes, ballets and dramas. Author of 'Le Capitaine Bric-a-brac' (1880); 'Souvenirs d'un officier' (1888); 'L'Adorée'; 'P'ti'-Mi'; 'Le Reflet'; 'En Volupté'; 'Glorita, fille et marquise'; 'Yetto, mannequin'; 'Ville d'Amour'; 'La Mer' (1895); 'La Remplaçante' (1906); 'L'Amour en danger' (1912), etc. He died in 1918.

MAJESTY (Latin, *majestas*). *Majestas,* in a collective sense, was used in republican Rome to signify the highest power and dignity, the attribute of the whole community of citizens, the *populus.* The *majestas* was also ascribed to the dictator, consul, and even Senate, though in the case of the last the word *auctoritas* was used in preference. At a later period,

under the Roman emperors, *majestas* was the name of the imperial dignity, whilst that of a magistrate was called *dignitas*. To kings the attribute of majesty was given much later. The courtiers introduced the title into France under Henry II. In the Treaty of Crespy (1544) Charles V is styled *imperial*, Francis I *royal majesty;* and in the Peace of Câteau Cambrésis (1559) the titles of *most Christian and Catholic majesty* are found for the first time. In England Henry VIII first adopted the title *majesty, grace* and *highness* being the titles formerly employed. At present this title is given to all European emperors and kings.

MAJOLICA AND MEZZA-MAJOLICA. Spelled also maiolica. It is generally claimed that the word was derived from the island of Majorca, whence the first pieces of this ceramic ware were imported to Italy. The term majolica has become a very confused and indefinite expression and used by writers with different meaning. The term, in its first application, referred only to the early Italian lustre-ware made (15th century) with transparent silicious glaze and outer surface of metallic sheen in imitation of the lustre-ware of Hispano-Moresque creation. Later, the early enamel-covered and color-decorated wares of Italy were called majolica regardless of metallic lustre surface, and the lustre-ware having Oriental style of form and decorative treatment was termed *mezza-majolica.* But the term majolica has in modern times been vulgarized into a broader definition by the public including practically everything in ceramics having glaze coating and painted decoration. Leading experts retain the more distinctive terms. Lustre decoration consists of imparting a metallic or pearl-like (*nacreous*) sheen to the outer surface of the ceramic ware by coating over the already decorated and fired piece with a thin layer of a pigment containing either gold, silver, copper, etc., and then firing under moderate heat. The effects are very delicate and beautiful and are known, according to the different sheens produced, as ruby (rubino), gold, silver, mother-of-pearl (madreperla), etc.

Mezza-Majolica.— The earliest production of this ware was in Persia and Turkey, but it is only in quite recent years that the actual fabriques have been located. To this Turkish ware belong the pieces heretofore labeled «Lindos» and «Rhodesian» ware from the location of the sites where examples had been excavated. The actual sites of production now satisfactorily proven and dates of discovery of these prototypes of mezza-majolica are as follows: Rekka (1896), Sultanabad (1905), Rhages, quite recently. The ware formerly termed «Siculo-Arabian» is now said to have had its home in Syria or Egypt, and the so-called «Rhodesian» ware in Osmanli-Turkey. The latter has most brilliant coloring (blue, grayish-black, green, etc., and, later, red) and ornamentation as well as most masterly technique in execution. At Fostat, in Lower Egypt, lustred and unlustred ware was produced before the 12th century. We find among the Persian examples cylindrical vases, pear-shaped bottles, plates, tiles, bowls, mosque lamps, etc. In the Persian polychrome enamel-decorated ware of the 17th century we find dark blue, yellow, green, purple, red, black, turquoise, all on very white ground, with typical Persian decoration (arabesques, flowers, turbaned heads, figures, etc.). Such 17th and 18th century ware was produced in northeast Persia, Bokhara, Kirman, Kashan, etc. Practically all this ware had its body coated (*engobe*). The Mohammedan tiles (known in Arabic as *rojolos*) were very beautiful and utilized in covering outside spaces of the mosques as well as the internal wells. Grand effects are those presented in the Blue Mosque, at Tabriz (15th century) and at Khoda Bende Khan shrine at Sultanieh (14th century), etc. Spain produced glazed ware as early as the 8th century (mosque of Cordova has examples). Through its Moorish artists Spain produced lustre-ware, an industry doubtless derived from Oriental sources, at an early date, Calatuyad having both domestic and export trade in the 12th century. This same gold-lustre ware was produced in Malaga during the 14th century, and, by the end of the 15th century, Manises, near Valencia, was the centre for the gold-lustre ware industry, retaining its pottery kilns to the present day. The yellowish tin-glaze on Spanish majolica covers both the inside and outside of vessels. Color is mostly cobalt blue, but coats-of-arms show a sparse use of brown and violet. The great Alhambra vase and pieces of a similar character belong to the 14th century and were produced in Granada. This Hispano-Moresque art was continued by the Christians after the Moors were expelled, but it soon became decadent in merit. The Spanish colored glazed tiles (*azulejos*) had the centre of that industry, in the early period, in Seville, but no lustre-ware appears to have been made there. In the Spanish decoration predominating motifs were plant life, Arab scripts, figures of animals and concentric circles. The frequent display of heraldic coats-of-arms shows Christian tendency later. The ware consisted mostly of dishes, basins, ewers, vases, apothecary pots (*albarellos*), etc. Talavera, in the 16th to 18th centuries, produced tin-enameled ware prolifically. For some time, at least, Paterna, Quarte, Villelonga, Alaqua, Carcer, Moncada, etc., produced gold-lustre ware. The quality of the gold-lustre remained good into the 17th century though other ware became inferior long before. And the modern lustre shows coppery effect instead of the earlier pale gold tones. Alcora produced the best pieces. Sicilian (Siculo-Arabian) mezza-majolica ware dates back to the 9th century.

Majolica.— Italy imported her lustre-ware from Spain and the island of Majorca, apparently, till about the 15th century, but, by the middle of the 14th century she had started her own mezza-majolica fabriques and by the first half of the 16th century the industry was in its zenith, to become thoroughly decadent by the end of the 16th century. The recent discovery in Faenza of the piece decorated with Astorgio Manfredi (1393–1405) coat-of-arms and the documentary statement of the contemporary writer Pietro del Bono (1330) make it appear that Italy was producing opaque underglaze majolica in the 14th century besides her silicious transparent colored glazes (mezza-majolica). By the 16th century Italian majolica was being made in Pesaro, Urbino, Gubbio,

Caffagiolo, Treviso, Bassano, Nove, Padua, Candiana, Verona, Milan, Venice, Lodi, Turin, Genoa, Savona, Arbisola, Ferrara, Modena Reggio, Scandiana, Sassuolo, Siena, Pisa, Asciano, Monte Lupo, San Querigo, Castel Durante, Citta di Castello, Bagnolo, Faenza, Forli, Rimini, Ravenna, Bologna, Deruta, Fabriano, Spello, Viterbo, Rome, Capo di Monte, Naples, Grotaglia, Castelli in Abruzzo, Palermo and Catala Girone. Lustre-ware was produced only at Pesaro, Deruta, Gubbio, Urbino and Castel Durante; a few pieces made at Caffagiolo and elsewhere were experimental. The body of old Italian majolica is a buff-colored clay.

Gubbio.— This ware is famous for its lustre pieces. Those emanating from the studio (botega) of "Maestro Giorgio" (early 16th century) are all elaborately decorated and have a lustre surpassing all other wares. His metallic reflecting surfaces, Solon says, "pass from bluish-purple to ruby-red, from golden-yellow to emerald-green," his *madre-perla* is absolute perfection. Few Gubbio pieces bear any marks, but besides the before-mentioned Giorgio Andreoli were other Andreolis — Salembini, Giovanni and Vinzentio. The Gubbio fabrique was in decadent condition by 1551. The characteristic decoration of the ware consists of grotesques (*groteschi*), which the contemporary Picolpasso terms "a candelliere"; they contain artistically executed large scrolls (in yellow or brown) terminating in the heads of sea-horses, monsters, birds, etc., with cherub heads intermingling; trophies with mottoes surround busts. As centre-piece appears a genre or other scene. Human figures show weak drawing.

Urbino.— Under the powerful protection of Duke Guid'Ubaldo II this town took a leading position in the second half of the 16th century with its flourishing majolica fabrique and its remarkably artistic creations. As these pieces were produced for presentation to grandees and even sovereigns perfection of detail and talented elaborate composition were undertaken. So high is the artistic merit of some of the painting that it is claimed to have been from the designs of the great Raphael himself. Three artists are prominent in this work: Guido Durantino (or Guido Fontana), Francesco Xanto da Rovigo (both of these signed in full), the latter copied, with modifications, engravings after Raphael; and Orazio Fontana (son of Guido), whose drawings are characterized by a light outline in the blue color that was utilized in the flesh tints. The Fontanas did also peculiar grotesque decorations on a white background with very graceful effect, some having medallions of figures as centre-pieces. The Patanazzi family (end of the 16th century) were the last of the majolica painters of Urbino. Amongst Urbino motifs were figures, chimera, etc., also we find ornament in relief on salt boxes, inkstands, vases, coffrets, etc., of very decorative form. But the most remarkable production of Urbino was a series of vases designed by Battista Franco, 344 lovely specimens of which are in the Santa Casa de Lorette. The general belief in the claim of Vasari that the originator of the opaque tin-glaze in Italy was Luca della Robbia (1399–1482) has been shaken since the discovery of the Manfredi jug (mentioned above), and it is now supposed that Italian tin-glazed majolica was being produced by the 14th century at least.

Mexican Majolica.— Until about 10 years ago the fine specimens of old opaque tin-glazed majolica found in Mexico and sought for by collectors were supposed to be Spanish creations and imported by the colonists. Mrs. Robert W. deForest, with her fine collection of this ware (now donated to the New York Metropolitan Museum of Art), was led to take a generous interest in investigating the source of the product. And the late Dr. Atlee Barber of the Pennsylvania Museum, Philadelphia, by his researches disclosed the following facts: About 1526 the Spanish majolica technique was being taught to the colonists by Dominican friars from the Talavera potteries. In 1531 Pueblo de los Angeles started a pottery with Spanish artisans and became the centre of a large industry. Mexican-made enamel-glazed tiles were used, instead of the imported articles, to decorate the insides of the walls and also the exteriors of churches, hospitals, convents and even private houses. By 1653, as is shown by documents, the Mexican-made glazed pottery was equal to the imported and shipments from Spain were no longer in demand, and a potters' guild was established, to protect the industry in that year. By 1750 there were 30 prosperous potteries making three qualities of wares that they termed "fine, common and yellow." Five colors were used in fine ware, three in common ware. The best period was from 1650 to 1750. Specimens show two kinds of body — the white, soft, porous and the harder-baked red. The process used was that of baking the clay body first, then dipping in the tin enamel engobe and decorating over the enamel. The piece was then subjected to a second firing. The ware has been classified as follows: (1) "Hispano-Moresque" phase, up to the end of the 17th century. (2) "Spanish" or "Talavera" phase, from beginning of the 17th century to about end of the 18th century (showing Talavera influence). (3) "Chinese taste," done by copying pieces of imported Chinese porcelain, started 17th century and continued to end of 18th century. (4) "Hispano-Mexican" or "Puebla" phase, started about 1800 and lasted beyond 1850. Decadence followed, then extinction. The fourth style has green, yellow, purple, brown, red, black and later rose and mauve, in the decoration. Tiles have only three colors, blue, green and yellow, generally. The product consisted of chocolate or vanilla jars, vases, albarelli (drug pots), barrel-shaped flower jars, circular dishes, bowls, saltcellars, inkstands, basins, cup-holders, tiles, etc.

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CLEMENT W. COMBE.

MAJOR, Charles (EDWIN CASKODEN), American novelist: b. Indianapolis, Ind., July 25, 1856; d. Feb. 13, 1913. He was educated in the public schools and studied law, establishing a practice at Shelbyville. He contributed to various magazines and published *When Knighthood was in Flower* (1898); *The Bears of Blue River* (1901); *Uncle Tom Andy Bill* (1908); *Dorothy Vernon of Haddon Hall* (1902); *Yolanda, Maid of Burgundy* (1905); *Gentle Knight of Old Brandenburg* (1909); *The Little King* (1910); *Touchstone of Fortune* (1912).

MAJOR. *In military science,* the major is a field officer ranking next below a lieutenant colonel and above a captain. He has generally the command of a battalion, the exercises of which he superintends, and in action or on parade carries into effect the orders of his superior officer. The term in the French service has been superseded by that of *chef dè bataillon.* A brigade major is an officer who performs for a brigade, or in garrison, the duties ordinarily discharged by a major in a regiment or battalion. A major general ranks next above a brigadier general. In other cases, the term major, when applied as an epithet to the several denominations of men in an army, signifies the superior of the department; as sergeant major, the chief noncommissioned officer in a regiment, who assists the adjutant; drum major, the chief of the drum corps, etc.

MAJOR BARBARA, a play by George Bernard Shaw, published in 1907. The few men who have ever been able to look evil in the face without illusion have been called cynics, says Shaw and he has created Andrew Undershaft, millionaire munitions maker to prove his point. Barbara Undershaft, a major in the Salvation Army, is conscientiously determined to save the immortal souls of the poverty-stricken inhabitants of London's slums. Her fiancé, Adolphus Cusins, sometime professor of Greek, has joined the Salvation Army only to save Barbara for himself. Andrew Undershaft, Barbara's father is a powerful munitions maker who has been separated from his family for many years at the time the play opens. To guarantee their children a private income for life, Lady Britomart, Barbara's mother, calls Andrew Undershaft to their home. When it is discovered that Andrew's money, considered tainted because it is earned by war and carnage, can buy even the services of the Salvation Army, Barbara resigns her commission. Adolphus Cusins is persuaded to become heir to the munitions business and Barbara marries him, hoping to do God's work for its own sake among the munitions workers. Shaw's central theme is that poverty is the greatest moral crime and truest evil in the world. "The crying need of the nation is not for better morals, cheaper bread, temperance . . . but simply for enough money," the author states in the preface. Andrew Undershaft has completely removed poverty as a threat to the lives of his employees; therefore he is moral. Barbara and Adolphus, who represent the purely intellectual type, are both made to see that man's soul is beyond salvation, that there are no adventitious aids to dignity, as long as there is poverty or the threat of poverty. It is impossible, according to Shaw, for man to care about ethical or political considerations on an empty stomach.

MAJORCA. See MALLORCA.

MAJORITY. See ELECTIONS; PRIMARY, DIRECT; PRIMARY, PRESIDENTIAL PREFERENCE; VOTE, VOTERS, VOTING.

MAJUBA, mä-jōō'bä, **HILL,** an eminence in the extreme north of Natal, about 7,000 feet above the sea, the scene of the defeat of 648 British troops, with the loss of their leader, Sir George Colley, by a superior force of Transvaal Boers, Feb. 27, 1881. The attack was unexpected, and the Boers found the British resting after a night march and a climb of eight hours. The loss of the Boers was about 130, of the British more than 200 in killed and prisoners, besides many wounded and some missing. To the British nation the name Majuba Hill became a synonym for disaster. The anniversary of this fight was marked by the success of Lord Roberts, commander of the British forces in the campaign of 1900, when he received the surrender of the Boer commander, General Cronje.

MAKAH (CAPE PEOPLE), Indian tribe of Cape Flattery, Puget Sound, Washington. They are the southernmost tribe of the Wakashan stock and the only one within the boundaries of the United States. They are of the Nootka branch. They claimed a considerable territory between Flattery Rocks and Hoko, but ceded to the government all these lands except that in the immediate vicinity of Cape Flattery in 1855. The Makah reservation was defined in 1873, and an added reservation for the use of the tribe was established in 1893 and is known as the Ozette.

MAKAROV, Stepan Osipovich, Russian vice-admiral: b. Kiev, Dec. 29, 1848, d. April 13, 1904. He entered the navy in 1864 and received rapid promotion for distinguished services. During the Russo-Turkish War 1877–1878, he commanded the gunboat *Grand Duke Constantine,* and for a series of daringly successful attacks upon Turkish ports, which earned him the title of "the Cossack of the Sea," he was promoted captain of the second rank, aide-de-camp to the late Czar Alexander II, was decorated with the orders of Saint Vladimir and Saint George and received a golden sword of honor. In 1881 he took part with the legion of Mikhail Dmitrievich Skobelev in the capture of Geok-Tepe in which Gen. Alekséi Nikolaevich Kuropatkin also figured prominently. The same year he commanded the cruiser *Taman,* the station guardship of the Russian embassy at Constantinople, and made a careful and complete study of the defenses of the Bosporus. After the disastrous attack of the Japanese on the Russian fleet at Port Arthur in February 1904 Makarov, then vice-admiral, was sent to the Far East to direct the Russian naval operations, and arrived at Dalny March 8. He repaired and converted the blockaded squadron into an active aggressive naval force, but on April 13 was lured out of harbor by a decoy squadron. Discovering the Japanese main fleet trying to intercept him he at once returned and was about to enter the har-

bor, when his flagship, the *Petropavlovsk,* was destroyed by one of the sunken mines laid by the Japanese across the passageway, and Makarov, his guest, Vasili Verestchagin (q.v.), the famous war artist, 16 staff officers and over 800 sailors perished.

MAKART, mäk'ärt, **Hans,** Austrian painter: b. Salzburg, May 28, 1840; d. Vienna, Oct. 3, 1884. He began his art studies in the Academy of Vienna. In 1859 he went to Munich, and painted in the studio of Piloty, under whose teaching (1861–65) he developed remarkable talent as a colorist. His earliest success was a Rembrandtesque picture of *Lavoisier in Jail* (1862). His first work to gain him wide fame was his three-paneled picture, *The Seven Deadly Sins* or *The Plague in Florence,* which aroused a storm of adverse criticism, wonder and admiration in Paris and Germany. In 1869 the Emperor Francis Joseph built him a fine studio in Vienna, and he produced his series of *Abundantia* pictures, *Fruits of the Earth; Fruits of the Sea.* In 1873 followed the picture which attracted so much attention in the Exhibition of Philadelphia (1876), his *Venice Doing Homage to Caterina Cornaro.* He traveled in the East during the winter (1875–1876), and his Egyptian sketches materialized in his *Cleopatra, Antique Hunt on the Nile,* etc. His *Entry of Charles V into Antwerp* (1875–1878) gained a medal at the Paris Exposition of 1878 and his *Diana's Hunting Party* is one of the most successful of his larger paintings, combining superb coloring and modeling of the nude with grand landscape effect. It is in the Metropolitan Museum of New York and is most characteristic of the gorgeous sensuousness of a painter who woke the intellectualists of German art to a sense of color, and broke free from the traditions of a somewhat stiff and pedantic method, gaining in life and intensity what he sacrificed of academic correctness.

MAKE-UP. The last two decades have seen make-up progress from its early category of woman's conceit to become an art and an integral part of feminine beauty and psychology. Chief credit for this about-face in the acceptance of widespread use of cosmetics should go to the motion picture industry, which set new standards of beauty and, through its motion picture studio laboratories and experimentation on the screen itself, brought new products and principles of application and use to the world's women.

Make-up as troop camouflage was an important part of World War II. Topflight make-up artists were drawn into the armed forces to put their skill to work in prosthesis. Today, make-up picks up where plastic surgery leaves off.

The war proved that make-up forms a part of feminine morale. In hard-pressed England, cosmetics were named a luxury. When, as an experiment, lipstick was again provided for women defense workers, output increased and women's whole general attitude changed.

The basic principles for the application of make-up as evolved for motion pictures remain the same for street, black and white and color motion pictures, stage, black and white and color portraiture, and 16-mm. photography. Television make-up alone deviated at first, but it now follows stage principles to a degree.

Street Make-up for Women.—The principles of corrective make-up are based on the classification of women's faces into seven different types: oval, square, round, triangle, oblong,

COLOR CHART

Skin	Foundation	Powder	Lipstick	Cheek rouge	Hair
Blonde light skin	Natural (very light)	Lightweight non-coloring	Light orange-red	Light orange-red	Light blonde
Blonde, medium skin	Faintly pink	Lightweight non-coloring	Pale strawberry	Pale strawberry	Medium blonde
Blonde, sallow skin	A light blue-red	Lightweight non-coloring	Light blue-red	Light blue-red	Dark blonde
Blonde, reddish skin	A peach buff	Lightweight non-coloring	True pepper red	True pepper red	Ash blonde
Blonde, dark skin	A warm copper	Lightweight non-coloring	Medium blue-red	Medium blue-red	Reddish blonde
Red head, light skin	A faintly pink or light blue-red	Lightweight non-coloring	Pale strawberry	Pale strawberry	Strawberry blonde
Red head, medium skin	A pale peach buff	Lightweight non-coloring	True pepper red	True pepper red	Copper blonde
Red head, sallow skin	A warm rose glow	Lightweight non-coloring	Medium blue-red	Medium blue-red	Medium red
Red head, reddish skin	A peach buff	Lightweight non-coloring	Medium blue-red or pale strawberry	Medium blue-red or pale strawberry	Light auburn
Red head, dark skin	A warm copper	Lightweight non-coloring	True pepper red	True pepper red	Light brown
Brunette, light skin	Faintly pink or a light blue-red	Lightweight non-coloring	Medium blue-red	Medium blue-red	Medium brown
Brunette, medium skin	A pale peach buff	Lightweight non-coloring	Medium blue-red or a pink-red	Medium blue-red or a pink-red	Dark brown
Brunette, sallow skin	A warm rose glow	Lightweight non-coloring	Medium blue-red	Medium blue-red	Henna brown
Brunette, reddish skin	A peach buff	Lightweight non-coloring	Medium blue-red or a pink-red	Medium blue-red or a pink-red	Black
Brunette, dark skin	A warm copper	Lightweight non-coloring	Deep blue-red	Deep blue-red	Dark gray
Gray, light skin	Light blue-red	Lightweight non-coloring	Light blue-red	Light blue-red	Medium gray
Gray, medium skin	Faintly pink or a warm rose glow	Lightweight non-coloring	A light blue-red	A light blue-red	Light gray
Gray, dark skin	A peach buff	Lightweight non-coloring	A pink-red	A pink-red	White

Note:—A peach buff foundation is particularly good for summer-to-winter transition on any type, and is flattering to ruddy, sallow or freckled skins.

inverted triangle, and diamond. In straight make-up the attempt is always to create the illusion of the perfect, oval contour. Cheek rouge is the greatest single factor in corrective street make-up, because it absorbs light. All make-up should be used in minimum, and no street make-up should ever appear obvious or blatant. Cosmetic items should be chosen to match skin tones and to complement the color of hair, eyes, and skin.

It is well for teen-age girls to remember that women in the middle twenties and upward use make-up only to achieve the appearance of fresh, youthful skin. The author does not approve of girls from 12 to 14 using other than a light coating of lipstick. From 14 to 16 they may augment this with a little powder and a very light application of cheek rouge for evening.

It is of great importance that women past 35 remember that as the years pass, their skin is undergoing a change, gradually becoming lighter. By the same token, they should begin to turn to the lighter shades of rouge and lipstick. Women in their sixties, for instance, are most flattered by a cameo-pink shade. Dark tones against a light skin are harsh and aging.

In preparing for application of a street make-up, the skin should first be cleansed with two applications of cleansing cream removed with tissue. Skin freshener should then be patted over the face with absorbent cotton. Freshener should not be allowed to remain on the face, but in turn should be patted off with tissue or a soft towel.

The choice of base make-up depends both upon the subject's age and skin type. For normal skins, choice is optional among cream foundations, liquid-cream, or lanolin cake. Cream foundation is best for dry skins, because it acts as a daytime lubricant. For oily skins, too, either a cream or liquid-cream foundation is advisable, because such bases allow normal oil excretion and absorb it. In overactive areas around the nostrils and on the chin when shininess becomes apparent, pressing those areas with tissue to remove excess oil and then repowdering keeps make-up looking perfect throughout the day.

The subject's choice of base is then applied in minimum, and the manufacturer's direction for use should be followed closely. The base should be smoothed over the face to form a thin, equally distributed film and should be carried over and under jaw and chin lines and blended out so that no line of demarcation is apparent. In application, an upward, outward circular motion, the fundamental massage movement, should be used. This same movement should be used in all cream applications and in washing face and neck, because it tends to keep tissue firm. Downward pulling movements weaken underlying tissue and promote sagging and wrinkles.

Next and probably the most important step in street make-up is the application of cheek rouge. There are two types: cream and dry rouge. Cream rouge should never be applied over a dry base, that is, cake. Dry rouge only should be used. Cream rouge should be used directly over cream and liquid-cream foundations *before powdering*. Dry rouge is used after powdering if it is found that insufficient cream rouge has been used. Application should be with a large art brush or powder brush, dusting the color on lightly over the same area originally covered with cream rouge.

Cheek rouge on the face should seem never to end. In other words, its use should be so subtle that it appears only as a faint, natural blush and no definite area of application should be apparent. The edges of the rouge area should be blended subtly into the surrounding foundation area by patting with the fingers. The value of cheek rouge as a corrective make-up item cannot be overemphasized. Because it forms a shadow and absorbs light, its proper use can camouflage a square face, add width to a thin face. (See Face Type illustrations.) Study of the average face and comparison with the Face Type illustrations will indicate to the individual the area of proper application.

Eyeshadow is applied sparingly on the center of the eyelids, and is blended outward to the corners of the eyes and upward to the eyebrow line. It should not be used on the inside corners of the eyelids next to the nose. Preferably, eyeshadow should be one of two natural shades, to match the eyes: blue-gray or brown. Any other shades, such as green or purple, destroy the natural appearance of the make-up.

Powder is an important finishing step in any make-up. If a base is used, the best choice is a lightweight, noncoloring foundation powder. This type does not add to or distort the color of the base. Being feather-light, its use does not provide a mask-like appearance. If no foundation make-up is used, a medium-weight, tinted powder should be used.

Whether or not a base is worn, powder should always be patted onto the face. Rubbing does not provide a smooth application. This is especially true when it is employed over any type of foundation. Powder should be used generously over the face, the patting procedure continuing until the base has absorbed as much powder as is necessary to "set" it. Excess powder is then removed with a powder brush, baby brush, or piece of absorbent cotton. A small, stiff-bristle brush should be used to remove powder from the eyebrows and around the hair line.

Eyebrow pencil should be used only when eyebrows are colorless or sparse, or when additional arching is needed. The pencil should never be used in a single, hard, continuous stroke. It should be sharpened to a flat point, and application should be with quick, short hairstrokes. After application, a small, stiff-bristle brush should be used to soften the outline.

Now if it is found that insufficient cream rouge was used, dry rouge is used to retouch the cheeks and is powdered over for smoothness.

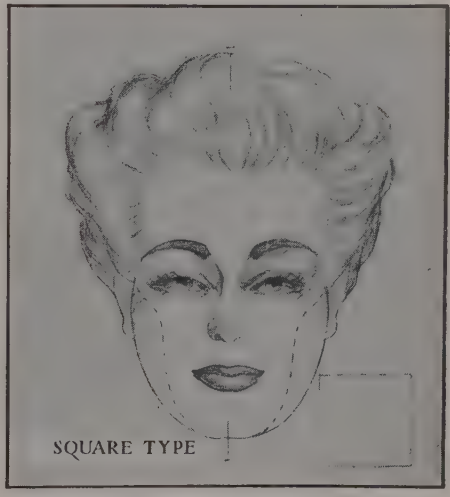
Proper application of lipstick is an art that should be practiced, because the mouth can so easily detract from or add to an illusion of beauty. Study of the face type illustrations will indicate correct mouth make-up according to type of face. In this manner, lipstick is used as a corrective cosmetic. Since the ideal mouth has perfect balance between upper and lower lips, the aim in employment of lipstick should be to camouflage too thin or too wide lips. This is done by drawing a new outline either above or below the normal lip outline. Lips should always be made up in a gradual curve. A mouth should never appear as a "cupid's bow" or as a wide splash of sulky color. Lips should be perfectly dry before application is started.

For the best results, a No. 5 art brush should be used as a dressing table brush during the initial make-up of the day. Once the correct outline of the lips is established, purse brushes

This type, with the forehead slightly wider than the chin, is considered the ideal. *Moist Rouge:* Apply in the center of the cheek, blend upward over the cheekbones toward the temple. *Lipstick:* Follow the natural lines of the mouth, retaining a full lip curve. *Eyebrows:* Retain a natural eyebrow line. Regardless of face type, the eyebrows should always start directly above the inside corners of the eyes. *Hair Style:* Retain the oval outline in coiffure; styling should be simple, with the hair drawn back from the forehead.

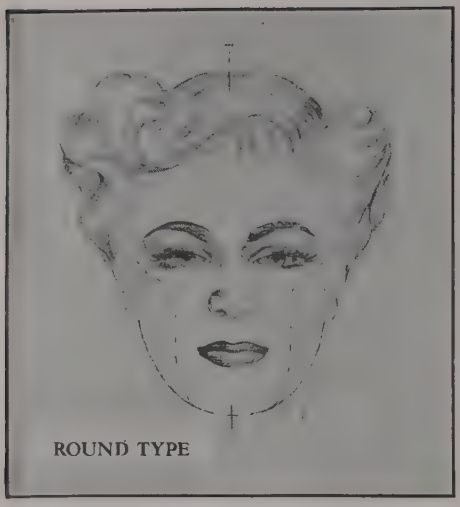
This type has a narrow forehead, high and wide cheekbones, and a narrow chin. *Moist Rouge:* Apply on the highest point of the cheekbone, blend carefully in a circular field. *Lipstick:* Gently curve the lips to moderate width, thereby adding an appearance of breadth across the lower part of the face. *Eyebrows:* Arch slightly. *Hair Style:* Keep fullness of hair above and below the ears. Hair should be combed back from, and dressed closely at a point even with the cheekbones. Use a short, diagonal part to give an appearance of greater forehead width.

This type has a wide forehead and a narrow chin line. *Moist Rouge:* Apply to the highest point of the cheekbone, carrying it upward toward the temple. *Lipstick:* Softly curve the upper lip; balance it with the lower lip for natural contour. *Eyebrows:* Retain the natural shape with a suggestion of an angle to disguise width of forehead. *Hair Style:* Retain simplicity on the crown. Begin fullness at a point above the ears and back of them. Greatest fullness should be even with the mouth line, making the lower part of the face appear wider.



This type has a straight hair line and a square jaw line. *Moist Rouge:* Apply in a circle under the eye's outer corner; blend toward the ear and down the jaw line very lightly to create a shadow on the lower face. *Lipstick:* Carry to the mouth's natural corners to reduce the width of the lower face. Curve the lips, with an upward tilt at the corners. *Eyebrows:* Arch slightly. *Hair Style:* Dress softly and loosely. An upward, balanced sweep from the temples minimizes squareness of features. Height is provided to add length to them.

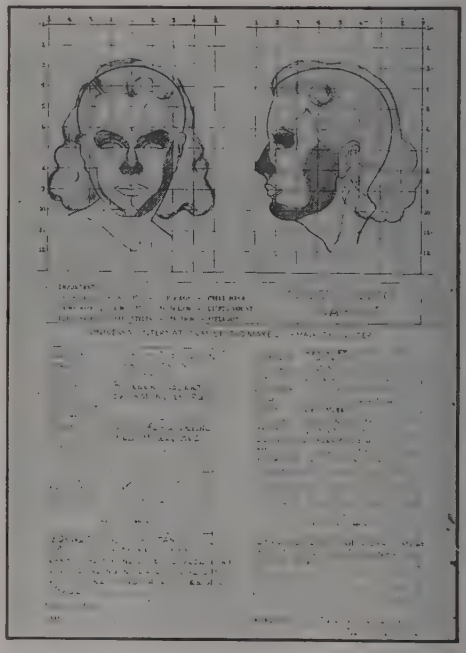
MAKE-UP



This type has a round hair line and a round chin. *Moist Rouge:* Use the darkest tone that blends with the complexion on the outer part of the cheek, carrying it toward the temples and down to shade the jaw faintly. *Lipstick:* Carry to the mouth's natural corners to reduce width across the lower face. Make up lips delicately with a natural curve. *Eyebrows:* Avoid a simple curve by arching subtly to a slight center angle. *Hair Style:* Avoid severity, and retain a soft outline at hair line. Create an illusion of length with a fullness above the ears.

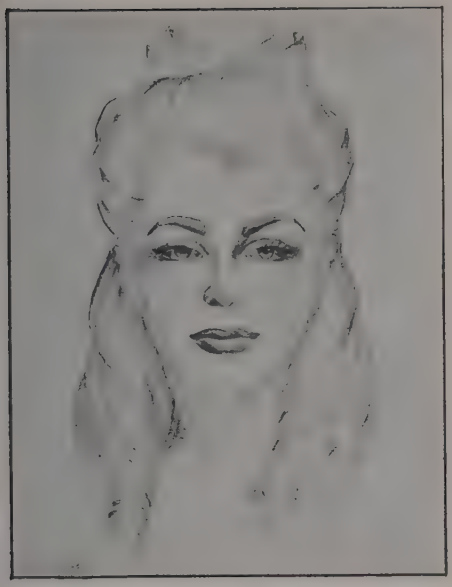
A long, narrow face with hollow cheeks is characteristic of this type. *Moist Rouge:* Apply in a carefully blended circular area in the center of the cheek, avoiding cheek hollows. *Lipstick:* Retain a natural outline. The lower lip should remain full at the corners of the mouth. *Eyebrows:* Follow the natural, structural eyebrow line. *Hair Style:* Style hair closely to the top of the head to reduce length of features. Create fullness behind the ears on a line even with the mouth to provide an appearance of greater facial width.

This type has a narrow forehead, a wide jaw and chin line. *Moist Rouge:* Apply in a modified triangle, shading up to the temple and blending faintly over the jaw line. Rouge should cover the outer half of the cheek. *Lipstick:* Carry to the natural corners of the mouth, and use a gently curved, perfectly balanced lip line. *Eyebrows:* Counteract squareness with a gentle curve, natural in width. *Hair Style:* A soft, fringe bang makes the forehead seem wider. Bring it into balance with an upward sweep from the temples.

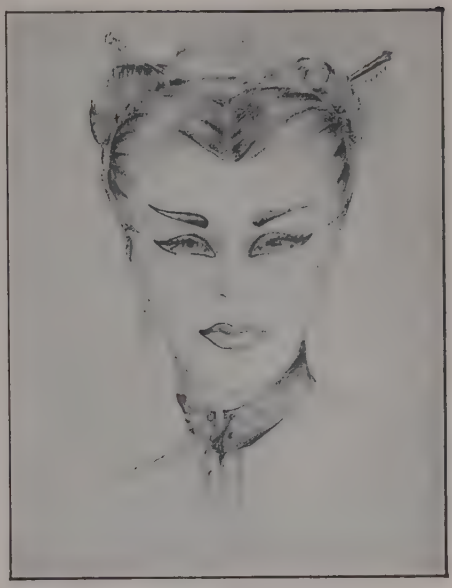


A chart made by a master make-up man during make-up tests for motion pictures. Indicating the areas for make-up and listing the proper types, it provides a key for future work.

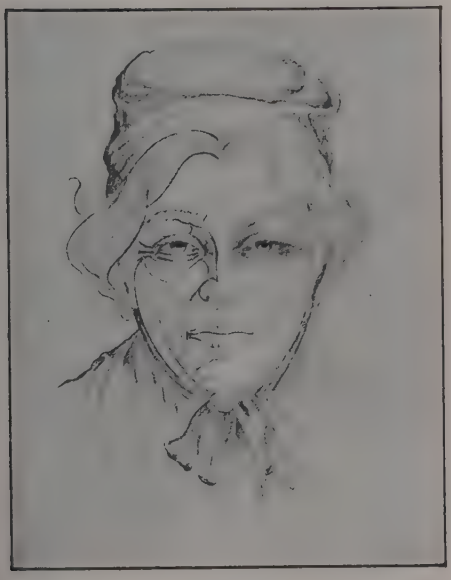
MAKE-UP



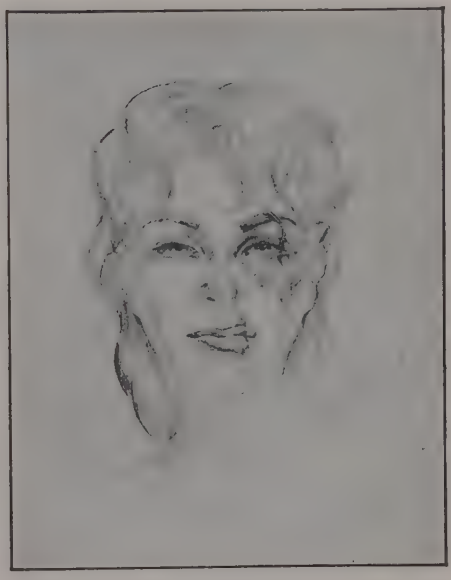
STRAIGHT



CHARACTER



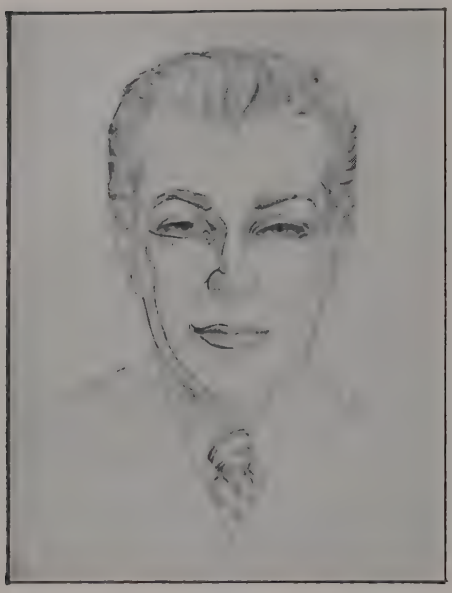
ELDERLY



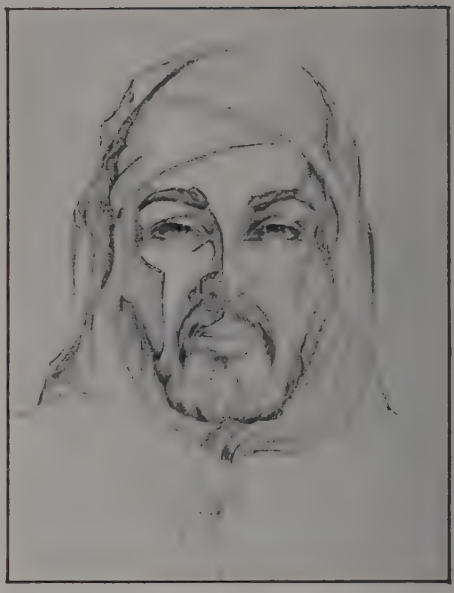
GROTESQUE

Feminine Theatrical Make-Up: These four drawings illustrate the basic principles of feminine theatrical make-up for the professional or amateur theater. The same model was used for each sketch, demonstrating how one person can be made up for each of the four basic types: straight, character, elderly, and grotesque. Detailed instructions for applying make-up, and the requirements, will be found in a subsection of the accompanying article.

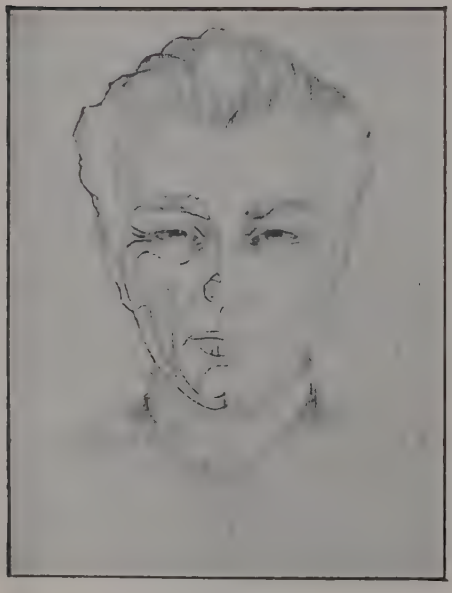
MAKE-UP



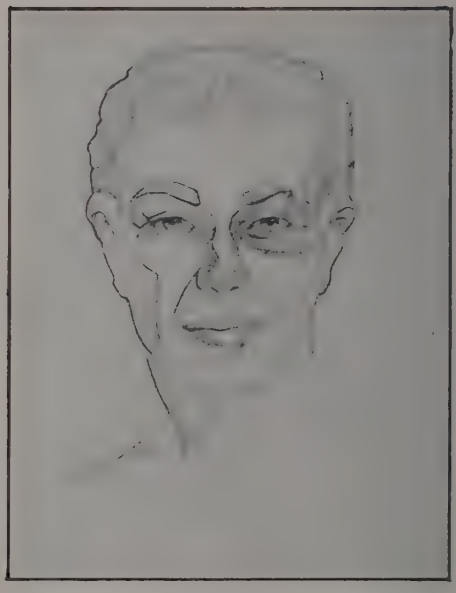
STRAIGHT



CHARACTER



ELDERLY



GROTESQUE

Masculine Theatrical Make-Up: These four drawings illustrate the basic principles of masculine theatrical make-up for the professional or amateur theater. The same model was used for each sketch, demonstrating how one person can be made up for each of the four basic types: straight, character, elderly, and grotesque. Detailed instructions for applying make-up, and the requirements, will be found in a subsection of the accompanying article.

or the stick itself can be used throughout the day to renew color. The art brush should be balanced by placing the elbow of the brush-wielding hand on the dressing table and the little finger against the chin. Using the flat of the brush, application should begin at the center of the upper lip and the outline drawn in a gradual curve to end *just before the corner of the mouth is reached.* This should be a continuous, hard stroke. When the upper lip has been completed, the flat of the brush is again employed on the lower lip, starting at the extreme corners of the mouth and drawing toward the center of the lip. On both upper and lower lips, if any outline irregularity is noticeable, the tip of the brush may be employed for final correction. The purpose of ending the upper lip outline within the actual corners of the mouth is to prevent a drooping line.

Upon completion of application, tissue should be placed between the lips; then should be pressed against the lips to remove excess color. The latter process should be continued until color fails to leave a tissue impression. When lips are too wide for beauty, foundation should be carried over the normal outline and powdered over as with the remainder of the face. This disguises normal outline, and lip rouge is employed in a corrective outline.

Mascara is the last step in a street make-up. It is preferable in most instances to apply it only to the tips of the upper lashes. If the eyes are inclined to be close together, it is applied only from the center of the eyes outward to the corners on both upper and lower lids.

Motion Picture Make-up.—*Black and White Photography.*—The actual steps in make-up and cosmetics used, with exceptions of cream rouge and shades of foundation, remain identical with those outlined for street make-up. Because cheek rouge creates a dark shadow in black and white screen photography, no cream rouge is used. When a feminine star's make-up is completed, a very light dusting of dry rouge is made simply for mental "lift." The amount of make-up used is comparatively the same as used for a good evening make-up.

Corrective make-up application is based on the premise that shadow absorbs light; highlights reflect light. Thus, to minimize any structural prominence a dark foundation would be used; to bring structural weakness into relief, a light foundation, or highlight, would be used. In the examples which follow, a shadow is a color three to five shades darker than the overall base color, and is applied before the highlight. A highlight is three to five shades lighter than the overall base and is applied after the shadows and before moist rouge and powder. (For corrective street make-up, highlight is one to two shades lighter than overall base; shadow, one to two shades darker.)

If a chin has a tendency to recede, we use a foundation three shades lighter than that used on the remainder of the face. Where the two shades meet, they are blended expertly together by patting with the fingertips. Creation of such highlight on the chin brings it into a stronger relief. A sagging, double, or prominent chin is disguised with use of a dark foundation.

When a protruding forehead is a problem, we choose a foundation three shades darker than that used on the remainder of the face, follow the same blending process. The darker foundation becomes a shadow, accepts light, thereby minimizing forehead prominence.

In contradiction to the foregoing use of shadow, a darker foundation is never used on a large, prominent nose. Use of shadow in such a manner would appear as discoloration. The size of the nose is minimized by using a lighter foundation on the cheeks at the sides of the nose, blending it off across the upper lip immediately under the nostrils. The nose itself and the remainder of the face are made up with a foundation cream that matches the normal skin tone, creating an illusion of fullness in the cheeks to minimize the nose. If a nose is short and flat, then a lighter foundation cream is used from the point between the eyes, straight down the bridge to end at the nose tip.

When the greater prominence lies in the cheekbones, a dark foundation is used over the cheekbones, a light foundation in the hollows of the cheeks and the recessions at the temples. The remainder of the face is made up with foundation matching normal skin tone.

These examples best explain the principles of corrective make-up and the use of highlights and shadows.

In the creation of a straight character make-up for the screen, where latex (sponge rubber) is not used to change facial structure, the subject's face is treated as an artist's canvas. An overall base, or primer (regular man's or woman's base color), is first applied to face and neck. Using artists flat sable brushes, numbers ranging from 1 to 20, highlight and shadows are applied in broad brush strokes, and are then blended with the fingertips. Wrinkles are accentuated with pencil. To promote an appearance of age on the mouth, base is carried over the lips, and pencil is used to stress normal lip wrinkles. Hair whitener is used to age eyebrows and temples. If a white head of hair is desired, a wig is used.

To create an age make-up, all hollows, crevices, and lines of expression are first covered with a dark brown foundation. When this procedure is finished, the face should somewhat resemble a skull. The subject's forehead is then forced into the deepest possible wrinkles, and all foundation is carefully wiped off the mounds of the wrinkles. As a result, the brown base is retained in the wrinkle crevices. Next, the subject squints one eye to obtain the deepest possible corner wrinkles, then the other, and the same procedure outlined above is followed. Then the lips are pursed, and the same method is followed on the wrinkled area surrounding the mouth. With completion of the mouth, all wrinkles and natural expression lines are accentuated.

Choice of shade for overall foundation would be dependent on the character to be portrayed. If a ruddy skin is characteristic, then a dark basic color (two shades lighter than wrinkle base) would be used; if pale, a lighter shade of overall base. Overall base should not be used in the shadow areas, such as temples and cheek hollows.

Shadow work now comes into play. In the wrinkling process, dark brown foundation was used in all hollows, including temples and cheeks. These same areas are now retraced with shadow. Care should be taken not to disturb the original application. Shadow placement is at the temple line, inside corners of the eyelids, down the outside planes of the nose, and from the nostrils to

the outside corners of the mouth. For extreme gauntness, shadow is applied in the cheek hollows.

Highlights follow shadows. Previously applied foundation is retraced with highlight; when it crowds onto the wrinkle areas, the wrinkling process should be repeated so as not to destroy previous work. Highlight coloring should be applied to all protruding points of the head's bone structure, that is, frontal forehead bones, nose bridge, cheekbones, nostril sidewalls.

Eyeshadow should be used only in the inside corners of the eyelids. On men, red foundation is used on the lower eyelid ledge, but is not extended beyond the outer corner of the eye. On women, no lining of any kind is used.

For powdering, use plain talc and repeat the entire wrinkling process while powdering. Excess powder is removed with a powder brush.

On men, no lip rouge is used; on women, very little is used, and the lower lip is thinned and the corners droop.

Hair whitener is used on eyebrows to conform with hair. No mascara is used and powder is allowed to remain in the lashes.

To age the neck, chin and neck are stretched backwards, and shadow is applied on either side of the neck cords. After shadowing, highlight is applied to the mounds of the cords. The chin is then dropped, and revealing lines or wrinkles are traced with brown pencil, and the mounds of the wrinkles highlighted.

In straight make-ups, no hand make-up is used unless the general make-up is very dark or very light. Hands should then be made up to match the face, because dramatic action often brings hands into play close to the face. To age hands, shadows are created between the sinews and veins. Hands are hung in a drooping position until the veins are outlined, and blue shadow is then used on the veins proper and between the sinews. The hands are then closed into fists, the tops of the knuckles highlighted, and from the ends of the fingers, a highlight is carried back to the wrist, accentuating sinews and cords of each finger. No overall base is used.

Historical character portrayals or extreme old age make-ups (Agnes Moorehead in *Lost Moment*), where change of bone structure is needed for the first and sagging and loose tissue for the latter, are handled with the use of latex (sponge rubber), otherwise called appliance make-ups. Appliance make-ups are very effective, but they are prohibitive from the standpoint of cost to the layman. Not only does their employment demand a complete laboratory set-up, but the formulas themselves are secret, varying with various requirements.

Make-up as such, however, is applied in exactly the same way over rubber as described in the foregoing. It is also the same make-up, with the exception of the base. Known as rubber grease, it is an evaporated oil base, necessary because any regular oil base discolors and deteriorates rubber.

Color Photography.—Continued experimentation with color film has necessarily brought about some changes in make-up principles. Where formerly the basic tone for a screen color make-up was light gray, the basic tone now is a light gray-green which is warmed with the desired shades through the use of primary mixing colors. The mix is according to part requirements and the story setting. For instance, if it is an outdoor picture, men's make-up would have a tendency to be on the brown side. Bases for women are brought up to the desired pink tone, dependent on individual coloring, although if it is an indoor, or drawing-room type of picture, the mix has a pinker tone. Only pre-picture testing can prove or disprove a correct color make-up.

The amount of corrective work done for color motion pictures is held at a minimum. While the principles remain the same, shadows and highlights must be handled much more subtly. Very little shadowing is done, and any highlights or shadow used are mixed with the base color so that only a suggestion of their use remains after application. Great pains are taken in blending highlights and shadows, since absolutely no hint of demarcation can remain. By the same token, any latex appliances used must be extremely subtle.

All color make-up is applied in absolute minimum, a straight make-up for women, for instance, utilizing only about half the amount of that customarily used for a street make-up. For women, both moist rouge and dry rouge are used, the former directly over the base and before powder; the latter after powder. Moist cheek rouge is first mixed with base color to avoid a "hot" rouge color. Matching colors in lipstick and cheek rouge are of the greatest importance, and those used for women are on the cameo-pink side because of the intensification of red in photography.

No cheek rouge is employed on men, and any lipstick is on the brown side. Applied very lightly, it is wiped off, the very limited residue serving to provide a faint definition.

Brown eyebrow pencil is used. All desired depth is acquired with brown. The use of black pencil results in an undesirable harshness. Mascara, too, is preferably brown, although sometimes there is occasion to use a dark brown shade on a very dark brunette.

Powder must be neutral (foundation powder) so that color value of base tones, highlights or shadows is not changed.

Stage Make-up.—Basic principles of application remain the same as for black and white photography. However, because at a distance of 40 feet a performer's face loses audience perspective, stage make-up must exaggerate the essential features.

Stage lighting is extremely important in judging stage make-up. A straw-colored light will dull blue and pink; blue light changes rouge to purple and deadens pink and yellow; a light pink spotlight on an actor's face will intensify all pink and red tints in his make-up, and tend to wash out the yellows and blues. Stage make-up, therefore, is better inspected under actual stage illumination than under dressing room lights.

The liquid and paste bases used for stage make-up run from flesh color through healthy sunburn for juvenile men; for older men, flesh through the lighter sallow shades. Standard for young leading ladies is peaches-and-cream, and a light sallow for older women.

Shadows range from dark through light brown; dark through light gray; medium blue through light gray and blue-gray. Both eyebrow pencil and mascara are black.

Powder, with the exception of character make-up requirements, should match the overall base color. For character make-up, base-colored powder is mixed in the proportion of one-third base color to two-thirds plain talc. Such a mix-

ture effectively reveals all highlight, shadow, or corrective work that has been done. For extreme old age, plain white talc is used. Because it is transparent, it not only reveals highlight and shadow work, but adds the white appearance of aged skin.

Adhesives in use include gutta percha, spirit gum, and resin, the last diluted with alcohol. These are used to fasten on wigs, moustaches, and beards, where hair is already on a piece. Nonflexible collodion is used over fish skin to create scars. Flexible collodion (collodion with 20 per cent castor oil mixed) can be used over cotton, before the base color, to provide a firm surface for a necessary change of facial contour. Application before foundation prevents base make-up absorption and allows retention of the modeled shade. Neither collodion nor nonflexible collodion should be applied directly to the skin. Rubber liquid adhesive can be used with cotton modelings. It is applied directly on the skin to hold the cotton, as well as on the cotton before application of the flexible collodion.

Feminine Stage Make-Up.—The basic role of stage make-up is to exaggerate the essential features of the character to be portrayed. The treatment of the hair and the selection of the costume, naturally, contribute tellingly to the final effect. The following instructions apply to the illustrations accompanying this article, on which are shown examples of the four basic types of feminine stage make-up: straight, character, elderly and grotesque.

Straight.—(1) Overall base: liquid pink (peaches-and-cream) applied sparingly to the exposed areas, the eyelids, neck and ears, inside and out.

(2) Shadow: Two shades darker than the base.

(3) Highlights: Two shades lighter than the base. If, however, the shadows and highlights are used for corrective purposes, apply them sparingly and blend them into the overall base, leaving no line of demarcation.

(4) Eye shadow: Blue-gray, green or brown. Apply over the base before powdering, but use only enough to define the color, about three times as heavy as used for the street.

(5) Eye liner: Black pencil. Use to line the eye at the upper lash line, extending the line a quarter of an inch beyond the outer corner of the eye. Line the lower lash line, starting at a point below the middle of the eye and extending a quarter of an inch beyond the corner, leaving a quarter-inch space between the upper and lower black lines. Blend with a small dry brush. Apply white foundation (clown white) with a make-up stump on the ledge of the lower eyelid, and extend it beyond the corner of the eye into the space between the upper and lower black lines. The eyes will then retain an "open" appearance.

(6) Cheek rouge: Very bright. Smile, and place moist rouge on the high point of the smiling cheek, as indicated in the illustration. Carefully blend the rouge under the outside corner of the eye up into the temple area and downward onto the lower cheek. Use three times the amount used for the street.

(7) Powder: Pat peaches-and-cream powder generously over the entire area and brush away the excess. Remove the surplus from the eyelids with absorbent cotton.

(8) Mascara and evebrow pencil: Black, no matter what the individual's coloring. If the hair coloring is very light, apply very lightly. If the eyes are small, use mascara only on the tips of the lashes. The eyebrow should never be higher above the eye than the normal opening of the eye itself.

(9) Lip rouge: Very bright. The mouth should be sharply defined and made up with full, round and curved lines. The corners should turn upward.

Character.—Character make-up is really a matter of portrait painting; a new personality is painted over the performer's face. As in the case of the Chinese make-up which is illustrated, a photograph or other likeness is obtained and a duplicate painted on the face. The placement of rouge and the treatment of the eyes and eyebrows in the illustration should be carefully noted. Black liner is drawn from the inner corner of the eye over the upper lid to end in an upward tilt about half an inch from the outer corner. The lower lid is lined in the same fashion, with the points of the lining meeting at both inner and outer corners to achieve an olive shape. One half of the normal eyebrow is covered with overall foundation and a thin, slanting brow, drawn in with black pencil, replaces it.

Elderly.—(1) Base for wrinkles: Dark brown. First cover all hollows, crevices and lines of expression with a dark brown foundation. Then wrinkle the forehead and wipe the foundation off the mounds of the wrinkles so that the brown color is retained in the crevices. Next, squint one eye and then the other to the fullest extent, and purse the lips, following the same procedure around the mouth.

(2) Hair whitener: Use this for graying or whitening hair. (A wig is used in the illustration.)

(3) Overall base: Peaches-and-cream, or lighter, according to character. The overall base should not be used in shadow areas (see illustration), such as temples and cheek hollows.

(4) Shadow: Light brown. In applying the base for wrinkles, dark brown is used in all hollows, including the temples and cheeks. These areas should be retraced with shadow, using care not to disturb the earlier application. Shadows are placed at the temple line, on the inside corners of the eyelids, down the nose planes, and from the nostrils to the outer corners of the mouth. If an extreme gauntness is desired, shadow should be placed in the cheek hollows.

(5) Highlights: These should be practically white. Retrace over the overall base previously applied, giving highlight coloring to all protruding points of the head's bone structure, such as the frontal bones of the forehead, the cheekbones, the bridge of the nose, and the walls along the sides of the nostrils.

(6) Eye shadow: Blue-gray or gray. Apply only in the inside corners of the eyelids. The outside bulge of the upper lid is highlighted to give an appearance of heaviness.

(7) Cheek rouge: Pale, or omitted, according to character.

(8) Powder: Plain talc. The wrinkling process must be repeated when powdering.

(9) Lip rouge: A minimum is used. The lower lip is thinned more than in a younger character and the corners droop.

Hair whitener may be used on the eyebrows, as in the illustration, to conform with the hair.

In cases of extreme make-up, the overall foundation is applied to the eyebrows. Any powder should be allowed to remain in the lashes. No mascara or eye liner is used.

Grotesque.—Following a portrait-painting procedure, extreme use of highlight and shadow is made deliberately, applied with a brush over the basic foundation. The center area of the brush stroke must retain the full density of color. At the edges, however, shadow or highlight become a part of the overall foundation, being carefully blended with the finger tips to avoid any line of demarcation. The mouth contour is further changed by the use of lip rouge, as in the illustration. In the creation of a scar, fishskin is used as a base to prevent burning the skin, and is applied before the make-up. After determining the scar area, cut the fishskin one inch wider and longer than the scar. Tear the edges carefully to blend with the skin and affix with spirit gum. After it is placed, create the desired scar on the fishskin with nonflexible collodion.

Masculine Stage Make-Up.—The following instructions apply to the illustrations accompanying this article, on which are shown examples of the four basic types of masculine stage make-up: straight, character, elderly and grotesque. References below apply to the preceding subsection of this article, *Feminine Stage Make-Up.*

Straight.—(1) Overall base: A healthy tan. Apply sparingly to the exposed areas, the eyelids, the neck and back of neck, and the ears, inside and out.

(2) Shadow: Two shades darker than base.

(3) Highlights: Two shades lighter than base. If, however, the shadows and highlights are used for corrective purposes, apply them sparingly and blend them into the overall base, leaving no line of demarcation.

(4) Eye shadow: Dark brown on blonds and black on brunets. It is used to create contrast for the whites of the eyes. Apply sparingly, with full density at the upper lash line. It must be blended with the base color at the upper limit of the eyeball.

(5) Eye liner: Use black lining pencil. Follow procedure outlined for feminine straight make-up.

(6) Cheek rouge: Rust color. In applying, start at the high point of the cheekbone and blend carefully down over the jaw line. Avoid a harlequin look. Use three times the amount of color used for a woman's street make-up.

(7) Powder: A healthy tan. Apply generously, brushing off the excess. Remove the surplus from the eyelids with absorbent cotton.

(8) Mascara and eyebrow pencil: Black mascara may be brushed both on lashes and eyebrows, or a brown or black eyebrow pencil may be used to emphasize the eyebrows. Angular eyebrows give an impression of dramatic masculinity.

(9) Lip rouge: Very dark. Men seldom need lip rouge for the stage. When necessary, a very dark shade should be used to indicate the desired shape and then wiped off, leaving only a faint trace. Too much lip rouge on a man can defeat an entire characterization.

(10) Dry cheek rouge: A small amount of rust-colored rouge should be used over the powder to retrace the moist rouge area.

Character.—Follow the feminine character make-up procedure, noting the shadow and highlight work on the accompanying illustration.

For artificial beards and mustaches, use crepe hair, which comes in variously colored braids. The complete make-up is applied over all areas of the face, except those where the artificial hair is to be used, before the beard or mustache is applied. Paint the hair area with spirit gum and allow it to dry. Pull the prepared crepe hair together in a point, paint the hair area with a second coat of spirit gum, and affix the hair. When the spirit gum has set firmly, comb the hair together and trim with scissors to the desired contour. The same method is used for applying eyebrows or in changing the front hairline. Crepe hair may be whitened just like natural hair.

Elderly.—(1) Base for wrinkles: Dark brown. Follow the feminine elderly make-up procedure.

(2) Hair whitener: Use for graying or whitening hair. The older the character, the further over the hair should be parted.

(3) Overall base: This depends on the character to be played. If a ruddy skin is desired, a dark basic color two shades lighter than the wrinkle base should be used. For a pale skin use a lighter shade of overall base. The overall base should not be used in shadow areas, such as the temples and cheek hollows.

(4) Shadow: Two shades darker than the overall base. Follow the feminine elderly make-up procedure.

(5) Highlights: Two shades lighter than the overall base. Follow the procedure outlined for feminine elderly make-up.

(6) Eye shadow: The same color as the overall base, or darker, depending on the character. It should be used only on the inside corners of the lids.

(7) Cheek rouge: Very light, or none, depending on the character. If used, dry rouge should be applied only to the high point of the cheek, after powdering.

(8) Powder: Use a plain talc. Repeat the entire wrinkling process when powdering.

(9) Tooth enamel: Black tooth enamel may be used to black out teeth. To fill or match teeth in exact color, apply white tooth enamel and allow it to dry.

No eye liner is used. A red foundation should be used on the lower eye ledge, extending no further than the corner of the eye. No mascara or eyebrow pencil is used. Apply hair whitener to the eyebrows. Allow powder to remain on the lashes. No lip rouge is used; the overall base should be carried over the lips.

Grotesque.—Follow the feminine grotesque make-up, noting the extreme use of shadow and highlight on the accompanying illustration. The sketch there is that of a prize fighter. The change in nose shape is accomplished by the use of cotton and collodion. Before any other make-up is applied, spread a thin coat of spirit gum on the nose area. Place small pieces of cotton on the bridge of the nose and build the new shape. Brush the edges with spirit gum. After the desired shape has been obtained, cover the entire area of cotton with flexible collodion, extending the collodion a quarter of an inch beyond the edges of the cotton to make it secure. Allow the collodion to dry between the applications. The drying may be hastened with a fan or blower. Before applying the base foundation, add a quarter-ounce of base foundation to a quarter-ounce of flexible collodion, mix

thoroughly, and apply over the entire area of cotton, remaining an eighth of an inch inside the margin line of the original spirit gum application. This will bind the edges of the applied spirit gum, cotton and collodion.

The process just described is not, however, as permanent as the use of nose putty which is manufactured in several colors to match the foundation make-up. Warmed to body temperature in the hand, it is modeled on the nose. The putty adheres to the flesh, and make-up is applied directly to it.

To achieve a cauliflower ear, bend a hairpin around the ear to hold it in the desired position, then cover it with adhesive tape. Create the necessary contours with spirit gum and cotton. Cover with a single coat of collodion and apply the foundation to all surfaces.

Television Make-up.—Just as continued developments in color film and photographic technique take place, and make-up is altered to meet those changes, just so are the rules for television make-up elastic. For, as television itself is still in a highly experimental stage so, too, is make-up.

At the present writing (1949), the most successful television make-up is that which closely follows stage principles: intensification of color and exaggeration of essential features. Shadow for television is two shades darker than base color; highlight, two shades lighter.

Because red is burned out and becomes a highlight, only a light dusting of cheek rouge is permissible after powdering. Here again, as in black and white motion picture work, it is used for psychological effect only.

Lip rouge for women is a garnet shade. After initial application it is powdered, excess powder removed, and lipstick again applied. This is to avoid any shine or glow. Lipstick, if used for men, is on the brown side, as for stage use, and is wiped off to leave only faint definition.

Overall base for men is a dark tan; shadow, a dark brown. For masculine leads, shadow work consists usually only of under-chin work or along the sides of the nose. Overall base for women is a light tan. These bases are on the true brown side, with an avoidance of pink or definite red tones. Television lighting washes out red, thereby resulting in glaring highlight.

Powder matches overall base. As with stage make-up, both eyebrow pencil and mascara are black for greater definition.

Photographic Make-up: Amateur and Professional.—For 16-mm. use, the make-up procedure as outlined for black and white motion pictures is correct. If in color, the best possible make-up is that designated for street, with the exception of cheek rouge and lipstick. In color, these should be two shades lighter than that customarily worn by the subject for street.

The most important single make-up item, photographically speaking, is the base. Not only is it flattering to the subject, but its use saves hours of retouching. Base color is that used ordinarily by the model for street. Exceptions are platinum or bleached blondes, when skin and hair tones are so often similar that definition is lacking. The same is often true of brunettes with olive skins. For blondes who pose this problem, foundation liquid or cream should be at least two shades darker than that used for street; for brunettes, one shade lighter.

In black and white still photography, Hollywood photographers often skip the use of powder if a subject's skin is unblemished and freckles are not too apparent. They use only cream or liquid foundation without powder. The result is lustrous, highlighted skin, with normal skin texture showing through.

For color stills or home movies, eyeshadow should be used very sparingly. If brown is used, it should be mixed with a little of the base, using only enough base color to bring the eyeshadow down to a smooth tan instead of brown. After mixing, it should be two shades lighter than in its original form. Blue-gray shadow should not be mixed.

For black and white portraiture, the subject should pass the tip of the tongue lightly over both upper and lower lips before each shot. The result is the nice lip hilations seen in Hollywood portraiture. Interesting hilations on bare shoulders are achieved by smoothing on a very little cold cream or vaseline, then toning it down with tissue.

If a bathing suit model has an even, overall tan, it can be effectively highlighted by covering it with an application of baby oil and removing the excess with tissue.

Hairstyling.—The importance of feminine hairstyling cannot go unrecognized, for by following the general rules laid out for hairstyling for the seven face types, women not only minimize faults but emphasize good points. Hair is the frame for the face, and correct balance is the secret of fine hairstyling. No matter how perfect the make-up, if hair is incorrectly or unbecomingly styled the illusion of beauty is destroyed.

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MALABAR, măl'ă-băr, district, Republic of India, State of Madras, bordering on the Arabian Sea, 5,790 square miles in area. Calicut is the capital. Together with the southern group of the Laccadive Islands, pop. (1941) 3,929,425.

MALACCA, mă-lăk'ă, British Malaya, a Settlement of the Federation of Malaya, in the southwest of the Malay Peninsula, 640 square miles in area. The capital and seaport is Malacca (pop., 1947, 54,507), on the Strait of Malacca 118 miles by sea from Singapore. Rubber and coconuts are extensively cultivated. Refugees from the Sumatran kingdom of Srivijaya fled in the 14th century to the small fishing village of Malacca which, within 100 years, grew to become the capital of an influential kingdom. It fell to the Portuguese in 1511 and was captured by the Dutch in 1641. Malacca was held by the British 1795–1802 and 1811–1818, and was ceded to them in 1824. Until 1948 it was one of the Straits Settlements. Pop. (1948) 244,582.

MALACHI, Book of. The book is perhaps actually anonymous. The author's name appears only in 1:1, which is very probably an editorial addition. The word Malachi means "My Messenger," and may have been taken from 3:1.

There is no serious question affecting the authorship of more than a few verses of the book. It has often been thought that 2:11 following, expresses a spirit of narrow Judaism which is

inconsistent with i, 11. This is so upon one interpretation of the latter passage which makes it refer to the turning of the nations to Yahweh either in the present or the future. That, however, is probably not the correct interpretation. The verse in the context, particularly in relation to the following verse, seems to be clearly present and not future. At present it is not susceptible of the broader meaning given; that could not have been true at any probable time of writing. Hence the probable meaning is rather that worship is offered by Jews who are scattered widely among the nations; the reference is to the faithfulness of the Jews of the diaspora. Thus understood it is not inconsistent with ii, 11f.

Verses 4–6, chap. iv, are quite certainly a later addition. Verse 4 is a legal gloss, quite different from anything else in the book; verses 5–6 are a gloss upon verses 1–3, a restatement of much the same idea but from a different standpoint, one that is out of harmony with the book.

The mention of Edom, i, 2–4, gives a general indication concerning the date of the book. These verses indicate some recent crushing disaster to Edom, which is narrated in a spirit of hatred to Edom. This hatred began, the history shows, with the treacherous violence of Edom at the destruction of Jerusalem in 586. The disaster here referred to was doubtless one that came from the invasion of the Nabateans, and might have taken place at any time during a considerable period before 312 B.C. The general time between 586 and 312 is thus indicated. The temple had been rebuilt after the exile, i, 10; iii, 1, 10, and the enthusiasm of the time of its rebuilding had passed away. This indicates a time considerably after 516 B.C. The general condition of the people is that of the time of Ezra and Nehemiah, with the temple service in disorder and disrepute, i, 6–8, 12–13; ii, 1, 8, 17; iii, 7–10, 14, see Nehemiah x, 32–39; xiii, 10–13. Also, the divorce of Jewish wives and the marrying of foreign wives were found frequently, ii, 10–16, see Ezra, ix-x; Nehemiah x, 28–30; xiii, 23–31. There is in the book, however, no reference to the work of Ezra and Nehemiah. Hence the book is to be assigned to the period before their activity, and presumably not long before, perhaps about 460 B.C.

The message of Malachi was intended to be primarily one of encouragement to the discouraged people in Palestine. The principal comprehensive thought of the book is that Yahweh still loves Israel, in spite of appearances to the contrary. This is stated at the beginning of the book, in i, 2–5. The reason assigned for the adverse conditions from which the people were suffering was the failure of the people to do their duty toward Yahweh. This was particularly a failure in relation to the outward national service. The outlook of the prophet is, therefore, in a considerable measure, formal. Yet this formal side is accompanied by a real ethical interest, as appears in ii, 27. A high standard for priestly activity is set up in ii, 7. The assurance of further prosperity for the people if they amend their ways is in connection with the coming of the day of Yahweh.

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MALACHITE, a native basic copper carbonate and hydrate, having the composition $CuCo_3.Cu(OH)_2$, crystallizing in the monoclinic system, but commonly occurring in massive form, or as an incrustation. It is brittle and has a specific gravity of about 4, and a hardness of from 3.5 to 4. Malachite is commonly subtranslucent, with an adamantine lustre. It is beautifully green in color, often banded with other colors and it occurs in many parts of the world, usually in connection with other ores of copper. Specially fine pieces are found in the Ural district, and at the Nizhne Tagilsk copper mines a deposit is known which contains at least half a million pounds of pure malachite. In the United States, the best-known deposits are those of Arizona. Malachite has been much prized as a gem stone and it is extensively used for panels, clock cases, table tops and other ornamental work.

MALACHY, Saint, Irish bishop: b. Armagh about 1094; d. Clairvaux, France, 1148. He belonged to the noble family of O'Morgair, was educated by Iombar, an anchorite, and ordained priest in 1119. He afterward studied at Lismore, and returning to Armagh was chosen bishop of Down and Connor (1125). His subsequent election to Armagh having been disputed (1129) he eventually, after a satisfactory settlement of the disputed questions and in accordance with his own desire, returned to the less important diocese, where he labored to secure for the Church a stronger foothold. In 1139 he set out on a mission to Rome. On his way thither he visited at Clairvaux and there began a lifelong friendship with Saint Bernard. He was commissioned in 1148 to go to Rome a second time, but was stricken on the journey and the last moments of his life were spent with Saint Bernard, at whose monastery he had stopped. He was a zealous reformer and to him is given the distinction of having opened the first Cistercian monastery in Ireland. The document known as 'Prophecy of Saint Malachy,' containing a Latin motto for each of the popes, is now considered not to be his production. He was canonized in 1190. Consult O'Hanlon, 'Life of Saint Malachy' (1859); Migne, J. P., 'Patrologia Latina' (Vols. CLXXXII, CLXXXIII).

MALACOLOGY. See MOLLUSCA.

MALACOPTERYGII, măl-a-kŏp-tē-rĭj'ĭ-ī, or **MALACOPTERI,** a group of fishes, in former systems of classification, including those with jointed and spineless or "soft" fin-rays. Compare ACANTHOPTERYGII; and see ICHTHYOLOGY.

MALACOSTRACA, one of the two primary divisions of the *Crustacea* to which all of the larger and more highly organized forms belong. The number of pairs of appendages and of segments is definite, the former being always 19 and the latter 19, except in the order *Leptostraca* which have also two abdominal

segments limbless. The boundary between head and thorax is not always clearly defined but the two always comprise 13 segments, of which five almost always belong to the head; the abdomen has six limb-bearing segments and is terminated by the telson which is probably a seventh segment. The head bears a pair of eyes, usually stalked, two pairs of antennae, a pair of crushing jaws or mandibles and two pairs of maxillae, to which a pair of maxillipeds is sometimes added (*Arthrostraca*). Of the typically eight thoracic segments from one to three bear maxillipeds and the remainder walking feet. In most cases the thorax is more or less completely covered by a carapace. The mode of development is varied, sometimes, as in the crayfish, it is direct, sometimes with a nauplius, but usually through the larval form called zoaea (see LARVA), which possesses paired eyes as well as a median eye, a swimming tail and usually seven pairs of appendages. The subdivisions are:

Order *Leptostraca* (*Nebalia*).
Order *Arthrostraca* { *Amphipoda* (beach fleas). *Isopoda* (wood lice).
Order *Thoracostraca* { *Cumacea* (*Diastylis*). *Stomatopoda* (*Squilla*). *Schizopoda* (*Mysis*). *Decapoda* { *Macrura* (lobsters and shrimps). *Brachyura* (crabs).

See CRUSTACEA.

MALADE IMAGINAIRE, mä-läd ē-mäzhē-nār, **Le,** a comedy in five acts by Molière. It was produced in Paris (1673), was the last work of its author and the last in which, as Argan, he appeared on the stage. See MOLIÈRE.

MALAGA, mäl'ä-ga (Sp. mä'lä-gä, ancient MALACA), Spain, capital of the province of Málaga, on a small arm of the Mediterranean, about 65 miles northeast of Gibraltar. It was a Phoenician and afterward a Carthaginian colony, was a flourishing city under the Romans and its long occupation by the Moors has left distinct marks in the older parts of the town; the Gibralfaro, or Moorish castle, on a hill overlooking the town, and considerable portions of the ancient fortifications, yet remain. Among the important buildings are the cathedral, a highly decorated structure in the composite style with a spire 300 feet high; the episcopal palace, customhouse and several hospitals and charitable institutions. The manufactures consist chiefly of iron, the ore of which is obtained from rich mines in the vicinity; soap, cottons, linens, and machinery. Wonderful gardens lie outside the town, like the Haciendas de la Concepción and De San José, where marvelous effects are produced by carefully tended sub-tropical vegetation. Along the coast in the direction of Vélez-Málaga are ancient Moorish watch-towers, used, after the fall of Granada, against the Moors themselves, who often descended upon the coast to plunder and destroy. The harbor is excellent and the trade is of importance, the principal exports being olive oil, lead in bars, wine and fruit, particularly raisins, grapes, oranges and almonds. There used to be a great export of raisins to the United States, the consumption of which, however, declined in favor of the California product. The climate, mild, dry and equable, makes Málaga one of the finest resorts for invalids in Europe. Pop. (1941 est.) 238,264.

MALAGA WINE, a sweet Spanish wine produced in the province of Málaga. It is one of the "muscatel" wines, and is rich, luscious and full of body. See WINE AND WINE-MAKING.

MALAGASY SUBREGION, a faunal division of the Ethiopian region in zoogeography which embraces Madagascar and some small neighboring islands. See MADAGASCAR; ZOOGEOGRAPHY.

MALAKHOV, or **MALAKOFF,** măl'ä-kôf. See SEVASTOPOL.

MALAMPAYA, mä-läm-pä'yä, a sound on the northwest coast of the province of Paragua, island of Palawan, Philippines; it is an arm of the China Sea, extending 24 miles northwest to southeast, and from three to six miles wide. It is entirely landlocked, Tuluran Island protecting it from the China Sea, and is entered by Blockade and Endeavor straits. Its depth varies from 36 to 54 feet, it is free from sunken dangers to navigation, and is one of the finest harbors in the Philippine Archipelago.

MALAPROP, Mrs., a character in the *Rivals* of Sheridan. Like Shakespeare's Dogberry she is made to employ words of the same length, accent and more or less similar vowel and consonantal value, interchangeably. Hence her well-known *Allegory on the Banks of the Nile; Derangement of Epitaphs; A Barbarous Vandyke,* etc.

MÄLAR, mä'lär, Lake of, Sweden, a lake running inland from the Baltic about 81 miles, with an average breadth of 13 miles and an area of 450 square miles. It contains upward of 1,200 islands. Its east end is closed by Stockholm, where its waters are poured into the Baltic by various channels, the difference of level being about six feet. It is surrounded by the populous districts of Stockholm, Nykioping, Upsal and Westeras, and the shores are varied with bays and hills, woods, lawns and cliffs, and are adorned with many castles, countryseats and villas, including the royal palaces of Drottningholm and Gripesholm.

MALARIA, an infectious disease caused by one of several parasites of the genus *Plasmodium.* It exists in birds and poultry (avian malaria), as well as in man. Human malaria is caused by four varieties of plasmodia: the *P. falciparum,* the *P. vivax,* the *P. malariae,* and the *P. ovale.* It is transmitted by mosquitoes of the genus *Anopheles.* The plasmodia are found in the blood where they occupy the red cells which are destroyed ultimately, at which time the full-grown parasite escapes, after dividing into segments, into the circulation where each segment again invades a red cell. The process of growth and fission continues indefinitely at regular intervals unless proper antimalarial treatment is instituted. The disease itself is characterized by intermittent chills accompanied by blueness of the skin, followed by high fever with remission, the temperature falling to normal or subnormal until the onset of the next paroxysm. In some varieties of malaria the course of the disease is rapid and irregular, a fatal termination sometimes occurring. This last is known as pernicious malaria.

The disease is of great antiquity and may have been mentioned by Hippocrates; and it has long

been regarded by some authorities as having been the cause of the decadence of the early Greeks. Thomas Sydenham (1624–1689) of London gave one of the earliest descriptions of malarial fever in 1685. Cinchona bark, used for centuries in its successful treatment, is said to have been introduced into Spain from Peru about 1632. Pedro Baldi (17th century), physician to Philip IV of Spain, was the first to publish information on the nature of Peruvian bark (1642). Quinine, the active principle of the bark, was first isolated in 1820 by Pierre Joseph Pelletier (1782–1842) and Joseph Bienaimé Caventou (1795–1877). The malarial parasite was first seen in 1880 by Alphonse Laveran (1845–1922), who seems to have realized its significance, although he made no further discoveries of importance regarding it. Seventeen years later, Ronald Ross (1857–1932) made the epochal discovery that the mosquito is the host, when he beheld the plasmodium in the stomach of the anopheles mosquito. This dramatic discovery was one of the greatest in the history of preventive medicine and has saved the lives of millions.

Malaria is most prevalent in tropical and subtropical regions, especially along coastal plains, river valleys, and marshy areas. In Asia, particularly in India, it is endemic. In certain regions, such as Mian Mir, it was once rampant, constituting a health problem of the first magnitude. It is widely distributed throughout Africa, and exacts a heavy toll in Liberia, Belgian Congo, and Senegal. Once it was common in Italy. It is also presently found in many parts of South America, such as Brazil, in south China, Malaya, and the islands of the Pacific. Of late it has declined rapidly in highly enlightened countries, in many of which it is practically extinct.

The diagnosis of the disease often presents difficulties, since the cycle of the parasite varies. The *Plasmodium vivax* is found in benign tertian malaria, the attack occurring every third day; the *P. malariae* is found in the quartan variety, the paroxysm coming every fourth day; the *P. falciparum* is present in the malignant tertian (estivo-autumnal), or pernicious variety, in which the paroxysms and fever curve are irregular. The classic symptoms are not always present. Occasionally, cyclic vomiting occurs, which hides the evidence of chills and shaking. From a clinical viewpoint, the disease may be divided into two main groups of cases. In the first, chills, fever, and sweating occur at regular intervals if the malaria is untreated. In the second, the symptoms are irregularly continuous.

The incubation stage is from ten days to three weeks and there may be prodromal or warning signs, such as failure of appetite and headache prior to the onset of the paroxysm. This is ushered in suddenly, with a violent chill, rapid pulse, and extreme prostration. Within two or three hours the temperature may rise to as high as 104° with the usual signs attending high fever, such as intense headache and backache. This is followed in four to six hours by a stage of intense sweating, after which the temperature falls to normal. The following day the temperature remains normal and the patient is quite comfortable except for weakness, but within 48 hours of the first paroxysm, the symptoms are repeated, possibly with even greater severity. In the pernicious form (estivo-autumnal), the seizures do not follow a definite pattern. The fever is irregular and continuous, and in certain forms delirium may be present, the patient becoming unconscious. In these forms, the temperature may be extremely high (106°) and death may result. In some cases, vomiting, diarrhea, and bloody urine are noted (blackwater fever). In others, there is intense jaundice and evidence of toxemia. In all malarias, anemia is present from red blood cell destruction and this may be severe in cases of long standing.

The plasmodium, which may be seen under a microscope, has been mentioned. Its life cycle is similar in all varieties, but the time varies from 48 to 72 hours. Parasites are found in the red blood cells as small ring-shaped bodies devoid of pigment. In human beings they enlarge greatly in the blood cell and develop pigment, finally, as has been mentioned, dividing into segments which are liberated into the blood stream after the cell in which they develop is destroyed. Following this, the new cells, now many times multiplied, invade other red corpuscles and the cycle is repeated. A female cell (macrogametocyte), a variety of sexually differentiated plasmodium which develops in the red blood cell but does not undergo segmentation, if ingested from circulating plasma by a mosquito of the genus *Anopheles,* will develop within the insect and may be transmitted from its salivary ducts to a person on whom it feeds. Thus the disease is spread far and wide if no protection is afforded.

Malaria is easily diagnosed through an examination of stained blood films. The optimum time for making such a diagnosis is about eight hours after a chill has occurred. If quinine has been administered, it may be impossible to make a microscopic diagnosis. All malarial fevers respond to the administration of quinine. If no result is obtained after such specific treatment for a period of one week, the disease under suspicion is not malaria. The prognosis is usually good. Even without specific treatment, most cases of benign malaria will recover within a few weeks, the disease being to a certain extent self-limited. With proper treatment, cure is assured although relapses are common, and for this reason a considerable period of observation by a physician is advisable, even after an apparent full recovery. Pernicious malaria has a more guarded prognosis. Treatment is not so salutary and relapses occur in a high percentage of cases.

The treatment of malaria is both preventive and curative. The most important measures in prevention are those which protect the person from being bitten by the causative agent, the anopheles mosquito. Complete screening of houses, the use of bed nets at night, drainage of marshy land, and covering of stagnant water with a film of kerosene to destroy the larvae are all important. In addition, treatment of all persons having enlarged spleens, who live in malarious localities, will cut down the number of human carriers. Quinine itself is not particularly useful as a preventive, although it is employed and seems to delay the onset of the disease in persons bitten by infected mosquitoes. When the disease appears, it is usual to employ quinine in .650 gram doses three times a day, in capsules or tablet form by mouth. Within three to five days the chills disappear and the treatment is then continued for about two months, using a single full dose of quinine once daily. During World War II, when there was a great shortage of quinine, atabrine and plasmochin, synthetic

drugs, were used with great success with troops in the field. There is no sure immunity against malaria, although some persons seem to have developed an immunity after an attack of the disease and continue to live in malarious localities without again acquiring it. The nature of this immunity is unknown. Attempts have been made to cultivate the parasite outside the body (in vitro), but without success. Until this is achieved, the question of whether or not there is such a thing as artificial immunity against the malarial parasite must remain unanswered.

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MALARIAL CACHEXIA, or **ANEMIA.** See HOOKWORM DISEASE.

MALARIAL FEVER. See MALARIA.

MALASPINA, mä-lä-spē'nä. (1) A glacier, Alaska, extending from Mount Saint Elias, at an elevation of 18,000 feet, to Yakutat Bay, a distance of 90 miles, while its front on the Pacific is between 60 and 70 miles wide. It was named in honor of the Spanish explorer, Alejandro Malaspina, who traversed the region in 1789–1794 in search of the Northwest Passage. With its tributaries, the Seward, Agassiz, Tyndall, and Guyot, the Malaspina covers some 1,500 square miles and has a depth of more than 1,000 feet. As it reaches the Pacific it breaks into dangerous icebergs which threaten shipping. (2) A volcano, also known as Mount Canlaon, 8,087 feet high, on Negros Island in the Philippines.

MALATESTA, mä-lä-tĕs'tä, a noble Italian family, leaders of the Guelphs in Romagna and rulers in Rimini in 1216–1528. Giovanni and Malatesta of the Malatesta tribe entered Rimini in 1216 and were granted citizenship in consideration of their aid against Cesena. The family rapidly gained in power and in 1237 Giovanni was named podestà. He was succeeded upon his death in 1247 by his son, Malatesta da Verucchio (1212–1312), who became supreme ruler in 1295 and who steadily increased his power until his death in 1312 at the age of 100 years. He also increased the power of the Guelphs and enjoyed the favor of Pope Boniface VIII. Of his four sons, two were Giovanni and Paolo, husband and lover, respectively, of Francesca da Rimini, whose story is told in Dante's *Inferno*. Malatestino, the eldest son of Malatesta, succeeded him upon his death in 1312, maintained the power of the Guelphs, annexed Cesena and, dying without issue in 1317, was succeeded by his youngest and only surviving brother, Pandolfo. The power of the Malatestas was extended over neighboring territories in succeeding years and the family became one of the most influential of the Renaissance. Carlo (1364–1429) was an ardent supporter of the popes, represented Gregory XII at the Council of Constance, and was named vicar of the church in Romagna. His nephew, Sigismondo Pandolfo (1417–1468), was a valiant soldier, a patron of arts and letters, as well as a poet and renowned antiquarian. He built the Church of Saint Francis, or temple of Malatesta, one of the most beautiful structures of the Renaissance. He made war for and against Pope Eugenius IV; against Venice and Florence with the Aragonese; then against the Aragonese at Piombino. He afterward fought with and against the Sienese, supported the cause of the Angevins, and was excommunicated in 1460 and burned in effigy by Pope Pius II. He was afterward restored to favor, but before his death he was practically stripped of his powers and possessions. He was succeeded by his wife, Isotta, and his son, Salustio, but both were murdered by an illegitimate son, Roberto. Roberto's son, Pandolfo IV (1475–1534), was the last Malatesta to rule Rimini, and he sold his rights to the Venetians in 1503. Thereafter the Malatestas at various times endeavored to regain control of Rimini until 1528, when it was incorporated in the Papal States. The Malatestas became citizens of Venice, and the Rimini branch became extinct in 1716.

MALATYA, mä-lä-tyä' (ancient MELITENE), city, Turkey, capital of a vilayet of the same name, on the railroad west of the Euphrates, 112 miles northeast of Gaziantep. Known to the ancients as Melitene, it was the station of the 12th (Thundering) Legion under Titus, and was raised to city status under Trajan. It was the capital of Armenia Tertia under Justinian. There are many ruined mosques and baths, relics of the city built in 756 by the caliph al-Mansur. Between the 6th and the 12th centuries, Malatya changed hands between the Greeks and the Saracens several times. It was reputed to possess 60,000 fighting men at the opening of the 11th century, and in 1102 was returned to Saracen control. Bar-Hebraeus, the celebrated Syrian scholar, was born there in 1226. After a disastrous earthquake in 1893 the city was practically rebuilt; much damage was done to it during the massacre of Christians in 1895. Malatya is an important trading center for agriculture produce. Besides Turks and Kurds, the population includes many Christian Armenians. Pop. (1945) 41,559. The vilayet of Malatya has an area of 8,208 square miles and population (1945) of 438,397.

MALAY, mä-lā', member of a people inhabiting the Malay Archipelago and Malay Peninsula (qq.v.). The true Malays, akin in racial type and language to the Polynesians and Micronesians, call themselves Orang Malayu. They descend from a proto-Malay tribe in Sumatra who, after some infusion of Hindu blood and culture beginning about 400 A.D., crossed to the Malay Peninsula and founded Singapore about 1160. They spread also to Java, and carried their maritime trade and piracy to other coastlands, sometimes driving the Indonesian aborigines, as in Borneo, into the uplands. In the 14th century the Malays established the kingdom of Malacca, and afterward they took possession of the Sunda Islands, the Philippines, the Moluccas, and some of the island groups of Australasia.

Physically considered, the Malays are a well-knit, olive-brown people of low stature, slight in figure, and with very small wrists and ankles. The face is round, the eyes black and somewhat almond-shaped, the nose short and small, the cheek bones prominent, the features flat, and the hair straight and black. The aboriginal inhabi-

tants of the Malay Peninsula, who now number about 30,000 people, are usually divided into two main divisions, Semang and Sakai; the Jakun, formerly considered to be a separate division, are now regarded as a subdivision. It is probable that the Sakai, whose original home is conjectured to have been Yunnan, China, appeared in Malaya some thousands of years before Christ. The Semang Negritos, having racial affinities with the Aëta of the Philippines and the aborigines of the Andaman Islands, may have been earlier arrivals. They roam the jungles in northern Malaya and are mostly men of the plains; they are regarded as being very low in the scale of civilization, and have only a very scanty knowledge of agriculture. The Sakai, who inhabit the hills and foothills south of the Semang, are of Mongoloid stock; they are seminomadic, and often live in communal huts. The Jakun are to be found in the coastal forests of southern Malaya. Originally seafarers in the course of many centuries they have in some cases been forced inland up the rivers.

A considerable element in the physical make-up of the civilized Malay is derived from the aboriginal stock. The Sakai are frequently tree-dwellers, building their houses in forked trees, 8 to 12 feet above the ground, reached by bamboo ladders which are hoisted at will. The tree-dwellers formerly made use of long blowguns from which were shot poisoned arrows. The blowgun was a bamboo about one and one-half inches in diameter and six and one-half feet in length. The bore, drilled most accurately, was a quarter of an inch; and the darts were nine inches in length, sharpened at one end and poisoned. With these they secured all the meat they ate in the jungle—birds, monkeys, snakes, and lizards.

The conversion of the Malays to Islam, which spread from northern Sumatra to Malacca, began in the 13th century. This process of Islamization was gradual and was not completed until about the 17th century, when Iskandar Muda, sultan of Atjeh, compelled acceptance of Islam at the point of the sword. Its effect among the Malays was enormous: India lost its pre-eminence among them as a sort of mother country; Indian ties were loosened and finally broken; Indian culture was no longer sought after; and the Arabs and their religion and culture were taken as a pattern. Nevertheless the Malays are still animist at heart. Their spirit worship and sorcery include a belief in man tigers, and the related semihypnotic state called *latah,* in which the victim makes violent involuntary movements in imitation of the actions of another person. They are also subject to neurotic crises, especially in the form called *amok,* a murderous frenzy, from which is derived the expression "to run amuck." The Malays are addicted to cockfighting and games of chance. The Malay language, which is widely used in southeastern Asia as the language of commerce, is soft and harmonious, and of simple structure; it is written in Arabic script. The literature, which is copious, comprises poetical compositions, such as rhyming proverbs, love songs, and dramas; and prose writings which are mostly based on Arab or Persian models.

Bibliography.—Schebesta, P., *Among the Forest Dwarfs of Malaya* (London 1929); Evans, I. H. N., *The Negritos of Malaya* (Cambridge, Eng., 1937); Hamilton, A. W. H., *Malay Proverbs in English and Malay* (Sydney, Australia, 1937); id., *Malay Made Easy,* 4th ed. (Sydney 1944); Cole, Fay-Cooper, *The Peoples of Malaysia* (New York 1945); Winstedt, Sir R. O., *The Malays: A Cultural History* (Singapore 1947).

MALAY ARCHIPELAGO, the great island group off the southeast coast of Asia, lying across the equator between the Pacific and the Indian oceans. It comprises the islands of Indonesia, together with New Guinea, Borneo, and the Philippines. The majority of the inhabitants are of Malay or Melanesian stock. Borneo and Sumatra, among the larger islands, stand on the Sunda continental shelf, which extends southeast from the Malay Peninsula and Indochina at a depth of less than 250 feet. The Celebes and smaller islands to the south and east are the tops of submarine ridges which rise between deep basins—such as the Flores, Celebes, and Banda seas.

MALAY PENINSULA, or **MALAYA,** the most southerly part of the mainland of Asia, is a long, relatively narrow portion of land extending in a southeasterly direction from the Isthmus of Kra (partly Siamese, partly Burmese) to the island of Singapore at its southern extremity. The length is some 750 miles and the maximum breadth, 210 miles. The peninsula south of Burma and Thailand constitutes the Federation of Malaya (q.v.), which has an area of approximately 50,850 square miles. The Strait of Malacca separates the west coast of the Malay Peninsula from Sumatra; on the east of the peninsula is the South China Sea. A range of mountains forms the backbone of the peninsula, numerous peaks exceeding 6,000 feet in altitude. The highest elevations are Gunong (Mount) Tahan, 7,185 feet, on the boundary between Pahang and Kelantan, and Gunong Kerbau, 7,159 feet, between Pahang and Perak.

Four fifths of the surface of the peninsula is covered by dense tropical jungle which yields ebony, teak, sandalwood, camphor, and other valuable timbers and more than 40 varieties of palm. The only generally cleared parts of the country are long stretches down the west coast, an area in the north, and a number of open stretches up the principal rivers. The rivers, at their sources and in their upper reaches, are quick-flowing, often with tortuous rapids and precipitous gorges. In the lower reaches, the descent is more gradual and the water takes on a muddy hue from contamination with the silt of the plains through which the rivers meander, debouching ultimately through strips of mangrove swamp—particularly on the west coast. The two principal rivers of the peninsula are the Pahang, 285 miles in length, which flows into the South China Sea, and the Perak, 200 miles long, which enters the Strait of Malacca. The coastline of the Malay Peninsula extends for over 1,000 miles. On the west is a practically unbroken succession of mangrove forests and mudflats, with infrequent indentations of picturesque bays fringed with coconut palms and the graceful spires of the casuarina; on the east coast there are long unbroken stretches of sand and surf bordered by a littoral vegetation which lends to it a beauty possibly unparalleled in the tropics.

Within the territorial waters lies Langkawi Island, on the west side of the peninsula, off Kedah, the highest peak of which is 2,888 feet in altitude. Farther south is the island of Penang (q.v.), whose features have been eulogized by travelers from the earliest times. The island of Pangkor, off the coast of Perak, was once a Dutch settlement, but little remains in evidence of this history beneath the vegetation which has

long since reclaimed its own. Off the east coast, among a sprinkle of beautiful islands, there is Tioman (a possession of Pahang), with its symbolic silhouette of granite peaks.

The principal features of the climate of the Malay Peninsula are copious rainfall, high humidity, and a uniformity of temperature which rarely varies more than 15 degrees during the day. There are no well-defined divisions between the seasons. The average monthly rainfall is some 8.0 inches; the average maximum temperature on the plains is 91°F., and the average minimum is 71°F. However relaxing may be the humid monotony of the perpetual summer's afternoon which is the Malayan climate, it has the redeeming feature of a cool and not infrequently chilly night.

Tigers and leopards are numerous and of great size. The Asiatic elephant, the rhinoceros, the seladang (a type of bison), the honey bear, and numerous varieties of deer are found, as well as apes and monkeys, many poisonous snakes, and numbers of beautiful and brilliant birds. Tin is by far the most important of the peninsula's mineral resources. See also FEDERATION OF MALAYA.

Consult Ridley, H. N., *Flora of the Malay Peninsula*, 5 vols. (London 1922–1925); Swettenham, Sir Frank, *British Malaya* (London 1929); Scrivenor, J. B., *Geology of Malaya* (London 1931); Tweedie, M. F. W., *Poisonous Animals of Malaya* (Singapore 1946).

MALAY STATES, nine native states under British protection in the Malay Peninsula. Four of them (Pahang, Perak, Selangor, and Negri Sembilan) formerly constituted the Federated Malay States, the remaining five (Johore, Kedah, Kelantan, Perlis, and Trengganu) being unfederated. In 1946 the nine Malay states and two former constituents of the Straits Settlements (Penang and Malacca) were federated as the Malayan Union; and in 1948 the latter was reorganized as the Federation of Malaya (q.v.).

MALAYA, FEDERATION OF. See FEDERATION OF MALAYA.

MALAYALAM, măl-ā-yā'lăm, an independent Dravidian language of southern India, originally allied to Tamil and spoken on the Malabar Coast. Malayalam is said to have developed from Tamil since the 9th century and now differs from it in pronunciation and in idiom, and in the retention of old Tamil forms obsolete in the modern languages.

MALAYAN BEAR, or **SUN BEAR,** a small bear (*Ursus malayanus*) found in the Malay Archipelago. It is about four and a half feet in length. The fur is black, fading into brown on the nose, which is broad and blunt. The chest bears a crescentic white mark, or an orange-colored, heart-shaped patch.

MALAYAN SUBREGION, a faunal division of the Oriental Region, composed of the southern end of the Malay Peninsula and all the islands of the Malay Archipelago as far as the Philippines and to Makassar Strait, where this district is separated from the Australian and Papuan subregions by Wallace's line (q.v.). The orangutan and the birds of paradise are its most characteristic groups. See DISTRIBUTION OF LIVING MAMMALS; ZOOGEOGRAPHY.

MALBAIE, măl-bā'. river, Canada, wholly within Charlevoix County, Quebec. After a widely curving course it turns southeast to join the Saint Lawrence River. At the confluence is La Malbaie, the county seat. The river is about 80 miles in length.

MALBONE, môl'bōn, **Edward Greene,** American miniaturist: b. Newport, R. I., August 1777; d. Savannah, Ga., May 7, 1807. He had a studio in Providence, R. I., during 1794–1796 and thereafter in Boston, Mass., until 1800, when he moved to Charleston, S. C., with his friend Washington Allston (q.v.). In 1801 they sailed for Europe, meeting Benjamin West (q.v.) in London. Rejecting the latter's advice to remain there, at the end of the year Malbone returned to Charleston. During 1804–1805 he again worked in Boston. Among his portraits were two (*Egeria* and *Annette*) of members of the Middleton family. The Corcoran Gallery, Washington, D.C., acquired his self-portrait; and the Museum of Fine Arts, Boston, his portrait of Washington Allston.

MALBORK, măl'bôrk, city, Poland, in Gdańsk Department, on the Nogat River 25 miles southeast of Gdańsk (Danzig); until 1945 it was within East Prussia, then bearing the name of MARIENBURG. The notable castle, dating from 1274, was the seat of the Teutonic Knights (q.v.) from 1309 until 1457, when it was acquired by the Poles. The city passed to Prussia in 1772, and subsequently became an important railroad center. Manufactures include chemicals, rubber products, soap, and sugar. It lay within the area of Prussia assigned to Poland in 1945 by the Potsdam Conference. Pop. (1946) 38,968.

MALCOLM, măl'kŭm, name of four kings of Scotland. MALCOLM I MACDONALD (d. 954) succeeded to the throne in 943. He secured cession of Cumbria in 945 from Edmund I, king of the West Saxons. MALCOLM II MACKENNETH (d. 1034) came to the throne in 1005. During his reign Lothian and Strathclyde were secured to Scotland. MALCOLM III MACDUNCAN, surnamed CANMORE (d. near Alnwick, Northumberland, Nov. 13, 1093), was the son of Duncan I, who was slain in 1040 by Macbeth (Maelbaethe), mormaor of Moray. With the help of his uncle, Siward, earl of Northumberland, he defeated Macbeth in 1054 and killed him in 1057. He was crowned at Scone. His marriage in about 1067 to Margaret, sister of Edgar the Aetheling, Saxon pretender to the throne of England, provoked retaliation by William the Conqueror in 1072. From 1077 to 1080 he waged war against England, and in 1093 he invaded Northumbria. He was slain while laying siege to Alnwick. His reign had an important bearing on the consolidation of Scotland. Margaret, who died a few days later, was afterward canonized; she was largely responsible for the ecclesiastical reform effected in Scotland by her husband. MALCOLM IV, surnamed the MAIDEN (b. 1141; d. Jedburgh, Dec. 9. 1165), succeeded his grandfather, David I, in 1153. He suppressed two rebellions in Scotland, but in 1157 he was forced by Henry II of England to relinquish Northumberland and Cumberland.

MALCOLM, Sir **John,** British colonial administrator and diplomat: b. Burnfoot, Dumfriesshire, May 2, 1769; d. London, May 30, 1833.

Entering the service of the East India Company as an army officer in 1782, he rose to reach the rank of major general in 1822. In 1799 he was sent to Persia to negotiate a treaty of alliance against Napoleon, and he was ambassador to that country in 1800, 1807, and 1810. During 1804–1805, following the Second Mahratta War, he helped to restore order in Sindhia and Holkar; and in 1817 he was appointed political agent in the Deccan. From 1827 until his retirement in 1830 he served as governor of Bombay. He wrote several books on India, and *The History of Persia* (2 vols., 1815).

MALCZEWSKI, mäl-chĕf'skē, **Antoni,** Polish poet: b. Warsaw, 1793; d. there, May 2, 1826. After serving in the Polish army during 1811–1816 he traveled through Europe, at that period becoming a close friend of George Gordon Byron (q.v.). His principal work was the narrative poem *Marja* (1825), the literary merits of which were recognized only after his death. During his life none of his compositions brought him fame, and he died in wretched poverty.

MALDEN, mâl'dĕn, Mass., city in Middlesex County, on the Malden River 5 miles north of Boston; altitude 32 feet; it is served by the Boston and Maine Railroad. The city is both a residential suburb of Boston and an important manufacturing center, products including rubber shoes, shoe lasts and trees, women's and children's clothing, and leather goods. The public library, completed in 1885 to the designs of Henry Hobson Richardson (q.v.), houses a notable collection of paintings by French and American artists. The Bell Rock Memorial Park, with a Civil War soldiers' and sailors' monument, marks the site of the town bell of colonial times by which the townsfolk were called to worship or to fight fire. The Parsonage House, 1724, was the home of the Rev. Joseph Emerson, ancestor of Ralph Waldo Emerson and the birthplace of the Baptist missionary to Burma, Adoniram Judson. Michael Wigglesworth colonial poet and preacher, was pastor here for some 50 years (qq.v.). The first settlement, about 1640, was made by persons moving out from Charlestown, which was expanding rapidly. They established homes along the Mystic River, of which the Malden is a branch, and called the place Mystic Side. In 1649 Malden became a separate municipality. Following its incorporation by the General Court, it had town government by a board of selectmen, until 1881, when it received a city charter. Since then the municipal government has been administered by a mayor with a bicameral body composed of a board of aldermen and a city council. Melrose was set off from Malden in 1850, and Everett in 1870. Pop. (1930) 58,063; (1940) 58,010; (1950) 59,084.

MALDEN, a South Pacific coral island 108 miles northwest of Starbuck Island and 275 miles southeast of Jarvis Island, within the jurisdiction of the high commissioner of the (British) Western Pacific Islands. The island, 35 square miles in extent, is uninhabited. There are remains of stone foundations for houses and temples which indicate that at one period the island was inhabited by Polynesians. No fresh water is now available, old wells having become salty or gone dry. During the 19th century extensive guano deposits on Malden were worked by an Australian company.

MALDIVE, mäl'dīv, **ISLANDS,** a chain of coral islands in the Indian Ocean 400 miles southwest of Ceylon; the archipelago constitutes a dependency of that British island colony. The Maldives comprise several hundred islets, of which 300 are inhabited, grouped in 17 atolls. The inhabitants, who according to the 1946 estimate numbered about 93,000, speak a dialect of Singhalese and are Mohammedan in religion. The capital of the dependency is on the island of Malé. A sultan (Lord of the Thousand Isles) is assisted by a People's Assembly, most members of which are elected. Dried fish, cowrie shells, coconut coir, and tortoise shell are the principal exports from the islands. The Maldivians are expert sailors and navigators, and carry on a considerable trade with India, Ceylon, and Sumatra. During the 16th century the Maldivians repelled numerous attempts by the Portuguese to establish a settlement on their islands. Subsequently they were attacked on many occasions by pirates from the Malabar coast of India, and as a consequence the Maldivians placed themselves under Singhalese protection in the 17th century. During World War II, a British naval port and airbase was constructed on the isolated atoll of Addu, southernmost of the Maldive Islands. Consult Hockly, T. W., *A Short Account of the People, History, and Customs of the Maldive Archipelago* (London 1935).

MALE FERN. See FERNS AND FERN-ALLIES.

MALEBRANCHE, mâl-brănsh', **Nicholas de,** French metaphysician: b. Paris, Aug. 6, 1638; d. there, Oct. 13, 1715. He was the youngest child of Nicolas de Malebranche, secretary to Louis XIII, and Catherine de Lauzon, sister of a viceroy of Canada. In 1660, after studying theology at the Sorbonne, he entered the Congregation of the Oratory. He ranks second only to René Descartes (q.v.), greatest of French thinkers, in the history of French metaphysical speculation. The essence of his philosophy, which was founded upon that of Descartes, is a sort of mystical idealism. As set forth in Malbranche's brilliant work *Recherche de la vérité* (4 vols., 1674 ff), we have cognizance of things and objective realities as subjective thoughts and feelings, through the idea which resides in our souls; but this idea is in God, so that we perceive everything in God (*vision en Dieu*) as the primal cause of all existences and things. Hence the famous doctrine of Occasionalism or Interference, in accordance with which the objective thing and the subjective impression are made on every occasion to coincide, by the direct interposition of God, in whom alone we think and feel. In the history of philosophy Malebranche may be styled the connecting link between Descartes and Baruch Spinoza (q.v.), the difference between his philosophy and that of the pantheist Spinoza consisting in the fact that to him the Universe was in God, and to Spinoza God was, in fact, in the Universe. Other works included *Traité de la nature et de la grâce* (1680); *Traité de la morale* (1683); *Entretiens sur la métaphysique et sur la religion* (1688); *Traité de l'amour de Dieu* (1697). Consult Ollé-Laprune, L., *La Philosophie de Malebranche* (2 vols., 1870); André, *La Vie du Révérend Père*

Malebranche' (1886); Farny, 'Etude sur la morale de Malebranche' (1886).

MALESHERBES, Chrétien Guillaume de Lamoignon de, krā-tē-ăñ gē-yōm dė lä-moin-ŏñ dė mäl-ės-ārb, French statesman: b. Paris, Dec. 6, 1721; d. there, April 22, 1794. He was educated at the Jesuits' College, entered the legal profession and in 1745 became counsellor of the parlement of France; in 1750 he was president of the Court of Aids. He was broad-minded and liberal in his policy, favoring the publication of the 'Encyclopédie' and owing to his protestation against different measures of Louis XV was removed from office. Under Louis XVI he was Minister of the Interior, but resigned in 1776 and until the Revolution spent his time upon his estates and in travel, with the exception of 1787–88, when he was again Minister. At the outbreak of the Revolution he came loyally to the assistance of Louis XVI and was leading counsel in his defense. He remained with the monarch until almost the last and 11 months later was guillotined for treason. He was the author of essays and pamphlets on financial questions, etc.

MALET, Claude François de, klōd fräñ-swä dė mä-lā, French conspirator: b. Dôle, Franche-Comté, France, June 28, 1754; d. Paris, Oct. 29, 1812. He entered the army in 1771 and became a brigadier-general in 1799. Suspected of conspiracy against Napoleon, he was dismissed from the army in 1807 and confined in La Force. While there he laid new plots and was thenceforward confined in a state prison from 1808 till 1812. During Napoleon's campaign in Russia Malet made his escape from prison on the night of October 22-23, and by circulating the false news of Napoleon's death won over some of the National Guards. While the latter secured the principal public offices in his name, Malet liberated his fellow conspirators, Generals Guidal and Lahorie, from prison. He was, however, himself taken prisoner by Laborde, chief of the military police of Paris, and was shot with his fellow conspirators.

MALET, Lucas. See HARRISON, MARY SAINT LEGER.

MALFATH, Giovanni Francesco Guiseppe, Italian mathematician: b. Ala di Trento, 1731; d. Ferrara, 1807. He was educated at the Jesuit College at Verona and later studied under Riccatti at Bologna. For 30 years from 1771 he was professor of higher mathematics at Ferrara and attained high rank among the mathematicians of his time. He is best remembered for his publication of a mathematical problem known as "Malfath's problem," of which he gave the first solution. It was published in a memoir 'Tentativo per la risoluzione delle equazioni di quinto grado' (Pavia 1772).

MALFORMATION IN PLANTS. See PLANTS, MALFORMATION IN.

MALHERBE, François de, fräñ-swä dė mäl-ārb, French poet: b. Caen, France, 1555; d. Paris, Oct. 16, 1628. He was educated in Heidelberg and was engaged in the wars of the League. In 1605 he became court poet under Henry IV, but his work as a critic was of greater value than his poetry, which was lacking in poetic feeling and originality, though metrically perfect. He was the founder of the French school of classicism and must be credited with arousing a critical sense among the thinkers of France. His works consist of translations from the Latin and one volume of original verse. Consult Allais, 'Malherbe et la Poésie française à la fin du XVI. Siècle' (1892); Brunot, 'La Doctrine de Malherbe' (1891).

MALIBRAN, Maria Félicité, mezzo-soprano singer: b. Paris, 1808; d. Manchester, England, 1836. She was early trained for the operatic stage by her father, Manuel Garcia (q.v.), the Spanish tenor, and made her début in London (1825). She had lived in that city since 1817 as a teacher of singing, and her success in Rossini's 'Barber of Seville' was such that she was induced to follow her father to New York, where he had an engagement to establish grand opera. Here she married a French merchant named Malibran. She returned to the stage on her husband's failure in business, and in the spring of 1828 appeared on the Parisian boards in Rossini's 'Semiramis.' She subsequently was welcomed with great enthusiasm in London, Naples, Vienna, Milan and Venice, and traveled with the violinist de Bériot, whom she married shortly before her early death. She was a great actress as well as a marvelous songstress, and the irresistible charm of her person, added to the generosity of her mind and disposition, made her during her brief career one of the most fascinating operatic singers that had ever won the applause of the European public. In 1838 a statue was erected to her in Brussels, which had been her last place of residence. Consult Nathan, 'Life of Madame Maria Malibran de Bériot' (1846); Teneo, M., 'La Malibran, d'après des documents inédits' (in 'Sammelbände der internationalen Musik-Gesellschaft,' Leipzig 1906).

MALIC ACID, an organic acid discovered in 1785 by Scheele, and now known to be widely diffused throughout the vegetable kingdom, occurring sometimes in the free state, and sometimes in the form of its potassium, magnesium or calcium salts. It occurs abundantly, for example, in the gooseberry, cherry, strawberry and barberry, and also in unripe apples, from which latter fact it derives its name (Latin *malum,* an apple). It may be conveniently prepared by boiling the juice of mountain ashberries with enough milk of lime to almost neutralize it, and pouring the precipitate into boiling dilute nitric acid. Acid malate of calcium crystallizes from the nitric acid upon cooling, and this is dissolved in water, and precipitated by acetate of lead, the lead malate that is thrown down being subsequently decomposed by sulphuretted hydrogen gas. Malic acid has the formula $C_4H_6O_5$ or C_2H_3 (OH) $(COOH)_2$, is dibasic, and can be obtained in the form of colorless prisms or needles, which are hygroscopic, and dissolve readily in water and in alcohol. Malic acid kills algæ, and when present in a solution in any considerable amount it prevents the precipitation of cupric and ferric salts by the alkalis. With bases it forms compounds known as "malates," which are mostly soluble. See SUCCINIC ACID.

MALICE, *in law,* a premeditated or formed design to do mischief or injury to another, called also "malice prepense" or "aforethought." Blackstone says that malice prepense is not so properly spite or malevolence to the deceased

in particular, as any evil design in general; the dictate of a wicked, depraved and malignant heart; and it may be either express or implied in law. Express malice is when one, with a sedate, deliberate mind and formed design, kills another. It many cases where no malice is expressed, the law will imply it; as where a man willfully poisons another; in such a deliberate act the law presumes malice, though no particular enmity can be proved. A spiteful, malignant, vindictive or revengeful disposition is apt to commit acts of malice both in the ordinary and the legal sense, and may be guilty in the former and not in the latter sense. An injurious act emanating from a weak mind, a lack of caution or a sudden, unaccountable impulse, may have all the force of ordinary malice, but in the absence of a designed, intentional injury, it will not come within the strict limits of criminal malice. The law infers an intent to kill from the deliberate use of a deadly weapon, and it has been held that a burglar intended murder when he broke into a dwelling because he would commit it if necessary to escape.

MALICIOUS PROSECUTION, prosecution of a person unsuccessfully, maliciously and without cause. To constitute this offense it must be proved: (1) That the prosecution averred to be malicious was instituted by the defendant named. (2) That it was decided against prosecutor. (3) That the suit was without probable cause. (4) That the motive was malice. (5) That the plaintiff was injured by such malicious prosecution.

Quod facit per alium facit per se is fully applicable to the defendant in a suit for malicious prosecution; hence a corporation may be liable although it acted through its agent. See TORT.

MALIGNANT PUSTULE. See ANTHRAX.

MALIGNANTS, in English history, a name applied in 1643 by members of Parliament to designate those whom they considered to be the evil advisers of Charles I. Afterward the name was extended to all who sided with the king against the Parliament.

MALIK, mȧ-lēk′, **Jacob** (Russ. JAKOV), **Alexandrovich,** Soviet government official: b. Kharkov, 1906. He was educated at the Institute of People's Education in Kharkov and at the Soviet Institute for Foreign Affairs at the University of Moscow, from which he was graduated at the age of 31 and immediately entered the Foreign Office as deputy press chief in Moscow.

In 1939 Jacob Malik received his first foreign diplomatic assignment as counselor at the Soviet embassy in Tokyo. On May 20, 1942, he was appointed ambassador, and he remained in Tokyo until 1945, when the Soviet government declared war against Japan. He returned to Tokyo in January 1946 as political adviser to Lieut. Gèn. Kuzma Derevyanko, chief Russian delegate to the Allied Council for Japan. On Aug. 24, 1946, he was appointed to the Moscow post of deputy foreign minister for Far Eastern affairs, and shortly afterward as deputy commissar for foreign affairs. In May 1948, Malik replaced Andrei Gromyko (q.v.) as the Soviet Union's permanent representative to the United Nations.

As chief Russian U.N. spokesman he figured prominently during 1948 in debates over the Palestine and Kashmir questions, and he vigorously opposed the dissolution of the U.N. Atomic Energy Commission, which had voted to suspend operations because of a stalemate over policies. In early 1949 he sought U.N. membership for the Democratic People's Republic of Korea, and in January 1950 he demanded the expulsion of the Chinese Nationalists. After his resolution of Jan. 13, 1950, for the ouster of the Nationalists, had been blocked, Malik boycotted subsequent council meetings until Aug. 1, 1950, when he returned to the Security Council to assume the rotating presidency.

MALINAO, mä-lē′nou, municipality, Philippine Islands, in the Province of Albay, Luzon, situated 17 miles north of Legaspi. It is on the main road, and is the shipping point for the large hemp production of the surrounding region. There is an extinct volcano nearby and also mineral springs. Pop. (1939) 15,089.

MALINES. See MECHLIN.

MALINGERING, mȧ-lĭng′gĕr-ĭng, **a term** denoting feigning disease on the part of a soldier, sailor, prisoner, etc., in order to obtain discharge from service, or escape from duty or labor. It implies some overt act, such as the previous application of a ligature, or the taking of some drug, which produced the appearance of the disease said to exist. A worse form of the same crime, "willfully maiming," is erroneously called malingering.

Consult Callie, John, *Malingering and Feigned Sickness* (New York 1913); and Smith, W. R., *Medical Jurisprudence* (London 1913).

MALL, Franklin Paine, American anatomist: b. Belle Plaine, Iowa, 1862; d. Nov. 17, 1917. He took his M.D. at Michigan in 1883, later studied at Heidelberg and Leipzig and in 1886–1888 was a fellow at Johns Hopkins, acting as instructor in pathology at that institution 1888–1889. He was adjunct professor of vertebrate anatomy at Clark University in 1889–1892, and was professor of anatomy at the University of Chicago in 1892–1893. He was professor of anatomy at Johns Hopkins University after 1893 and after 1915 also served as director of the department of embryology at Carnegie Institute Washington, D.C. He was a trustee of the Marine Biological Laboratory, Woods Hole, Mass., and wrote extensively for scientific publications, including the *American Journal of Anatomy,* the establishment of which in 1901 was largely his responsibility.

MALL, môl or měl, **The.** (1) A promenade in Central Park, New York, regarded as one of the most successful landscape effects in the United States. (2) An avenue in London on the north of St. James' Park.

MALLALIEU, măl-lā-lū′, **Willard Francis,** American Methodist bishop: b. Sutton, Mass., Dec. 11, 1828; d. Aug. 1, 1911. He was graduated from Wesleyan University in 1857 and became a Methodist Episcopal clergyman in 1858. He held many important charges and in 1872, 1876, 1880, and 1884 was a member of the general conferences. He was presiding elder of the district of Boston in 1882–1884 and in 1884 was

elected bishop. He retired in 1904. He published 'The Why, the When, and How of Revivals' (1901); 'The Fullness of the Blessing of the Gospel of Christ' (1903); 'Words of Cheer and Comfort' (1907).

MALLARD. See DUCK.

MALLARMÉ, Stéphane, stā-fän mäl-ärmā, French poet: b. Paris, March 18, 1842; d. Valvins, Fontainebleau, Sept. 9, 1898. Most of his life was passed as an instructor in English at the Lycée Fontanes of Paris. He is known as the founder of the curious poetic school of the "Décadents," in whose organ, *Le Décadent,* as well as in *Le Parnasse Contemporain,* he published much. Incomprehensibility appears to have been the object of his study, and he entirely attained it in his preface to an edition (1880) of Beckford's 'Vathek.' Others of his works are 'L'Après-midi d'un faune' (1876); 'Petite Mythologie' (1878); 'Les Dieux antiques' (1880); 'Poésies' (1887), a translation of Poe's poems (1888), perhaps his most satisfactory performance; and 'Vers et prose' (1893).

MALLEABILITY, *in metallurgy,* the property of extending under the blow of a hammer. For every metal there is a temperature of greatest malleability. The following is the order of malleability of the metals: Gold, silver, copper, platinum, iron, aluminum, tin, zinc, lead.

MALLEABLE GLASS. See GLASS, CHEMICAL PROPERTIES OF.

MALLECO, mäl-yā'kō, formerly a province of Chile, now divided between Bio-bio and Cautin. Its area was 3,303 square miles, and its capital city was Angol. The country is mountainous and well wooded in the eastern and western parts. About one-half of the population is composed of Indians of the Arauco tribe. Wheat is the staple agricultural product of the country. The other industries of importance are cattle raising, timber cutting and mining. The population was about 120,000.

MALLEE-BIRD, or **MALEO,** a name for the Australian mound-bird (q.v.), derived from a native language.

MALLERY, Garrick, American ethnologist: b. Wilkesbarre, Pa., April 23, 1831; d. Washington, D. C., Oct. 24, 1894. He was graduated from Yale College in 1850 and was admitted to the bar in 1853; he practised law in Philadelphia until 1861, when he enlisted and served through the war in the Federal army, attaining the rank of lieutenant-colonel. He was executive officer of the Signal Service Bureau until 1876, when he was engaged in a geological survey in Dakota, and in 1879 was retired from the army and appointed chief of the bureau of ethnology. Among his books are 'A Calendar of the Dakota Nation' (1877); 'Israelite and Indian, a Parallel in Planes of Culture' (1889); 'Greeting by Gesture' (1891); 'Picture Writing of the American Indians' (1893), etc.

MALLESON, George Bruce, English soldier and historical writer: b. London, May 8, 1825; d. there, Feb. 28, 1898. He was educated at Winchester College, and from 1842 till 1877 served in India, at first in the army, and subsequently in government posts. His chief work 'History of the Indian Mutiny' (1878–80) commenced where the second volume of Kaye's 'Sepoy War' left off, and in 1890 there appeared a joint edition of the two histories in six volumes, the third volume of Kaye's work being omitted and a new sixth one added. Other works by him are 'The Mutiny of the Bengal Army' (1857); 'History of the French in India' (1868); 'Sketch of the Native States of India' (1875); 'Final French Struggles in India and Indian Seas' (1878); 'History of Afghanistan' (1879); 'The Decisive Battles of India' (1883), and lives of 'Clive'; 'Eugene of Savoy'; 'Prince Metternich'; 'Wellesley'; 'Dupleix'; 'Akbar' and 'Warren Hastings.'

MALLET, John William, American chemist: b. Dublin, Ireland, Oct. 10, 1832; d. 1912. He was educated at Trinity College, Dublin, and at Göttingen, and emigrating to the United States in 1853 became assistant professor in chemistry at Amherst 1854–56 and later chemist to the United States geological survey of Alabama. In 1856–60 he was professor of chemistry at the University of Alabama. He entered the service of the Confederacy and was paroled in 1865 as lieutenant-colonel of artillery. The chair of sciences at the University of Louisiana was occupied by him in 1865–68 and after 1868 he was professor of chemistry in the University of Virginia, becoming professor emeritus in 1908. He contributed valuable scientific articles to the leading chemical periodicals and published 'Cotton' (1862); 'Chemistry Applied to the Arts' (1868); 'Syllabus of a Course of Lectures on General Chemistry' (1890; rev. ed., 1901).

MALLET, a wooden hammer used in carpentry and also in the game of croquet (q.v.). The gavel is a variety of mallet. Various small mallets are used by gold beaters, jewelers, dentists and other artisans.

MALIAN, mä-yän', Julien de, West Indian dramatist: b. Le Moule, Guadeloupe, 1805; d. Paris, France, 1851. He gained wide reputation as a writer of comedies and dramas, many of which have been presented on the metropolitan stage. The most popular are 'Two Roses' (1831), a historical drama of the civil wars in England; 'The Carpenter' (1831), a comedy; and 'The Wandering Jew' (1834).

MALLOCK, William Hurrell, English author: b. Devonshire, 1849; d. April 2, 1923 He was graduated from Balliol College, Oxford and won the Newdigate prize in 1872. He never entered a profession but devoted himself entirely to literary work. His philosophical and sociological writings include 'Is Life Worth Living?' (1879); 'Social Equality, a Study in a Missing Science' (1882); 'Atheism and the Value of Life' (1884); 'Property and Progress' (1884); 'Labour and the Popular Welfare' (1893); 'Studies of Contemporary Superstition' (1895); 'Classes and Masses' (1896); 'Aristocracy and Evolution' (1898); 'Doctrine and Doctrinal Disruption' (1900); 'Religion as a Credible Doctrine' (1902); 'The Reconstruction of Belief' (1905); 'The Nation as a Business Firm,' and 'Social Reform' (1914). He also wrote several works of fiction, most of which deal with the same social and religious problems as the above works, including 'The New Republic' (1877), in which he introduced many

well-known contemporaries under thin disguises; *A Romance of the Nineteenth Century* (1881; new ed., 1894); *The Old Order Changes* (1886); *A Human Document* (1892); *The Heart of Life* (1895), and *The Individualist* (1899), and published two volumes of verse, *The Veil of the Temple* (1904); a translation of Lucretius *On Life and Death* (1878), and *An Immortal Soul* (1908). His philosophical works deal with the fundamentals of religion, arguing for supernaturalism and aiming to show that science alone supplies no basis for religious belief; in his political and economic writings, he attacked the radical and socialistic theories and tendencies of the age.

MALLOPHAGA, mă-lŏf'ă-gȧ. See INSECTS.

MALLORCA, mä-yôr'kä, or **MAJORCA,** mȧ-jôr'kȧ, Spain, an island in the Mediterranean, the largest of the Balearic group; area, 1,352 square miles. It is about 120 miles distant from Spain. It is very irregular in shape, and deeply indented, particularly in the northeast. The scenery is picturesque, the climate mild and agreeable, and in many of the valley regions vegetation is luxuriant. There are quarries of marble of various grades; lead and iron have been obtained, and coal to a considerable amount is mined. The olive and vine are extensively cultivated and there are large orchards of figs and oranges. The principal exports are olive oil, light wines, brandy, wool and silk. There is a wireless station with a 500-mile range located at Soller, not only for ship and shore traffic, but also for international service. Pop. (1940) 327,120.

MALLORY, Stephen Russell, American lawyer: b. Trinidad, West Indies, 1813; d. Pensacola, Fla., Nov. 9, 1873. His parents removed with him to the United States in 1820 and he was educated in Mobile and in Nazareth, Pa. He studied law and was admitted to the bar in 1839; he was United States senator 1851–57 and in 1861 entered the service of the Confederate States as secretary of a navy not in existence. He was arrested at the close of the war and held for 10 months, after which he returned to Pensacola and was until his death engaged in law practice.

MALLOW, a genus of herbs (*Malva*), of the family Malvaceae. The species, of which there are less than a score, are widely scattered and are characterized by angled, lobed or dissected leaves and solitary or clustered axillary flowers. They include four species cultivated in America and one very well-known weed, *M. rotundifolia,* popularly known among children as cheese-plant because of the shape of the fruits, which also suggested another popular name, shirt-button plant. The plant is a perennial, very persistent of life and rather difficult to eradicate except by constant clean cultivation. Musk mallow (*M. moschata*) is cultivated for its large, showy pink or white flowers; *M. alcea* is also popular. *M. crispa* furnishes a useful fiber, as probably other species could be made to do. Its leaves are often used for garnishing but are not eaten. This species and *M. sylvestris* are frequently seen in old gardens and in their vicinity as escaped plants, but are not offered for sale by seedsmen. The name mallow is loosely applied to many plants of the mallow family, but not of the genus *Malva;* for instance, marsh mallow (*Althaea officinalis*), rose mallow (*Hibiscus moscheutos*) and Indian mallow (*Abutilon abutilon*); also, more loosely still, to unrelated plants, as Jew's mallow (*Corchorus olitorius* or *C. capsularis*). See also CORCHORUS; HOLLYHOCK; HIBISCUS.

MALMAISON, mäl-mā-zôn̈, a celebrated French château on the Seine, 10 miles west of Paris. Built in the mid-18th century, it became the residence of the Empress Josephine who purchased it in 1798. After her divorce she returned to Malmaison where she died in 1814. After the disaster of Waterloo (1815), Napoleon spent five days there. It is now a museum of both the First and Second Empires. Its famous rose garden is partly restored.

MALMÉDY, a town at the eastern border of Belgium, southeast of Verviers. It is located in the romantic valley of the Amblève River. Like Eupen, it was returned to Belgium by the Versailles Treaty in 1918, reannexed by Hitler in 1940 and liberated in 1944. Belgium's claim to Malmédy is based on the fact that, up to 1815, it belonged to the principality of Stavelot.

The market place has lovely old houses and the old abbey is used as a town hall. Local industries are papermills and tanneries. Pop. (est. 1949) 5,597. See also EUPEN.

MALMESBURY, William of. See WILLIAM OF MALMESBURY.

MALMESBURY, England, market town and municipal borough, Wiltshire, 94 miles west of London, on the Great Western Railway. It is built on a ridge of land almost surrounded by the river Avon and one of its small tributaries. Its site was chosen by a Scottish or Irish monk named Maildulphus for a hermitage in 635. He later gathered a colony of disciples about him, one of whom, Adhelm, became abbot of the abbey founded there, ruins of which still remain. Athelstan rebuilt the monastery and is buried there. The town grew around the abbey, but was not incorporated until 1645, the charter then granted remaining in force until 1885. The modern town has a considerable agricultural trade, manufactures silk and pillow lace, and has tanneries and breweries. Two miles distant is the manor house of Sir Lawrence Washington, and the church at Gardson where many members of the Washington family are buried. Pop. (1947) 2,556.

MALMO, mäl'mė, Sweden, a seaport and the third largest town of the country, on the Sound, almost opposite Copenhagen, 17 miles distant, with which it has steam-ferry communication, a channel being maintained in winter by an ice-breaker. Malmö is a busy industrial center with important manufactures, is the terminus of several railroads and is 384 miles by rail southwest of Stockholm. The town and its harbor have been considerably improved and modernized, and an extensive export and import trade is carried on. Malmö dates from the 12th century, but until 1500 it was little more than a poor fishing village. It again suffered a period of decline but revived after the improvements to the harbor effected in 1775. Pop. 118,000. It has an interesting city hall, Saint

Peter's Gothic Church and an ancient castle. The industries include iron works and foundries, manufacture of railroad cars, shoes, gloves, tobacco, and chocolate.

MALMSEY, mäm'zĭ, a sweet wine, made from a grape grown on rocky ground, in Spain, Italy, and Madeira, exposed to the full influence of the sun, and not gathered until partially withered.

MALOLOS, mä-lō'lôs, municipality, Philippine Islands, and the capital of the Province of Bulacán, Luzon, situated at the head of one of the inlets of the Pampanga River delta, five miles northwest of Bulacán, the former capital and 20 miles northwest of Manila. It is a telegraph and military station, is near a station of the Manila-Dagupan Railroad and is the center of an important trade. It is in a region which was a stronghold of the insurgents, and immediately after the close of the Spanish War was made the capital of the insurgent government. Rice is extensively cultivated in the vicinity. Pop. (1948) 38,779.

MALON, mà-lôn', **Benoît,** French Socialist: b. near Sainte-Etienne in the Department of Loire, June 23, 1841; d. Asnières, Sept. 13, 1893. He early entered upon a journalistic career and his activities in behalf of Socialistic agitations caused his enforced absence from France for a time preceding 1880. He then founded the *Revue Socialiste* which he edited until his death. He attained considerable influence through the breadth of his teachings, which advocated the necessity for an inclusion of certain high religious, ethical and moral considerations with the socialistic principles of government. Author of *L'Internationale, son histoire et ses principes* (1872); *Histoire du Socialisme et des prolétaires* (1881–1884); *Le socialisme intégral* (1890–1891).

MALONE, mà-lōn', **Edmund,** Irish Shakespearean scholar: b. Dublin, Oct. 4, 1741; d. London, April 25, 1812. He was educated at Trinity College, Dublin, and was called to the Irish bar in 1767, but henceforth devoted himself entirely to literary pursuits. His most important and permanent critical works are *Attempt to Ascertain the Order in Which the Plays of Shakespeare Were Written* (1778), which still carries authority; his edition of the poet in 10 volumes; and the edition known as the Third Variorum, which was prepared after his death by James Boswell, the younger, out of material left by the critic, and published in 21 volumes. This last is still the best of all complete critical editions.

He also published *Remarks on the Rowley* (Chatterton) *Controversy; An Inquiry into the Ireland Shakespearian Forgeries;* and biographical memoirs of Sir Joshua Reynolds, Dryden, W. Gerard Hamilton, and others.

Consult Prior, James, *Life of Edmund Malone* (London 1864).

MALONE, Walter, American poet and jurist: b. Desoto County, Miss., Feb. 10, 1866; d. Memphis, May 18, 1915. He was graduated at the University of Mississippi and subsequently engaged in the practice of law and in literary work. He contributed to the periodicals of the day and published *Claribel and other Poems* (1882); *The Outcast* (1886); *Narcissus* (1893); *Dusk and Dawn* (1895); *December and June* (1896); *Coming of the King* (1897); *Songs of North and South* (1900); *Poems* (1904); *Songs of East and West* (1906); *Hernando DeSoto,* an epic poem highly praised (1914).

On March 29, 1905, on petition of practically all members of the Memphis bar, he was appointed judge of the Circuit Court of Shelby County and held the position until his death. An association composed of members of many states has been formed to erect a bronze portrait statue to Walter Malone in the principal park of Memphis; while another association has for its object to have his *Opportunity* cast into a bronze tablet to be erected in Court Square, in the heart of Memphis.

MALONE, mà-lōn', village, New York, and Franklin County seat; altitude 730 feet; on the Salmon River; and on the New York Central, and the Rutland railroads; 167 miles northeast of Utica. It has an airport. Situated 12 miles from the boundary between the United States and Canada, Malone is a port of entry for the seventh customs district.

Lying in the northern foothills of the Adirondack Mountains, the town is surrounded by a fertile agricultural area raising hops, hay, potatoes, and has dairy products. Considerable lumbering is also carried on. A large tract of woodland near by was burned over in the early 1900's, and, as a part of the Adirondack State Park, has been reforested. Mineral resources of the region remain to be developed. Industrially, Malone has had a varied list of products. Paper milling was at one time the chief dependence of the village; now other manufactures include shoes, slippers and moccasins, bronze and aluminum powder, and woolen clothing. There are lumber mills, tanneries, foundry and machine shops, and railroad repair shops. Hydroelectric plants line the river. The mills and lumber camps employ many French-Canadians. In most of the homes in the village, both English and French are spoken. This French-Canadian element is an important factor in the industrial population of northern New York, as in northern New England.

Malone has good schools, parks, playgrounds, and facilities for recreation. The northern New York Institution for Deaf Mutes is located here. The Wead Library is handsomely housed, and the county historical society maintains a library and a museum. There are many points of historical interest. The home of William Almon Wheeler (q.v.) is now the Elks Club. The home of the founder of the village, Richard Harison, was used during the War of 1812 as headquarters for Gen. James Wilkinson (q.v.); this was in 1813, when Wilkinson was ordered to the frontier and failed to carry out plans for a campaign in Canada. Arsenal Green was a parade ground in the War of 1812 and was occupied by British troops during the brief period when the village was held by them. The federal building, the courthouse, and old Franklin Academy are notable.

Malone was first settled in 1802 by a group of Vermonters, one of whom selected the name in honor of Edmund Malone (q.v.), an Irish Shakespearean scholar. The village was incorporated in 1833. From its earliest days Malone had a strong Irish element, and in 1866 the village was selected by the Fenians (q.v.) as a base for an invasion of Canada. They did ac-

tually cross the border, but, after an encounter with Canadian troops, they returned to Malone and disbanded. The village is governed by a mayor and council. Pop. (1940) 8,743; (1950) 9,501.

MALOO CLIMBER. See BAUHINIA.

MALORY, măl'ô-rĭ, Sir **Thomas,** author of the English prose romance *Morte d'Arthur.* The work was finished in the ninth year of Edward IV's reign, 1470, and published by Caxton in black-letter folio, in 1485. Little is known of the author; he may have been a priest; Caxton calls him "a servant of Jesus both day and night," and priests frequently were accorded the title "Sir." Probably he was a Welshman. See also ARTHURIAN ROMANCES; GRAIL, THE HOLY; LANCELOT OF THE LAKE; MERLIN; MORTE D'ARTHUR; TRISTAN.

MALOT, mà-lō', **Hector Henri,** French novelist: b. La Bouille, near Rouen, France, May 20, 1830; d. Vincennes, July 18, 1907. He studied law, but abandoned it for a literary career, and in 1859 issued the first of a long series of successful novels. He was for a time newspaper correspondent in London, and literary critic of *L'Opinion Nationale.* He wrote *Victimes d'amour* (1859); *Sans famille,* published in English as *No Relations* (1878); *Conscience* (1888); *Complices* (1893); *En famille* (1893); *Amours de jeune; Amours de vieux* (1896); an autobiography, *Le Roman de mes Romans* (1896).

MALPIGHI, măl-pē'gē, **Marcello,** Italian anatomist: b. Crevalcuore, Italy, March 10, 1628; d. Rome, Nov. 29, 1694. He received a medical education in Bologna and was granted a doctor's degree in 1653. In 1656 he became professor of medicine at Pisa, where he formed a friendship with the mathematician Borelli, who encouraged him to proceed with researches in anatomy. His health failing he returned to Bologna and continued his investigations, which resulted in discoveries which established facts undisputed in the modern world of science and placed the world's knowledge of physiology on a new footing; his researches in botany and entomology were highly important. In 1691 he was summoned to Rome as first physician to Innocent XII, in which office he died.

He published numerous scientific works of great value, a complete edition of which was published in Venice 1743. The principal of these are *Observationes Anatomicae* (1661) and *Epistolae Anatomicae* (1665).

MALPLAQUET, măl-plà-kā', **Battle of,** the bloodiest in the war of the Spanish Succession, gained by Marlborough and Eugène, the commanders of the allies, against the French under Claude de Villars, Sept. 11, 1709. The French lost 10,000; the allies more than 20,000. Malplaquet is a village in the Department of the Nord, near the Belgian frontier, 20 miles east of Valenciennes. After the victory there the allied armies soon took Mons and Douai. See SUCCESSION WARS.

MALSTATT-BURBACH, măl'shtät-bŏŏr'bäkh, section of Saarbrucken, Germany, on the Saar River. It is situated in a coal-mining district and is almost entirely given over to factories and workmen's dwellings. There are manufactories of iron, steel and cement machinery, boilers and safes. It has a large wharf for handling the exports of coal. Malstatt received municipal rights in 1321, but these were later surrendered. The town began to grow in the middle of the 19th century and in 1874 it joined with Burbach to form a city.

MALSTROM, Norway. See MAELSTROM.

MALT AND MALTING. See BREWING AND MALTING.

MALTA, môl'tà (ancient MELITA), British island in the Mediterranean. With Gozo and Comino it forms the British Crown Colony of Malta (Maltese Islands). The Maltese group has a total area of 122 square miles, of which 95 square miles belong to Malta. Malta is of irregular oval shape, 17 miles long, with a central breadth of nine miles; its greatest elevation is over 750 feet. It is of limestone formation, and is deeply indented on all sides except the south, where the coast forms a continuous and almost unbroken line. Of great strategical importance, it is very strongly fortified, especially Valletta, the capital, which is the headquarters of the British Mediterranean Fleet and the principal naval and mercantile coaling station in the Mediterranean. During World War I it was one of the most important of British naval stations and in World War II it was repeatedly bombed by German and Italian aircraft. It served as a British air base for attacks on Italian Libya and Sicilian airfields.

The climate is sultry in summer and somewhat enervating when under the influence of the humid sirocco blowing from Africa, but generally is mild and healthful. There are only a few small streams, but the springs are so numerous and copious that no deficiency of water is felt, and since 1880 an extensive system of waterworks has greatly improved sanitary conditions. Malta has a bare, stony appearance owing to the absence of trees. The soil is thin but remarkably fertile; and its fertility is increased by the skillful cultivation and the diligent toil of the inhabitants. Large crops of wheat and potatoes are raised, early varieties of the latter being largely exported to England; maize, barley, cotton, cloves, oranges, figs, grapes, carob beans and peaches and other fruits are also grown. Filigree ornaments and a little cotton are manufactured. Sheep and goats are kept, with smaller numbers of cattle, mules, asses and horses.

The language of the people is a dialect of Semitic origin derived from the Carthaginian and Arabic tongues, with a strong admixture of Italian. The native population believe themselves to be of Phoenician descent. English and Maltese are the official languages. English is used for all administrative purposes; Maltese is used in the courts of law, having been substituted for Italian in 1934.

The executive head of Malta is a governor, who is also commander in chief of the island. On Feb. 26, 1939, Malta was granted a new constitution under letters patent dated February 14 which granted some measure of self-government. These powers were enlarged in 1947. The constitution provides for a Council of Government, composed of eight official members, two unofficial members nominated by the governor, and 10 elected mem-

bers. The governor presides over the Council, with a casting vote but no original vote. Ecclesiastics are precluded from membership. Malta is of great historical, archæological and architectural interest. It was in St. Paul's Bay that the Apostle Paul is now generally believed to have been shipwrecked in 58 A.D. (Acts xxvii and xxviii). The island was held in turn by the Phœnicians, the Greeks, the Carthaginians, and the Romans. It was conquered by the Arabs in 870 A.D., and was attached to Sicily from 1090 until 1530, when the Emperor Charles V turned it over to the Knights of St. John, who distinguished themselves during succeeding centuries by their bold defense of Christianity against Moslemism, especially during the siege of 1565. As the Knights of St. John of Malta they became famous throughout the civilized world. They ruled the island until they were dispersed by Napoleon in 1798. Thereafter the Maltese rebelled against the French, and aided Great Britain when her fleet blockaded the island, 1798–1800. At the request of the inhabitants Britain made the island a protectorate, and it was formally annexed to the British Crown by the Treaty of Paris in 1814. It is one of the most important ports of call in the world. Consult Gatt Rutter, J., "Malta" (1936); Porter, W., "A History of the Knights of Malta" (1883); Zammit, Th., "Malta. The Islands and Their History" (1926).

MALTA FEVER or **UNDULANT FEVER,** a disease closely related to, if not identical with, the livestock malady known as Bang's disease or infectious abortion, and first described by Hippocrates nearly 2,300 years ago. Highly prevalent in the Mediterranean area, especially on the Island of Malta, it has spread from there throughout the world. Variously known as Malta fever, Mediterranean fever, Neapolitan fever, etc., more recently it was given the name "Undulant Fever" because the attacks come in waves or undulations. The symptoms are characteristic, the fever being accompanied by intense pain, enlargement of the spleen, swelling of the joints, excessive perspiration, etc. The fever may last for but a few days, a few weeks, or it may continue for months, then disappear only to reappear after an indefinite period. The patient may be ill for two or three years before any definite improvement is noted. The mortality rate, however, is low. The causative agent was isolated by Dr. David Bruce, a British army surgeon, in 1887, from human beings who had succumbed to the disease on the Island of Malta. He called the germ *Micrococus melitensis.* Later it was discovered that the germ invaded goats, and that humans commonly acquired it by drinking the milk of infected goats. It was brought to the United States a number of years ago when Southwestern ranchers imported large numbers of goats from Malta. It has since been learned that the germ invades cattle and swine, and most of the cases developing in the United States have been traced to the drinking of milk of infected cows. Professor Bang isolated the germ of the abortion disease in 1897, and in 1918 Miss Alice C. Evans of the U. S. Department of Agriculture discovered the similarity or close relationship between the germs isolated by Bruce and by Bang. See also BANG'S DISEASE.

MALTA, Knights of. See JOHN, ORDER OF SAINT.

MALTE-BRUN, mäl'tĕ-broon (Fr. mältbrŭn), **Conrad** (properly MALTHE BRUNN), Danish geographer: b. Thisted, Jutland, Aug. 12, 1775; d. Paris, Dec. 14, 1826. He devoted himself to literature and politics in Copenhagen, but having given offense by writing in favor of the liberty of the press and the enfranchisement of the peasants, was banished to Sweden in 1800. He went later to Paris, where he became famous as a geographer. He edited the foreign political department of the *Journal des Debats,* but is best known for his "Summary of Universal Geography" (8 vols., 1810–29). The first six volumes only were completed by Malte-Brun. Among his other works are "Ancient and Modern Poland"; "History of Travel," and "Mathematical, Physical and Political Geography."

MALTESE (mâl-tēs' or -tēz') **CROSS.** See CROSS.

MALTESE DOG. See DOG.

MALTHA, (1) according to Pliny, a name used for an inflammable mud which flowed from a pool at Samosata, Commagene, North Syria, and resembled naphtha. (2) A mixture of wax and pitch for caulking ships; mineral tar is another name for maltha, which is found oozing from rocks in certain localities, particularly in California.

MALTHUS, Thomas Robert, English political economist: b. near Guildford, Surrey, Feb. 14, 1766; d. Bath, Dec. 29, 1834. He studied theology at Cambridge and was ordained in the Church of England, continuing to pursue his profession as a teacher while holding a small living in Surrey. In 1805 he was appointed professor of history and political economy at Hailcybury College. In his famous "Essay on the Principles of Population" he propounded (1798) what is known as the Malthusian Doctrine, namely, that the increase of population advances at a geometrical, the increase of the means of life at an arithmetical, ratio; that this condition of things renders the condition of the poor more and more hopeless; that unless famine or war interfere to diminish population the means of life will eventually prove inadequate; that discouragement of early and improvident marriages and the cultivation of self-restraint must be employed to avert the danger. These positions have been the subject of long and widespread discussion. His other writings include "An Inquiry into the Nature and Progress of Rent" (1815); "Principles of Political Economy" (1826); "Definitions in Political Economy" (1827). Consult Bonar, "Malthus and His Work" (1885); Soetbeer, "Die Stellung der Sozialisten zur malthusischen Bevölkerungslehre" (1886); Molinari, "Malthus, Essai sur le Principe de Population" (1889); Cossa, "Il principio di populazion di T. R. Malthus" (1895). See ECONOMICS.

MALUS, Etienne Louis, ā-tē-ĕn loo-ē mă lüs, French physicist and military engineer: b. Paris, June 23, 1775; d. there, Feb. 23, 1812. He was educated at the École Polytechnique, and upon leaving the school received a captain's commission in the corps of engineers, and served during the campaign of 1797 with the army of the Sambre and Meuse. Subsequently he participated in the campaign in Egypt, and in 1804 superintended the construction of forti-

fications at Antwerp and Strassburg. Whatever time could be spared from his professional labors was devoted to scientific pursuits. His chief publications consist of a mathematical 'Traité d'Optique,' first published in the 'Mémoires présentés à l'Institut' in 1810, in which he promulgated some valuable discoveries respecting the refraction of light in transparent media; and the 'Theory of Double Refraction' (Mémoires présentés à l'Institut, Vol. II), containing an account of his discoveries respecting the polarization of light, which consisted in showing that light may acquire properties identical with either of two rays yielded by refraction through Iceland spar by the process of simple reflection at a particular angle from any transparent body. This discovery gained for its author his election to the Institute and the biennial medal of the Royal Society of London. He also published an 'Essay on the Measurement of the Refractive Force of Opaque Bodies.'

MALVACEAE, a family of flowering plants, the mallows and their allies, in the order *Columniferæ,* with the calyx gamosepalous; petals contorted in a bud, stamens numerous, monadelphous; anthers extrorse, monothecious; pollen-grains spiny. They are herbaceous or woody plants, mucilaginous in their juices, and usually densely hairy, especially when young. The leaves are palmately nerved and frequently deeply five-lobed. The flowers are large, funnel-shaped, conspicuously and beautifully colored, attracting the aid of insects in fertilization. The fruit is schizocarpous. This family contains many important genera and species of plants elsewhere described, such as the mallows (*Malva, Lavatera,* etc.), hollyhocks (*Althæa*), cotton-plants (*Gossypium*), the rose-mallows (*Hibiscus*), etc. About 60 genera and 900 species are accredited to this family by systematic botanists.

MALVERN, măl-vẽrn, Ark., town and Hot Spring County seat; alt. 315 feet; 43m. SW. of Little Rock, and 22m. SE. of Hot Springs; on Missouri Pacific; and Rock Island railroads. It is in a timber, mineral, and farm area, producing lumber, cotton, clays, barite, titanium ore, and marble. It has a metal plant, two foundries, a shoe factory, and wood products mills. Incorporated in 1872. Pop. (1950) 8,072.

MALVERN, mâl'vẽrn, **Great,** England, a fashionable inland watering-place in Worcestershire, on the east side of the Malvern Hills, at the foot of the Worcestershire Beacon, 1,395 feet high, the summit of which commands magnificent views. A restored 11th century priory church and Malvern College are the chief edifices. Malvern is widely celebrated and greatly frequented owing to its salubrious climate and the efficacy of its mineral springs. Pop. of urban district about 17,000.

MALVERN HILL, Battle of. After the close of the battle of Glendale (q.v.), June 30, 1862, the Army of the Potomac was put in position on Malvern Hill, an elevated open plateau on the left bank of James River, 60 feet high, and about 1½ miles by ½ mile in area. On this plateau the army was disposed in a large arc, both flanks resting on the river and protected by gunboats. Porter's Fifth corps was on the left, Couch's division of Keyes' corps on the right of Porter, Heintzelman's two divisions—Kearny and Hooker—on the right of Couch, Sumner's corps on the right of Heintzelman, and Franklin's corps on the right of Sumner. Peck's division of Keyes' corps was on the right of Franklin and was the extreme right of the army, and it and the left of Porter's line stood back to back. There were numerous batteries of artillery along and in rear of the line. The position was a very strong one: the Confederate D. H. Hill says: "Tier after tier of batteries were grimly visible on the plateau rising in the form of an amphitheatre." The approach to the position was over 400 to 500 yards of open ground swept by artillery fire. When it was discovered early in the morning of July 1 that McClellan had fallen back from Glendale during the night Lee gave orders for immediate pursuit. Jackson marched by the Willis road, and when in sight of Malvern Hill he formed line, with Whiting's division on his left and D. H. Hill's on his right, one of Ewell's brigades occupying the interval. The rest of Ewell's division and Jackson's own division were held in reserve. Magruder was directed to take position on Jackson's right, but before his arrival two of Huger's brigades came up and were placed next to Hill. The Confederates felt the Union lines with infantry and artillery, and when Magruder came up, about 2 P.M. Huger's two brigades—Armistead and Wright—with four batteries, were ordered forward. The batteries, as they emerged in succession from the woods, were promptly knocked to pieces by the fire of over 60 guns brought to bear upon them, and the two brigades were repulsed with loss. This attack fell upon the right of Porter and left of Couch, and the latter was now reinforced by Caldwell's brigade of Sumner's corps. No serious advance had been made on other parts of the line, but Hill had suffered severely from artillery fire in getting his troops in position opposite Couch's right. At 5:30 P.M. Magruder assaulted Porter's line and the left of Couch with the five brigades of Armistead, Cobb, Wright, Mahone and Barksdale. All were met by such a terrific fire of artillery and musketry, which swept the slope of the hill, that they could make no headway, though gaining temporary advantages, and fell back with great loss. Toombs', G. T. Anderson's and Ransom's brigades were now ordered in; Toombs got lost in the thick woods; Anderson and Ransom shared the fate of those preceding them, and fell back. Magruder's fight ended before dark. While Magruder was thus engaged with Porter and the left of Couch, D. H. Hill, on his left, advanced against Couch's right, which, as the action progressed, was reinforced by Caldwell's brigade, three regiments of Hooker's division under Sickles and some of Kearny's division. Hill's five brigades were commanded by Generals Garland and Ripley and Cols. J. B. Gordon, A. H. Colquitt and C. C. Tew. The slope to Couch's line was about 800 yards, without cover, and the advance directly in the face of guns on the slope and bristling on the summit, from which burst forth such a terrific fire of shell and canister that Hill's brigades withered under it. Toombs' brigade was picked up and sent to their support, but the six brigades were hurled back, some in great disorder after the loss of half their men.

Later in the evening Taylor's brigade of Ewell's division, on Hill's left, moved against the left of Kearny's division, and was repulsed by artillery fire alone.

Half an hour after Hill had been disastrously repulsed and his troops scattered, McLaw's division of two brigades—Semmes and Kershaw—came up and assaulted Porter's right. Semmes made some headway up the slope, but was met by the 69th and 88th New York of Meagher's brigade, which Sumner had sent to Porter's assistance, and was repulsed after a hand-to-hand encounter. Kershaw, on Semmes' left, was likewise repulsed, and his repulse at twilight marked the close of the battle, but it was 9 o'clock before the firing ceased and quiet settled down on the bloody field.

Sixteen Confederate brigades had heroically thrown themselves against the Union left, but were repulsed by the artillery and nine brigades. Advanced regiments were forced back, but generally recovered ground; batteries or parts of batteries were withdrawn, but again run forward; yet "never for an instant was the Union line broken or the guns in danger." The Confederate loss was over 5,500; Jackson's four divisions had 2,301 killed, wounded and missing; Magruder and Huger about 2,900. The Union loss was less than 2,000.

E. A. Carman.

MALVERN HILLS, măl'vẽrn hĭls, England, a range of picturesque hills on the borders of Worcester and Hereford shires. It extends north and south for about nine miles, and attains an altitude of 1,395 feet in the Worcestershire Beacon.

MALVERNE, măl'vẽrn, village, New York, in Nassau County, Long Island, 17 miles east of New York, altitude 21 to 37 feet above sea level. It is served by the Long Island Rail Road. The development was originally called Norwood but in 1913 the name was changed to Malverne after Malvern, Eng. The final e was added by mistake in the spelling when the railroad timetable was printed and it has been kept ever since.

Malverne is a non-industrial home-owning community. The schools are modern and well-equipped. There is a public library.

The town was incorporated in 1921. The form of government is representative as laid down in the General Village Law prescribed by New York State. Pop. (1950) 8,086.

MAMARONECK, mă-măr'ō-nĕk, village, New York, Westchester County, altitude 47 feet, on Long Island Sound and the New York, New Haven and Hartford Railroad, 20 miles east by rail from Grand Central Station in New York.

Part of the village, along with the village of Larchmont, is included in the town of Mamaroneck. The section is principally residential, but there are some small local industries. There is a public library. Notable buildings are the library, the municipal building, and the postoffice.

The village's name is Indian, and is variously said to mean "He assembles the people" and "Where the salt water meets the fresh." Settled in the 1650's, the village was incorporated in 1895. It has a mayor and council, and a village manager. Pop. (1940) 13,034; (1950) 15,016.

MAMBAJAO, mäm-bä'hou, municipality, Philippine Islands, in Misamis Oriental Province, situated on the northwestern coast of Camiguin Island, which lies off the northeast coast of Mindanao. Pop. (1948) 25,193.

MAMBER, măm'bẽr, a widely diffused colloquial name for the common wild goat (*Capra aegagrus*) of southwestern Asia. See also Goat.

MAMBUSAO, mäm-bōō'sou, municipality, Philippine Islands, in the Province of Capiz, island of Panay, on the west tributary of the Panay River, opposite Ibajay and 17 miles southwest of Capiz, the provincial capital. Pop. (1948) 18,619.

MAMELUKES, măm'ẽ-lūks (from the Arabic *memalik,* a slave), in Egypt, slaves from the Caucasian countries, who from menial offices were advanced to dignities of state.

In the 13th century the Seljuk Turks, whose greatest chief had been the Sultan Saladin, were masters of Egypt and western Asia. It was a Turkish custom to carry off boys from conquered territories as slaves, and to train them as military bodyguards for the sultans.

Such a bodyguard of white slaves, or Mamelukes, was formed in Egypt. The Mamelukes became an invaluable fighting force; their leaders were taken from their own ranks and in 1250 their commander Kọtuz (Mozaffar Saif aldin) overturned the government, and made himself sultan of Egypt. Ten years later, another Mameluke captain, Bibars (Baybars I, 1233–1277) slew Kọtuz and seized the sultanate. From this time the Mamelukes were masters of Egypt, and successive Mameluke sultans ruled until the conquest of the Ottoman Turks in 1517.

The series is divided into two groups, the Turkish (Bahri, 1250–1390) and the Circassian (Burji, 1390–1517). The succession of each sultan was usually secured by the violent death of his predecessor. Lesser Mameluke chiefs ruled the provinces under a kind of feudal system.

The Mameluke sultans were, on the whole, able rulers, and raised Egypt to great prosperity. They were also patrons of literature, architecture, and other arts. After the Ottoman conquest, Egypt was officially placed under a Turkish pasha, but practically under Mameluke beys, who controlled the several provinces. They formed a fine body of cavalry, and attacked the French, when they landed in Egypt, with the greatest fury; but they were unable to withstand the European artillery, and many of them soon joined the French. The pasha of Egypt, Mehemet Ali, destroyed the Mameluke beys, March 1, 1811, by a perfidious stratagem, and immediately afterward ordered a general massacre of the Mamelukes in every province of Egypt. Some hundreds managed to escape into Lower Nubia, where they built a small town, and endeavored to keep up their force by disciplining Negroes in their peculiar tactics. They did not succeed, however, and shortly afterward dispersed. See also Egypt—*History.*

MAMEY, or **MAMMEE APPLE.** See Mammee Apple.

MAMEY SAPOTA, măm'ē sà-pō'tà, a large tree (*Calocarpum mammosum*) of the family Sapotaceae, native of tropical America. The leaves are large, obovate, glabrous, the flowers small and

inconspicuous and the fruit globose or egg-shaped, rusty brown, and three to seven inches long, with a single large seed. The fruit is very popular in the tropics, especially in Cuba, and is sometimes shipped to the United States. It is eaten fresh, or used for sherbets or marmalade. The tree is grown in Florida and California, but so far not very successfully.

MAMMALIA. See MAMMALS.

MAMMALS, a class of animals, known also as beasts, or quadrupeds, the highest of the vertebrate group in the sense that it comprises forms whose organization is on the whole the most efficient on account of the complexity, or perfection, of the various organs and parts. The diagnostic character of the class is the possession of cutaneous glands, which secrete a complex fluid, called milk, for the nourishment of the young. The lower jaw articulates directly with the cranium, without the mediation of a quadrate bone. The occipital condyles, two in number, form part of the exoccipitals. The internal ear contains a series of three or four separate small bones, which are concerned in audition. The heart is four-chambered, with two auricles and two ventricles; a single left aortic arch; blood warm; red blood discs, not nucleated. A muscular diaphragm separates the heart and lungs from the abdominal cavity. With few exceptions, mammals are clothed with hair, a special outgrowth of the epidermis, and even in these exceptional cases isolated hairs are found at some stage of their life.

Mammals as a class are extremely diversified in size, appearance and habits. The structure of some is modified for a purely aquatic life, of others for burrowing in the earth, for flying, for leaping, for running, etc. Some live entirely in the sea, others pass their lives in the treetops and others in subterranean caverns, which they excavate.

All mammals possess limbs, which are normally four in number, but the hind pair is suppressed in the whales and sea-cows. The limbs assume the form of legs for terrestrial progression, wings for flight or paddles for swimming. The class includes man, and the majority of the animals most useful to man, such as the horse, ox, sheep, goat, dog, cat, etc. It includes also the whales, the largest of existing animals. About 600 genera and 5,000 species of mammals (exclusive of fossil forms) are known, of which about 200 genera and 1,200 species occur in North America, north of Panama.

Integuments.— The skin of mammals consists of two principal layers, a superficial one, called the epidermis or cuticle, and a deeper layer, the dermis or corium. The epidermis is again divided into two layers, an external horny layer and a deeper one, called the Malpighian layer. The epidermis is usually quite smooth, and is beset with hairs which are a special outgrowth of this part of the integument peculiar to the class. The cetacea are without hairs, except a few about the mouth. In the pangolins, the epidermis develops large scales which cover the greater part of the body. Epidermic scales of smaller size are found on the tails of various rodents, insectivores and marsupials. The horns of ruminants, the nasal horn of the rhinoceros and all claws, nails and hoofs are also epidermic structures.

The dermis or corium is generally thicker than the epidermis and contains blood-vessels, tactile nerve endings, sweat glands which open on the surface of the body and fatty tissue. In the whales and seals the fat cells are enormously developed immediately below the dermis and constitute the "blubber." In the armadillos bony plates occur in the dermis, forming a carapace or shell. They are covered by horny sheaths. The presence of small hard tubercles in the skin of certain porpoises gives ground for the belief that the ancestors of the cetacea were covered with a bony armor, somewhat like that of the armadillos.

Hair.— True hairs are found only on mammals. They are simple epidermic structures growing from papillæ sunk in the dermis. They consist of central cellular pith, encased in a horny sheath. In some mammals the sheath is rough, and the hair is then capable of being matted together to form "felt." In the majority of mammals the hairy covering consists of coarse long hairs and fine short hairs intermingled, forming the fur. In the porcupines the coarse hairs assume the form of large stiff spines, or quills; in the hogs they are smaller and more flexible, forming bristles. The hairy covering is usually shed once or twice annually, except in the case of man and of the manes and tails of such ungulates as the horse, the hairs of which may persist throughout life.

The majority of mammals have a number of large, long hairs, or vibrissæ, arranged in a definite fashion about the mouth, eyes and ears, which serve to a certain degree as tactile organs. In deer and some other ruminants the hairs consist mainly of the cellular pith and hence are easily broken.

The color of mammals is chiefly due to the pigments contained in the hair, which belong to the class known as melanins. Black, white and brown in various mixtures and shades are the commonest colors. The coloration is chiefly protective, but some such sharp contrasts of black and white as those of the skunks are thought to be warning colors, and the clear white of the under side of the tail of deer, certain hares, etc., to be directive, or distinguishing, marks for the young.

Skeleton.— The skeleton consists of an axial portion, comprising the skull, the backbone or vertebral column, the ribs and the sternum; and an appendicular portion, or the skeleton of the limbs. In the skull the bones are bound firmly together by the overlapping or interdigitation of the edges, except the lower jaw, the ossicles of the internal ear and the hyoid, or tongue, bones. In adults most of the sutures are usually obliterated. The snout or rostrum consists of the premaxillary, maxillary, palatine and pterygoid bones below and on the sides, and the nasals above, while within are the median vomer and the ethmoid bones. The rostrum abuts against the brain-case or cranium, which is vaulted, and comprises three segments, an anterior one, consisting of the presphenoid, orbito-sphenoids and frontal; a middle segment, consisting of the basisphenoid, alisphenoids, squamosals and parietals; and a posterior segment, consisting of the basi-occipital, exoccipitals and supra-occipital. The exoccipitals bear the two condyles for articulation with the vertebral column. At the base of the skull, between the occipital and squamosal, are

the periotic bones, containing the organ of hearing or internal ear, and the tympanics, which form the bony walls of the orifice of the ear. The tympanics are greatly expanded in whales and some other mammals, forming shell-shaped bullæ.

The vertebral column comprises five sections, the cervical, dorsal (or thoracic), lumbar, sacral and caudal. The cervical vertebræ are seven in number in all mammals, whatever the length of the neck, the only exceptions being the manatees, which have six, and the sloths, which have six, eight or nine. In certain whales, the majority of porpoises and some rodents, the cervicals are more or less united; in the right whales they form a single bony mass. The dorsals vary in number from 9 to 22. Articulated with each is a pair of ribs. The ribs terminate below in cartilages, which sometimes ossify, forming what are called "sternal ribs." By means of these cartilages the anterior pairs of ribs are connected with the breastbone or sternum, which may consist of a single piece, as in the whalebone whales, or of several segments arranged longitudinally. The posterior pairs of ribs are sometimes called "floating ribs" because their cartilages do not meet the sternum, but are attached to those of the more anterior pairs, or are quite free. The lumbar vertebræ follow the dorsals and are without ribs. In number they vary from 2 to 30 in different forms. The number of dorsal and lumbar vertebræ combined is quite constantly 23 in the odd-toed ungulates (horse, rhinoceros, tapir, etc.), 19 in even-toed ungulates (deer, ox, sheep, etc.), and 20 or 21 in carnivores and most insectivores. Man, the higher apes and many bats have 17. Following the lumbars is the sacrum, consisting usually of three vertebræ joined together and connected with the pelvis. This region is not distinguishable in the whales and sea-cows, which lack hind limbs. The caudals, or tail-vertebræ, complete the column. In man and in certain apes and bats they are three in number and rudimentary, but as many as 46 are present in the long-tailed pangolins. In the intervals between the anterior caudals below are situated small V-shaped bones, called chevrons, whose chief function is to protect the larger blood-vessels of the tail. They are especially well developed in the whales and edentates.

In many groups of mammals the anterior limbs are connected with the axial portion of the skeleton through the pectoral girdle, consisting of the shoulder blades, or scapulæ, and the collar-bones or clavicles. The scapula is not attached directly to the vertebral column, but its acromion process is joined to the anterior end of the breastbone, or sternum, by means of the clavicle. Clavicles are wanting in all seals, whales, sea-cows and ungulates, and are rudimentary or wanting in various representatives of several other groups. They are present in man and, with one or two exceptions, in all monkeys, bats, insectivores and marsupials. The upper-arm bone, or humerus, articulates superiorly with the scapula, and below with the two bones of the fore-arm, the radius and ulna. In the majority of mammals the radius, or outer bone, is permanently crossed over the ulna at the lower end, as is especially well seen in the elephants. In man and a few other forms the radius can be rotated. Following the fore-arm is the wrist or carpus, consisting of three rows of small bones, which, however, are variously united in different forms; and finally the digits, which are normally five in number, each consisting when fully developed of a metacarpal bone and three other bones, or occasionally more, called phalanges, though the first digit, or thumb, usually has but three in all. In man and apes the thumb is opposable to the other digits. In many mammals this digit and also the fifth are greatly reduced, or entirely wanting. In the ruminants, such as the pig, ox, deer, camel, etc., the first digit is wanting, and the second and fifth are reduced in size, or entirely lacking, while the third and fourth are equal in length and well developed. In the odd-toed ungulates, such as the horse, rhinoceros, tapir, etc., the third digit is longest, the others being reduced in length, rudimentary or wanting. In ungulates the metacarpals are usually much elongated and in such ruminants as the deer, ox, etc., are united, forming what is known as a "cannonbone." The cetacea are peculiar in that the bones of the fore-limb are not movably articulated and that the phalanges of the middle digits often greatly exceed three. In bats the phalanges are very greatly elongated to give support to the wing membranes.

The hind-limb is connected with the vertebral column through the pelvic girdle, which is united with the sacrum. The bones of the hind-limb, which are homologous to those of the fore-limb, are the femur or upper leg-bone, the tibia and the fibula or lower leg-bone, the tarsal or ankle bones and the metatarsals and phalanges constituting the hind-foot. The peculiarities of the bones of the fore-feet in ungulates, already mentioned, are found also, with only slight modifications, in the hind-feet.

The terminal phalanges of both fore and hind feet are compressed and pointed in beasts of prey and such as climb or dig, forming claws, which are covered with horny sheaths. In large running mammals, the terminal phalanges are more or less broad and flat and likewise covered with horny sheaths, forming hoofs or nails. Certain bones not connected with the skeleton, such as the *os penis, os cordis,* etc., are developed in the viscera of various mammals.

Teeth.— In mammals, unlike the lower vertebrates, teeth are not produced indefinitely, but in fixed number. At most two visible sets are developed. Traces are found, however, of at least one pre-milk and one post-permanent dentition. The first, called the milk dentition, appears during infancy, being replaced by the second set, called the permanent dentition, as maturity is reached. The milk teeth are less numerous and usually smaller than those of the permanent set. Teeth occur only in the premaxillary and maxillary bones and the mandibles or lower jaw. The upper teeth are divided into incisors, which are implanted in the premaxillæ; canines, which are almost invariably simple and stand immediately behind the suture between the premaxillæ and maxillæ; and premolars and molars, which occupy the edges of the maxillæ. The premolars have "milk" predecessors, while the molars have not. The nomenclature of the teeth of the lower

jaw is the same as for those of the upper jaw, their character being determined by their relation to the latter and by their form and mode of development. While the greatest diversity exists as to the form of the individual teeth, and the development of the dentition as a whole, there are rarely more than 44 in all. The exceptions are among the marsupials, where the number rises to 54 in the marsupial anteater, *Myrmecobius,* and to 64 in a fossil form *Amphitherium;* also among the cetacea, one species of which has as many as 246 simple teeth. The true anteaters, *Myrmecophagidæ,* and the spiny anteaters of Australia, *Echidna,* are without teeth at any time, but many mammals which do not possess them when adult have rudimentary teeth in the fœtal stages. Such is the case with the whalebone whales, and with the platypus, *Ornithorhynchus.* The rudimentary teeth in these disappear early and are replaced by whalebone in the case of the whales, and by horny plates resembling teeth in the platypus.

Teeth consists of two portions, the root and the crown. When most complex they contain three structural elements, the enamel, the dentine and the cement. The enamel is hardest and is restricted to the crown, while the dentine makes up the mass of the tooth, and the cement usually surrounds the root, or fills spaces between the enamel-folds of the crown. The enamel develops from the epithelial tissue of the jaws, the dentine from the deeper-lying areolar tissue and the cement from the walls of the tooth-capsule. Some teeth, such as the incisors of rodents, the tusks of the elephant, etc., grow continuously during life; other complete their growth early. Especially remarkable forms of teeth are the tusks of elephants, which are incisors, and the tusks of the narwhal, the boar and the babirussa, which are canines. When the crowns of the teeth greatly exceed the roots in height, as in the horse, the teeth are said to be hypsidont or hypselodont; when the reverse is the case, the teeth are called brachydont. Teeth having the crown in the form of tubercles, as in the hog, are called bunodont; those with transverse ridges, as in the ox, many rodents, etc., are called lophodont.

Alimentary Canal.—The mouth, or entrance to the alimentary canal, contains the tongue, which in the majority of mammals is so attached below that it can be protruded but a short distance, but is often sufficiently free to be used in grasping food and turning it about in the mouth during the process of mastication. In those mammals which feed upon ants and termites, such as the anteaters, pangolins, etc., and also in certain fruit-eating bats, the tongue is very long and slender and can be extended far beyond the mouth. On the posterior surface of the tongue are the organs of taste, and the upper surface is often roughened by horny papillæ. A number of large glands, called salivary glands, open into the mouth. Their function is to moisten the food and initiate the process of digestion. The glands most constantly present are the parotid, situated at the base of the ear, and opening inside the cheek, and the submaxillary, situated near the angle of the lower jaw, and opening under the apex of the tongue. At the back of the mouth is the entrance to the œsophagus or gullet, usually a simple tube, leading to the stomach. The stomach is an oblong, curved sac, usually enlarged at the cardiac end where the œsophagus is attached, and smaller at the lower, or pyloric, end, where it joins the intestines. It is usually simple, but in the ruminants and the cetaceans consists of several chambers. The intestines join the stomach at the pyloric end. They are usually of great length, and divided into two distinct sections. The portion nearest the stomach, called the small intestine, is joined below by one of larger diameter called the large intestine. The upper end of the latter is frequently dilated, forming a pouch called the cæcum, which in herbivorous mammals, and notably in rodents and many ungulates, is greatly enlarged or elongated. In man, the higher apes and the marsupial wombat it terminates in a narrow prolongation called the vermiform appendix. Different sections of the small intestine have received the names duodenum, jejunum and ileum; and of the large intestine, colon and rectum. The inferior orifice of the intestines is the anus or vent. Generally speaking, the intestines and cæcum are shortest in carnivorous mammals and longest in such as are vegetable feeders, but the carnivorous whales and seals, which have long intestines, form a conspicuous exception.

Besides the numerous glands situated within the intestine are two large ones, the liver and the pancreas, whose ducts open into the intestines near the stomach. The liver is a large, flat gland, which may be divided nearly into a right and a left lobe as in man, the cetacea and ruminants, or may have these lobes again subdivided into two by a longitudinal fissure. Two smaller lobes, called the Spigelian lobe and the caudate lobe, are commonly added. Attached to the liver is the gall-bladder, which is, however, absent in the cetacea and some other orders.

Kidneys.— The kidneys, whose function is to secrete urine, are situated in the upper part of the abdominal cavity near the vertebral column. They are two in number, oblong and usually simple, but in the cetacea, and also in bears and seals, are divided into separate lobules. A duct or ureter leads from each kidney to the urinary bladder, from which in turn a common duct, called the urethra, leads to the exterior of the body. In the monotremes, however, the ureters do not enter the bladder, but into a common urogenital passage or cloaca.

Lungs.— The lungs are situated in the thorax, which is cut off below from the abdominal cavity by a muscular diaphragm whose action assists in the process of breathing. The lungs consist of two spongy lobes, a right and a left, which are free below, but attached above to the two principal divisions of the windpipe. In the cetacea and sea-cows, the lobes are simple externally, but in other orders are more or less subdivided. A third median lobe, called the azygos lobe, is present in some groups. Air breathed in through the nostrils reaches the lungs through the trachea or windpipe, the upper end of which, the larynx, lies in the throat. Its orifice, the glottis, is protected by a cartilage, called the epiglottis, which prevents particles of food from entering the windpipe. The larynx is made up of cartilages, of which the largest are the thyroid, the cricoid and the arytenoid. Within the larynx are the vocal cords, two parallel elastic, fibrous bands, whose

vibrations produce the voice. The lower end of the windpipe divides into two smaller tubes, or bronchii, each of which enters a lobe of the lungs and subdivides into numerous smaller branches. A third bronchius, which enters the right lung, occurs in some cetaceans and ruminants.

Heart.—The heart in mammals is four-chambered, consisting of two thin-walled auricles and two ventricles, both with thick walls, but the right, which supplies only the lungs, thinner than the left. There is no direct communication between the left and right sides of the heart after birth. The valve between the right auricle and the right ventricle is tendinous, except in the monotremes.

The aorta, or principal artery, bends toward the left immediately beyond its connection with the heart and gives off the innominate, left common carotid, and subclavian arteries, which, with their branches, supply the head and anterior limbs. The method of branching of these arteries from the aortic arch and from one another varies widely. Blood is carried from the alimentary canal to the liver by a single vein, except in Echidna, in which as in lower vertebrates the abdominal vein is present. The kidneys are supplied with blood only by the renal arteries.

Brain.—Except for certain fossil forms, the brain of mammals is characterized by its relatively larger size as compared with that of lower vertebrates, and especially by the magnitude of the cerebral hemispheres and the perfection of the connections between them. In most mammals the surface of the brain is divided by numerous irregular fissures and convolutions. They are absent only in small bats, rodents and insectivores, and in *Ornithorhynchus*. The largest forms in each order, generally speaking, exhibit the greatest complexity, and there has been a remarkable development in the class in this direction since Tertiary times. The cetacea have very large and complex brains, though they are small relatively, when compared with the size of the body.

Sense Organs.—The organs of sense, except that of touch, are located in the head. The sense of touch is generally distributed over the skin, but is most acute in the snout, and in the extremities, except when used merely in locomotion. The wings of bats and the prehensile tails of monkeys are also especially sensitive. Some burrowing mammals, such as the mole, have imperfect eyes, the optic nerve being more or less atrophied. The Indian river-dolphin, *Platanista*, is a blind form, having rudimentary eyes, without crystalline lenses. The mammalian ear is characterized, besides the chain of ossicles, already mentioned, by the complex cochlea, which is usually spirally convoluted. The tympanic membrane, or eardrum, seals the auditory chamber from without. In the majority of mammals the external orifice of the ear is surrounded by a fold of skin, called the pinna or external ear. These are absent in cetaceans, sea-cows, seals, etc., which live in the water, and also in some burrowing mammals.

Reproductive System.—In mammals the female reproductive organs comprise the ovaries, Fallopian tubes or oviducts, uterus and vagina. The ovaries are two in number, a left and a right. Approximated to them are the Fallopian tubes, which widen below and form the uterus. In the lower mammals the uterus of each side is separate, but the two unite below in a common vagina, while in the higher groups, the uterus and vagina are both single. The male organs comprise the testes, spermatic cord and penis. In cetaceans, sea-cows and seals, which are aquatic, and in the elephants, conies and many edentates, the testes are internal in position, but in most other forms they descend periodically, or permanently, into a pouch of the integument, called the scrotum. The structure of the penis in mammals is peculiar to the class. An *os penis* is present in the majority of bats, insectivores, rodents, carnivores and primates.

During development the mammalian fœtus is nourished through a complex structure, called the placenta, formed in part by the internal wall of the uterus of the mother and in part by the membranes of the fœtus itself. The placenta is characteristic of the class as a whole, but is not found in the monotremes, nor in most marsupials. The form and other characteristics of the placenta differ in the several orders of mammals and are regarded as of importance in classification.

Distribution.—The geographical distribution of existing mammals, as of other animals, is the result of varied conditions and influences, some transient and others of long continuance, beginning in the relatively remote geological times when the class first made its appearance. Among the principal factors in the problem of distribution may be included changes in the extent and configuration of the land areas of the globe, changes in climate and in food supply, the appearance and disappearance of enemies, and latest, but by no means least, the interference of man. These and other factors in distribution are considered under the heading DISTRIBUTION OF LIVING MAMMALS. It is only possible here to mention some of the more important facts in the distribution of mammals. Of widest distribution are the purely aquatic orders, the cetacea and pinnipedia, whose range covers all seas and reaches from pole to pole, but it should be noted that no sea-lions occur in the north Atlantic. Next follow the bats, whose range is nearly world-wide, but they do not enter the Antarctic zone, and only very few species cross the Arctic Circle. On the other hand, they are found in New Zealand and in oceanic islands where no terrestrial indigenous mammals occur. Of the purely terrestrial orders, the rodents have the widest range, covering every continent and reaching from the Arctic zone to Patagonia and Tasmania. Carnivores, like rodents, have an almost world-wide distribution, but in Australia only one species of the order occurs, the dog known as the "dingo," *Canis dingo;* and it is uncertain whether this may not have been introduced by man at a remote date. The monotremes (comprising only the genera *Ornithorynchus, Echidna* and *Proëchidna*) are limited to Australia, Tasmania and New Guinea. Marsupials occur only in Australia, Tasmania, New Guinea and America. The American marsupials, with the exception of one genus, all belong to the family *Didelphiidæ*, or the opossums. Edentates occur only in America, southern Asia and Africa. They have their greatest development in South America. One genus, *Tatu*, extends northward

into Texas. Ungulates inhabit all continents except Australia, but only two or three species enter South America. Of the two groups forming the order *Primates,* the lemurs and lemuroids occur only in Madagascar, Africa and southern Asia, while monkeys inhabit only Africa, southern Asia and South and Central America. One ape, *Macacus inuus,* is found at Gibraltar, but it is only doubtfully indigenous.

Fossil Mammals.— Mammals are believed to have originated as an offshoot from certain Permian and Triassic reptiles called *Theromorpha* or *Anomodontia.* The earliest recognizable remains of mammals are certain small teeth and jaw-bones found in the Triassic formations. They belonged to forms resembling monotremes and marsupials in some characters, but are usually placed in a separate order, called *Allotheria* or *Multituberculata.* Representatives of the *Allotheria* continued on through the Jurassic and Cretaceous. The existing orders of mammals first appear in the Eocene, the lowest formation of the Tertiary period, being foreshadowed in the lowest beds of that period by certain generalized groups such as the *Creodonta* and *Condylarthra.* The Eocene also contains remains of several groups, or suborders, of ungulate mammals, which have no living representatives. These are the *Ancylopoda, Typotheria* and *Toxodontia.*

The later Tertiary and the Quaternary periods show a greatly increased number and diversity of forms. Many of them represent families which persisted for only a relatively short period and are now extinct; others have continued to the present. Among the oldest of existing genera are *Didelphis* (opossum), *Sciurus* (squirrel), *Myoxus* (dormouse), *Sorex* (shrew), *Vespertilio* and *Vesperugo* (bat) and *Viverra* (civet), which originated in the Eocene; *Tapirus* (tapir), *Rhinoceros, Giraffa* (giraffe), *Elephas* (elephant), *Sus* (pig), *Talpa* (mole), *Erinaceus* (hedgehog), *Mustela* (marten), *Lutra* (otter), *Hyæna, Felis* (cat) and *Phoca* (seal), which originated in the Miocene.

Classification.— The class *Mammalia* was divided by Linnæus into three principal sections, *Unguiculata, Ungulata* and *Mutica.* The last comprises the cetaceans, the second all the ungulates except the elephant, and the first, the remainder of the class. This classification was replaced by Blainville, who proposed on embryological grounds to divide the class into *Monodelphia,* or mammals with a placenta; *Didelphia,* or mammals without a placenta (the marsupials) and *Ornithodelphia,* or the monotremes. Richard Owen combined the last two subclasses under the name of *Eplacentalia* and gave the placental mammals the name of *Placentalia.* Speculation as to the origin of the class as a whole led Huxley to propose as the source a hypothetical group which he named *Hypotheria,* the characters assigned being the absence of milk glands and of a corpus callosum in the brain and the presence of a quadrate bone for the articulation of the mandible. Existing mammals were divided into *Prototheria,* comprising the monotremes, *Metatheria,* the marsupials, and *Eutheria,* the so-called placental mammals. Cope in 1889, while retaining the subclass *Prototheria* for the monotremes, placed the entire remainder of the class in the subclass *Eutheria.* Flower and Lydekker (1891) adopt Huxley's divisions, while Beddard (1902) makes use of those of Cope. Flower and Lydekker's arrangement of families and higher groups is as follows (fossil groups printed in italics):

Subclass 1. PROTOTHERIA.
- Order 1. Monotremata (Monotremes).
  - Families: Ornithorhynchidæ, Echidnidæ.
- (Group, *Multituberculata* or *Allotheria.*
  - Families: *Plagiaulacidæ, Polymastodontidæ, Tritylodontidæ*).

Subclass 2. METATHERIA.
- Order 2. Marsupilia (Marsupials).
  - Suborder 1. Polyprotodontia.
    - Families: *Dromatheriidæ, Amphitheriidæ, Spalacotheriidæ,* Didelphyidæ, Dasyuridæ, Peramelidæ.
  - Suborder 2. Diprotodontia.
    - Families: Phascolomyidæ, Phalangeridæ, *Diprotodontidæ, Nototheriidæ,* Macropodidæ.

Subclass 3. EUTHERIA.
- Order 3. Edentata (Edentates).
  - Families: Bradypodidæ, *Megatheriidæ,* Myrmecophagidæ, Dasypodidæ, *Glyptodontidæ,* Manidæ, Orycteropodidæ.
- Order 4. Sirenia (Sea-cows).
  - Families: Manatidæ, *Rhytinidæ,* Halicoridæ, *Halitheriidæ.*
- Order 5. Cetacea (Cetaceans).
  - Suborder 1. Mystacoceti (Whalebone whales).
    - Family: Balænidæ.
  - Suborder 2. *Archæoceti.*
    - Family: *Zeuglodontidæ.*
  - Suborder 3. Odontoceti (Toothed whales).
    - Families: Physeteridæ, Plaatanistidæ, Delphinidæ.
- Order 6. Ungulata (Hoofed mammals).
  - Suborder 1. Artiodactyla (Even-toed ungulates).
    - Families: Hippopotamidæ, Suidæ, *Chæropotamidæ, Anthracotheriidæ, Merycopotamidæ, Cotylopidæ, Anoplotheriidæ, Dichodontidæ,* Tragulidæ, Camelidæ, *Poebrotheriidæ,* Cervidæ, Giraffidæ, Antilocapridæ, Bovidæ.
  - Suborder 2. Perissodactyla (Odd-toed ungulates).
    - Families: Tapiridæ, *Lophiodontidæ, Palæotheriidæ,* Equidæ, Rhinocerotidæ, *Lambdotheriidæ, Chalicotheriidæ, Titanotheriidæ, Macraucheniidæ.*
  - Suborder 3. *Toxodontia.*
    - Families: *Toxodontidæ, Typotheriidæ.*
  - Suborder 4. *Condylarthra.*
    - Families: *Periptychidæ, Phenacodontidæ, Meniscotheriidæ.*
  - Suborder 5. Hyracoidea (Conies).
    - Family: Hyracidæ.
  - Suborder 6. *Amblypoda.*
    - Families: *Pantolambdidæ. Coryphodontidæ, Uintatheriidæ.*
  - Suborder 7. Proboscidea (Elephants).
    - Families: *Dinotheriidæ,* Elephantidæ.
  - (Group *Tillodontia*).
    - Families: *Anchippodontidæ, Calamodontidæ*).
- Order 7. Rodentia (Rodents).
  - Suborder 1. Simplicidentata.
    - Families: Anomaluridæ, Sciuridæ, Haplodotidæ, *Ischyromyidæ,* Castoridæ, Myoxidæ, Lophiomyidæ, Muridæ, Spa-

lacidæ, Geomyidæ, Dipodidæ, *Theridomyidæ*, Octodontidæ, *Castoroididæ*, Hystricidæ, Chinchillidæ, Dinomydæ, Caviidæ, Dasyproctidæ.
Suborder 2. Duplicidentata.
Families: Lagomyidæ, Leporidæ.
Order 8. Carnivora (Carnivores).
Suborder 1. Carnivora vera (Fissipeds).
Families: Felidæ, Hyænidæ, Protelidæ, Viverridæ, Canidæ, Ursidæ, Mustelidæ, Procyonidæ.
Suborder 2. Pinnipedia (Pinnipeds).
Families: Otariidæ, Trichechidæ, Phocidæ.
Suborder 3. *Creodontia.*
Families: *Hyænodontidæ, Proviverridæ, Arctocynidæ, Mesonychidæ.*
Order 9. Insectivora (Insectivores).
Suborder 1. Insectivora vera.
Families: Tupaiidæ, Macroscelididæ, Erinaceidæ, Soricidæ, Talpidæ, Potamogalidæ, Solenodotidæ, Centetidæ, Chrysochloridæ.
Suborder 2. Dermoptera.
Family: Galeopithecidæ.
Order 10. Chiroptera (Bats).
Suborder 1. Megachiroptera.
Family: Pteropidæ.
Suborder 2. Microchiroptera.
Families: Vespertilionidæ, Nycteridæ, Rhinolophidæ, Emballonuridæ, Phyllostomatidæ.
Order 11. Primates.
Suborder 1. Lemuroidea (Lemurs and Lemuroids).
Families: *Hyopsodontidæ,* Chiromyidæ, Tarsiidæ, Lemuridæ.
Suborder 2. Anthropoidea (Monkeys and Man).
Families: Hapalidæ, Cebidæ, Cercopithecidæ, Simiidæ, Hominidæ.

The groups of existing mammals whose structural peculiarities are such as to entitle them to rank as separate families vary greatly as regards the number of genera and species they comprise, some being represented by a multitude of different forms, while others consist only of a single species, or a single genus with but a few species. Families consisting of only a single genus and species are as follows: The Chiromyidæ, established for the reception of the Aye-Aye, a singularly modified lemuroid mammal, confined to Madagascar; the Dinomyidæ, comprising only a large Peruvian rodent, somewhat like a paca, of which a single specimen is known; the Antilocapridæ, represented only by the Prong-horn of the western plains of North America; the Notoryctidæ, comprising only a small mole-like marsupial recently discovered in South Australia; the Ornithorhynchidæ, comprising only the Platypus, or Duck-bill, of Australia. These and other restricted families are to be looked upon as fragments of groups of genera and species, of which the greater number are extinct, or as branches from main lines of development which have never progressed and ramified.

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MAMMARY GLANDS, the milk-glands of mammalian animals (see BREAST). They are present in all mammals, in both sexes, but in the male are usually rudimentary, their functional activity being limited to the female, who secretes in these glands the milk for nourishing her young during a natural period after birth. In all mammals they are placed in pairs, but vary much in position and number in different groups. Zoologists give them names according to their position near the armpits (axillary), on the chest (pectoral), on the belly (ventral or abdominal), or near the groin (inguinal). They are never situated on the back. The number in an individual may be from 2 to 12 or more, and is usually even. The structure of the cow's udder is due to the uniting of the same number of mammæ as there are of teats, the number of which, when more than two, usually corresponds to that of the young produced at each birth. The mammary glands of Marsupialia (q.v.) are contained in the pouch. In monotremes — duck-bills and echidnas — the nipple is not present. (See PROTOTHERIA).

Diseases of the Mammary Glands.— The common inflammation of the glands (mastitis) is often attended by much swelling, with fever and painful tenderness. The formation of pus is apt to result in a slowly pointing abscess. Great care in diet and regulation of the bowels should be observed. Purgatives and fomentations may be necessary, also in many cases the placing of the arm on the affected side in a sling. Drawing off the milk and evacuating the pus may be practicable and will afford great relief. Pain in the breasts (mastolynia) may result from many causes, of which sore nipples is one of the most frequent. The nipples are also subject to cracks, ulcerations, etc., which occasion much difficulty and pain to the mother when suckling the child. Lotions of an astringent character, as tannin, etc., have a remedial effect in such disorders, as have also collodion and lunar caustic (nitrate of silver), when applied to the sore nipple. Metallic shields are used in severe cases for protection of the affected point. Among many specific disorders to which the mammary glands are liable are cancer and galactocele and other forms of tumor. See MILK FEVER.

MAMMEE APPLE, or **SOUTH AMERICAN APRICOT,** the fruit of a clusiaceous tree, bearing white, showy, fragant flowers, growing naturally in tropical America, but largely cultivated in tropical parts of the Old World. The fruit is several inches in diameter, with a double rind and a yellowish pulp like that of an apricot, which is sweet and nourishing and is eaten raw or with wine and sugar or is boiled. A spirituous liquor called Eau Créole is distilled from its flowers; and the gum exuding from the bark is used by the Central Americans for destroying chigoes in the feet. This gum-resin is similar to the "gamboge" derived from a closely related West African tree (*Garcinia hamburyi*).

MAMMON, a term popularly held to be a mere personification of riches. It is used in

Matt. vi, 24 and Luke xvi, 9. Milton makes Mammon a fallen angel of sordid character.

MAMMOTH, an elephant (*Elephas primigenius*) which inhabited the temperate parts of the northern world during the Glacial period, and at its close spread northward with the retreat of the ice, and survived until the Neolithic period of human history. Some account of the origin and probable wanderings of the species is given in the paragraph relating to fossil elephants under ELEPHANT. Mammoth remains have been found in intimate association with the handiwork of savage man; and upon a piece of bone a portrait of this animal was found scratched, the accuracy of which shows a close acquaintance by the Cave-dwellers of France with the animal in life, and much artistic skill. This elephant, although the word "mammoth" has become an expression for hugeness, was little if any larger, on the average, than the modern Asiatic elephant, to which it was nearly related. Its remains are abundant and enable us to reconstruct its form and features completely, especially since the remarkable discovery, first in 1799, of carcasses frozen into the icy cliffs along the Arctic coast of Siberia. One of the most important discoveries of this kind occurred in 1801. Since the earliest known times ivory from buried tusks of these animals has been obtained from northern Siberia and Alaska, and many curious stories were invented to account for its origin, especially among the Chinese, who had never seen an elephant; but the specimens above mentioned contained not only the tusks still in their sockets and every bone in its place throughout the skeleton, but a great part of the flesh was in a condition fit for sledge-dogs to eat and enjoy, and was covered with thick skin still clothed with long dark hair, beneath which was a dense woolly fur, well fitted to protect the animal against arctic cold. The ears were much smaller than those of modern elephants. This specimen of 1801, which is preserved in the Royal Museum at Saint Petersburg in the attitude in which it was found buried, measured 16 feet 4 inches from the forehead to the extremity of the tail; its height was 9 feet 4 inches, and the tusks, along the outer or greater curve, measured 9 feet 6 inches. Of other well-known specimens, that skeleton mounted in Chicago is one of the largest known, and its tusks measure 9 feet 8 inches. The largest tusks on record are a pair found in Alaska which measure 12¾ feet in length. All mammoth tusks show an outward and upward sweep very distinct from the growth of elephant tusks. The mammoth seems to have been extremely numerous all over northern Europe, Asia and North America, especially during post-glacial times, when northern Asia was covered with pine forests to the borders of the Arctic Sea, affording plentiful food in their leaves and twigs upon which these animals browsed. The disappearance of these forests, due to slow climatic changes, is supposed to be the principal influence which led to the extermination of the species, a fact otherwise not easily to be explained. It is probable that human hunting had much to do with the mammoth's final disappearance. (See also ELEPHANTS; FOSSIL). Consult Beddard, F. E., 'Mammalia' (New York 1902); Lucas, F. A., 'Animals of the Past' (ib. 1901); Scott, W. B., 'History of Land Mammals in the Western Hemisphere' (ib. 1913); Herz, O. F., 'Frozen Mammoth of Siberia' (Washington 1904). See MASTODON.

MAMMOTH CAVE, Ky., a remarkable American cavern, in Edmondson County, 85 miles southwest of Louisville, reached by a small branch line connecting at Glasgow Junction with the Louisville and Nashville Railroad. Its areal diameter is about 10 miles, and about 100 miles of passageway have been explored, including avenues, chambers, pits, domes and rivers. What is termed the Main Cave is three miles long, varying in width from 40 to 175 feet and in height from 40 to 125 feet. Its greatest enlargement is known as the Chief City (or Temple), an oval room 541 feet long, 287 feet wide and 125 feet high; anciently a rendezvous of the Indians, whose torches and other relics have been found in abundance. The Star Chamber mimics the starry heavens by reason of its lofty ceiling of black oxide of manganese flecked by snowy crystals of gypsum. The cavern exists in five successive tiers, through which, at various points, shafts have been cut, which are styled pits or domes, according to the point of view. The largest are the Bottomless Pit, Gorin's Dome, the Mammoth Dome and the Maelstrom, and their average depth is about 100 feet. Oval depressions, locally known as "sink-holes," drain through the pits and chasms and form subterranean lakes and rivers; which finally find an outlet to the neighboring Green River. The largest, the Echo River, gets its name from the wonderful reverberations of sound along its course. Boats are provided for short voyages. Eyeless fish abound, of which there are three or four species; besides, blind crawfish, blind crickets, flies, beetles and spiders and other abnormal fauna are found on the walls and under the rocks. The structure and habits of these animals have been studied with great care.

Beyond River Hall long avenues extend, many adorned by marvelous gypsum rosettes and brilliant arches of crystal efflorescence in the most fantastic diversity. Cleveland's Cabinet is frequently mentioned as a treasure-house of cave flowers, but some of the smaller rooms, for instance, Charlotte's Grotto, can boast of finer displays. The great cavern is said to end at Croghan's Hall, where is the Maelstrom already mentioned, but the few who have dared go to the bottom of this profound abyss report wide and long avenues beyond, which are yet to be explored. Everywhere, even in the deepest pits, the atmosphere is both chemically and optically pure; the temperature is uniformly about 54° F. all the year around, as has been determined by a long series of exact scientific observations, in order to discover the temperature of the crust of the earth.

The discovery of the Mammoth Cave is usually credited to a hunter named Hutchins, in 1809; but the present manager of the estate finds that the county records, in 1797, fix the entrance to this cavern as a landmark for a piece of real estate. The locality first gained notoriety by reason of its immense deposits of saltpeter, which were used in the manufacture of gunpowder during the War of 1812. After passing through the hands of several owners, the cave was bought by Dr. John Croghan, who

willed it to his nephews and nieces, with instructions that at their death it should be sold at auction. The acquisition of an area of over 70,000 acres, to be known as Mammoth Cave National Park, was authorized by Congress in 1926. See also CAVE; CAVE ANIMALS.

MAMMOTH HOT SPRINGS. See YELLOWSTONE NATIONAL PARK.

MAMO, a bird (*Drepanis pacifica*) of the Hawaiian Islands, related to the creepers, and now nearly extinct because of the great demand in past years for their yellow feathers for making the feather-cloaks formerly worn as insignia of royalty by the chiefs. Other birds supplied certain other required feathers. Very few of these cloaks remain in museums.

MAMORÉ, mä-mō-rā′, a river of Bolivia which has its rise in the Cordillera Real, near Sucre, and flows first east by south, then forms almost a semi-circle toward the north to Trinidad, from where its course is nearly north to where it unites with the Beni and forms the Madeira River. In the first part of its course it is called Rio Grande. The Mamoré is about 1,300 miles long and navigable for about 1,000 miles, with some obstructions. About 40 miles above its junction with the Beni are the Guajara Falls, above which navigation is free for about 400 miles to places where fallen logs have filled in between the banks and formed dams.

MAMPALON, an aquatic animal (*Cynogale bennetti*) of Borneo, of the civet family. It is otter-like in form, is about 18 inches long, has stout webbed plantigrade feet and is thoroughly adapted to an aquatic life while retaining purely viverrine characteristics of structure.

MAN. See ANTHROPOLOGY; APE; ARCHAEOLOGY; ETHNOLOGY; PRIMATES.

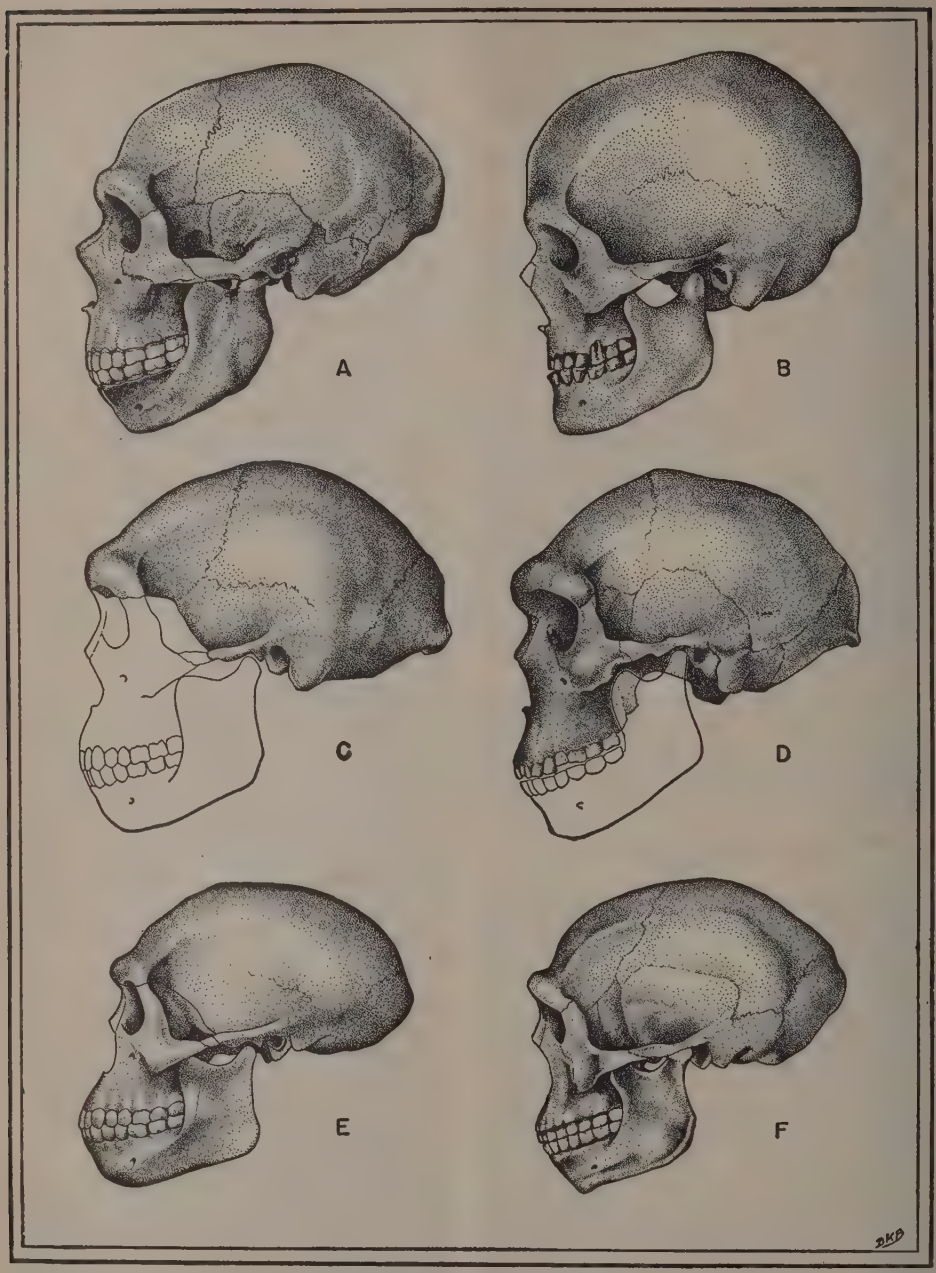
MAN, Prehistoric Races of. The knowledge that there actually were prehistoric races of man, physically different from any of the racial groups living today, dates back scarcely as far as the middle of the 19th century. Prior to that time the dawn of human existence was commonly assumed, even by many scientific men, to have been coincident with the beginning of recorded history, some 6,000 or 7,000 years ago. Even Georges Cuvier, the great French paleontologist of the early 19th century, was intolerant toward the idea that fossil human bones might be found. However, during the second quarter of the 19th century ancient stone weapons were found in Western Europe actually mingled with the bones of extinct beasts of the Diluvial epoch. Shortly thereafter fossilized human bones were similarly found in the floor of a cave, together with bones of elephant, rhinoceros, and other beasts long extinct in Europe. But these human bones, though very ancient, were not unlike those of modern man. They were clearly the remains of ancient examples of *Homo sapiens.* Then in 1856, occurred the epoch-making discovery of Neanderthal man, a low-browed creature clearly human but so unlike any known race of man that it was made the type of a new species, and in 1891 remains of Pithecanthropus, the famous "Ape man of Java," a barely human creature, were unearthed. Beginning with the early years of the present century discoveries in this field have been numerous in many parts of the world. These include, first, fossilized bones of ancient men and of the animals they hunted; second, archaeological relics such as stone and bone implements, which yield information regarding the cultural evolution of prehistoric men; and third, advances in geological knowledge which enable us to measure their antiquity and to know the physical conditions of the various periods in which they lived. No fossil bones of ancient man are known from deposits older than the early phases of the Pleistocene epoch, also called the Glacial or Ice Age; though it is generally admitted that the human and great ape branches diverged from a common stem during Tertiary time.

This is not the place for a discussion of the Pleistocene epoch or Ice Age, or of the disputed chronologies of its several cold and warm phases, but it may be said that estimates of the total duration of the Pleistocene vary from 500,000 years to 1,000,000, with the weight of opinion favoring a median figure. Most authorities recognize in Europe and in North America four periods of lowered temperature with glacial advance, each followed by a warmer interglacial phase. The glaciations are called, beginning with the oldest, the Günz, Mindel, Riss, and Würm, (named after four small rivers in Germany) or simply the 1st, 2d, 3d, and 4th. The second was far the most extensive. The fourth glacial advance is believed to have attained its maximum about 30,000 or 35,000 years ago, so that present time may be considered to be late in the fourth postglacial phase. Geological studies by H. de Terra and others in tropical regions in which no Pleistocene glaciation occurred reveal corresponding pluvial and interpluvial phases.

This article will be devoted chiefly to brief discussions of the various prehistoric types thus far known, stressing their physical features and their inferred relationships. Archaeological evidence will be touched upon only incidentally as it has little bearing on questions of race. A number of discoveries, which for one reason or another do not seem to be important, will be omitted.

It seems best to begin with earlier and more primitive races; then to discuss those which are somewhat more advanced but still below the level of *Homo sapiens,* which will be treated last. The initial discoveries of prehistoric types are usually sporadic and accidental and in many or most cases the material is fragmentary and incomplete. It must be admitted that actual knowledge of phylogenetic relationships and genealogical successions of these ancient human types is extremely meager and tentative, but it is growing steadily as new evidence is brought to light. It is important to realize clearly that these ancient human races were not necessarily limited in their geographic distribution to the particular region where the known fossil specimens were found, and also that the chronological range of such races and species probably comprised tens of thousands of years in every case.

Pithecanthropus of Java.—The most primitive fossil form to be universally accepted as a member of the human family is widely known under the names of "Trinil man" and the "Ape man of Java." In 1891–1892, Dr. Eugène Dubois of Holland unearthed in the dry bed of the Solo River near the village of Trinil in central Java,



SKULLS OF SIX IMPORTANT TYPES

A. Neanderthal man, (*Homo neanderthalensis*), Chapelle-aux-Saints, Corrèze, France. Mainly after Boule.
B. Cro-Magnon man, (*Homo sapiens*), Mentone, French-Italian Mediterranean coast. After Verneau.
C. Solo man, (*Homo soloensis*), Ngandong, Java. Facial bones unknown. Known part after Oppenorth.
D. Rhodesian man, (*Homo rhodesiensis*), Broken Hill, Northern Rhodesia, Africa. Lower jaw unknown. Known part after Woodward.
E. Pithecanthropus, (*P. erectus*), female skull, No. II, Sangiran, Java. Face restored from other specimens. Cranium after von Koenigswald.
F. Peking man, (*Sinanthropus pekinensis*), female skull, restored. After Weidenreich.

a fossilized upper part of a cranium, two molar teeth, and a thigh bone. All these fossils were clearly of higher primate character and Dubois believed them to be parts of a single individual. The cranium was very small, depressed in form with an extremely low, narrow, and retreating forehead with a prominent ridge above the eyes. The cranial capacity is now known to be slightly more than 900 cubic centimeters, which is barely within the minimal limit of normal human cranial volume but far in excess of that of any ape. The form of the brain is also essentially human. Dubois, believing that his Javan discovery represented the realization of a hypothetical missing link which had been postulated in 1868 by Ernst Haeckel and called by him *Pithecanthropus alalus* (speechless ape man), adopted this name for the genus of his Javan find, but substituted the specific name *erectus* in view of the fact that the form of the thigh bone showed that its possessor walked upright. Dubois characterized the creature as a "manlike transition form" and "the precursor of man." The fossils were later brought to Holland where they naturally aroused worldwide interest and evoked spirited discussion. Some authorities held that they belonged to an ape, but a more manlike ape than any hitherto known; others considered them the remains of a lower type of man; while a third group agreed with Dubois that he had discovered a transitional form or missing link. The two molar teeth were shown many years later to belong to an extinct Javan orangutan. As for the femur, though the association with the skull is by no means certain, there are no facts which preclude it. For 45 years the Dubois discoveries comprised the sum total of evidence regarding Pithecanthropus, but from 1936 to 1941 three additional crania and portions of a palate, two lower jaws, and several teeth of this type were found in Java by G. H. R. von Koenigswald. One of these was the fossilized cranium of a child of about two years of age found at Modjokerto, the low forehead of which already shows the beginning of a brow ridge. Further explorations yielded two adult skulls, one of them almost identical in form with the Dubois skull but more nearly complete and somewhat smaller, with a cranial capacity of only 775 cubic centimeters, considerably below any normal human skull. One especially heavy skull was made the type of a new species, *P. robustus,* by Franz Weidenreich in 1945, but there is a possibility that it may be merely a massive male skull of *P. erectus.* H. de Terra, who has made extensive correlation studies of the Asian and Javan Pleistocene, believes that Pithecanthropus had a time range from the first interpluvial phase nearly 500,000 years ago, to the second pluvial (equivalent to the European second glacial) and possibly the second interpluvial. If this is correct, the Pithecanthropus group may have existed for 100,000 years or even longer. Java was at that time, or had been earlier, an extension of the Asian mainland, part of a larger Malay Peninsula, so that Pithecanthropus may be considered essentially a southern Asian form. There is no indubitable evidence as to the culture of these primitive hominidae, but it is known that Peking man, a type only slightly more advanced, fashioned stone implements of a crude sort.

The important question regarding Pithecanthropus is: Does he represent an ancestor of any higher human type or does he exemplify merely the end of an early hominid branch which died out? A few years ago many authorities favored the latter alternative, but the discovery of the closely similar Peking man and the recent finding of the later and considerably more advanced Solo man in Java (both described below) lend probability to the view that Pithecanthropus represents a direct ancestor of higher type.

Javan and South Chinese Giants.—A discovery at Sangiran, Java, reported in 1941 by Dr. von Koenigswald is a fragmentary jaw of gigantic size, far larger than that of any known anthropoid ape or man. The teeth, two premolars and a molar, despite their great size show the fossil to be unquestionably human. Like Pithecanthropus, this giant form lacked a chin. Geologically it is believed to be older than Pithecanthropus. Dr. von Koenigswald named it *Meganthropus paleojavanicus* (great man of ancient Java). Dr. Weidenreich believed it to have been larger than a male gorilla. Another giant form discovered by von Koenigswald is represented solely by three huge molar teeth, one upper and two lower, which were found among many other teeth in a Chinese dispensary in Hong Kong. (The Chinese pharmacopeia includes fossil teeth which are pulverized for medicinal use.) The geological provenience is unknown, but the teeth are almost certainly of middle or early Pleistocene Age. The name *Gigantopithecus* (giant ape) *blacki* was given to this type by von Koenigswald, but Weidenreich, who studied the teeth with great care, was convinced that they belonged to a gigantic man, not an ape, and held that the appropriate generic name would have been *Gigantanthropus* (giant man). He believed that these Javan and South Chinese giants were probably ancestral to Pithecanthropus and later normal-sized men, though he admitted that there is no convincing evidence for this view as the actual material consists of only a jaw fragment of one and three teeth of the other of the giant forms.

Peking Man (*Sinanthropus pekinensis*).—For many years certain paleontologists have recognized evidence indicating that the human and ape branches diverged from a common stem during Tertiary time, probably in Asia. Many genera of fossil anthropoids are known from Miocene and Pleistocene formations in India. In 1927 a well-preserved fossilized hominid molar was found in cave deposits at Choukoutien, 37 miles southwest of Peking. On the sole basis of this tooth the late Dr. Davidson Black proposed a new hominid genus and species which he named *Sinanthropus pekinensis* (Chinese man of Peking). This apparently rash venture in taxonomy was soon vindicated by the discovery (1929–1930) of two nearly complete crania and several jaws and teeth almost as primitive as Pithecanthropus. The Choukoutien remains are found in a series of clefts or fissures in Ordovician limestone which represent the remains of a cave of Middle Pleistocene time which was frequented by these early hominids and also by various animals. Geological and paleontological evidence indicates that these cave deposits are perhaps a little later than the Trinil zone of Java. Their age probably corresponds to the second glacial advance in Europe with an estimated antiquity of some 450,000 years. Professor Black published a splendid series of studies of Peking man but unfortunately he died in 1934. He had a most able successor in Prof. Franz Weidenreich who continued the explora-

tions at Choukoutien and published many masterly reports on the material. In all, five fairly complete skulls had been found up to 1936, together with many jaws and teeth but very little of other skeletal parts. The remains found represent probably not less than 40 individuals. There is convincing evidence that most of these people were killed and the severed heads carried into the cave. All of the skulls had been broken open at the base apparently for the extraction of the brain, giving reason to suspect that Peking man practiced cannibalism. He certainly had mastered the art of making fire, fashioned extremely crude implements of chipped stone, hunted deer and other animals, and utilized lower jaws and pieces of deer antler as tools. Hackberries were carried into the cave and cracked to extract the kernels. The Sinanthropus skulls have a small but variable endocranial capacity; one of them measures only a little over 900 cubic centimeters, or about the same as Pithecanthropus. But others are larger, the largest measuring 1,200 cubic centimeters, thus being well within the normal range for Homo. The extremely depressed vault and similar heavy brow ridge give the skulls a striking resemblance to Neanderthal man, but in one particular they are remarkably like Pithecanthropus: namely, in the fact that the cranium is widest near the level of the ear and becomes narrower higher up in the region where the brain case of Homo is widest. There is no chin prominence and the teeth are definitely primitive. It cannot be asserted positively that Sinanthropus was an ancestor of any later type but, as Professor Black asserted, "its dental characters certainly seem to indicate that Sinanthropus could not have been far removed from the type of hominid from which evolved both the extinct Neanderthal and the modern *Homo sapiens.*" Later researches have fully confirmed this view.

Professor Weidenreich held the opinion, based on certain features of cranium, jaws and teeth, that the Mongoloid branch of recent man is more closely related to Sinanthropus than are the whites or Negroes.

Heidelberg Man (*Homo heidelbergensis*).—A human lower jaw found in 1907 in a sand quarry at Mauer near Heidelberg, Germany, remains the most primitive and the oldest human skeletal relic found in Europe with the somewhat doubtful exception of Piltdown man to be considered later. The jaw was found at a depth of 79 feet below the present surface, at the very bottom of a 50-foot layer of ancient river sand which for years had yielded fossilized bones of many species of Early Pleistocene animals, notably the straight-tusked elephant, the Etruscan rhinoceros, and the lion. There is some difference of opinion as to the exact geological age of these fossils, including the human jaw. They cannot be later than the second interglacial (Mindel-Riss) interval. Alfred F. E. Zeuner (1946) places the age as near 450,000 years, thus making it coeval with Peking man. The Heidelberg jaw is extremely massive, the chin prominence is entirely lacking, and the ascending ramus is broader than in any known human jaw, but, despite absence of chin, all the essential features are definitely human. The form of the dental arch is completely manlike, not at all apelike, and even the chinless front of the jaw is quite different from the corresponding part of an ape. The teeth are rather small for so massive a jaw, and the canines are no longer than in many modern men. Comparing it with the other very early hominid types, we find that some of the jaws of Peking man approximate it rather closely, though the teeth of Peking man are definitely more primitive. The recently discovered jaws and teeth of Pithecanthropus also seem to be less completely human. Prof. Otto Schoetensack of Heidelberg, who described the specimen in 1908 and named it *Homo heidelbergensis,* advanced the view, which has been very generally accepted, that Heidelberg man represents an ancestral pre-Neanderthal type or as H. F. Osborn expresses it, "a Neanderthal in the making." Other paleontologists, considering the Heidelberg type too primitive to be included in the genus Homo, later proposed such generic names as *Paleanthropus* and *Protanthropus,* but the original name given by Schoetensack is almost universally used. No artifacts are definitely associated with Heidelberg man, but certain worked bone implements have been tentatively ascribed to him (Voelcker, 1933). There is surely no reason to believe that he had not advanced culturally as far as Peking man. The famous jaw of 1907 remains the sole relic of Heidelberg man but its importance has been greatly enhanced by the discovery, more than 20 years later, of the probably closely related Peking man and the new material of the Javan Pithecanthropus. These three types, all of rather Early to Middle Pleistocene times, representing the oldest and most primitive universally recognized members of the human family, may well be grouped as protanthropic hominids. Their distribution accords with the view that various prehominid stocks radiated from a region in central or south central Asia, such as northern India where Miocene and Pliocene rocks have yielded many fossil anthropoids. Another form, possibly but doubtfully belonging with these protanthropic men, is represented by two badly fragmented skulls found by L. Kohl-Larsen in 1935 in northern Tanganyika, East Africa. The more nearly complete of these skulls has been restored by H. Weinert (1939) in such fashion as to give it a close resemblance to Pithecanthropus and Sinanthropus. He named it *Africanthropus njarasensis.* The geological incidence is uncertain but it appears to be Late Pleistocene, long after the time range of any of the three protanthropic types discussed above, and the inclusion of the Africanthropus in that group on present evidence does not seem to be unwarranted. The fact that the three somewhat similar protanthropic types (Java, Peking, and Heidelberg) were widely scattered toward the periphery of the great Eurasian land mass early in Pleistocene time (with the Africanthropus in Africa as a very doubtful fourth), all of them in regions later inhabited by more advanced human types, suggests that the differentiation of the human stock into the chief ethnic divisions known today, namely the black, yellow, brown, and white, may have preceded the attainment of the *Homo sapiens* status.

According to this concept recent mankind does not represent the collective progeny of a single primitive *Homo sapiens* stem which secondarily branched into several races as has commonly been assumed, but rather a composite species, a synthesis of three or four primary protanthropic types, none of which persists in pure form today. All modern races show intermingling, some much more than others. This theory of polycentric origin and parallel evolution of the primary races has been

proposed independently by Sir Arthur Keith and Dr. F. Weidenreich. It cannot be said to have been generally accepted by ethnologists.

Neanderthal Man (*Homo neanderthalensis*, Dr. William King, 1864; *Homo primigenius*, L. Wilser, 1897).—This was the first ancient type to gain recognition as a species distinct from *Homo sapiens*. The discovery which led to this identification and on which King's specific name is based was made in 1856. It consisted of the top of a skull and a number of other bones which were dug up in the floor of a limestone cave in a small ravine known as the Neanderthal, near Düsseldorf, Germany. The bones showed a number of unusual features, the skull especially being remarkable for its depressed vault, low, retreating forehead and heavy cornicelike ridge overhanging the orbits. For some years it was variously regarded as the skull of an idiot, as a pathologically deformed specimen, and as belonging to a barbarous and savage race. But it was recognized as a distinct human species in 1864. It is a remarkable fact that a female skull of the same species found in a cave at Gibraltar in 1848, eight years before the Neanderthal discovery, remained practically unknown until 1906 when it was shown to be of the Neanderthal species, of which by that time a number of other remains were known. Neanderthal man is now by far the best known of all types of Pleistocene humanity. His remains, chiefly from limestone caves and rock shelters, are in many cases thoroughly documented by the bones of contemporaneous animals and by associated stone implements of the Acheulean and especially of Mousterian culture which represent his handiwork. Germany, Belgium, France, Croatia, Spain, Italy, and recently Palestine have all yielded skeletal material and Mousterian implements, and the latter are also known in North Africa. A recent discovery of especial importance is a practically complete skull of a Neanderthal child of about eight years, together with other parts of the skeleton and Mousterian tools found in 1939 in a cave in southern Uzbek in central Asia. The particular significance of this find is that it extends the known range of Neanderthal man much farther eastward, and indicates that he was Eurasian rather than merely European. As stated above, Heidelberg man has commonly been considered a pre-Neanderthal form but the much more completely known Peking man is at least as well qualified to be a Neanderthal precursor. The site of the Uzbek discovery in central Asia is geographically almost exactly midway between Peking and Heidelberg.

For many years Neanderthal man was supposed to represent a single type, especially identified with the fourth or Würm glacial epoch and with the Mousterian flint industry. This group, which we may call the typical Neanderthal form, is represented by the original Neanderthal specimen, two skeletons from Spy, Belgium, and the skeletons from Chapelle-aux-Saints, Le Moustier, La Ferrassie and other well-known examples from France and other parts of Western Europe. These typical Neanderthals are all heavily built and of short stature, usually not more than five feet, three or four inches, the females somewhat less. In general, the bones are extremely massive. The skull is of strikingly unique form with a depressed vault, a low, retreating forehead and an especially notable feature is the heavy supraorbital ridge, very similar to that of Peking man. The cranium, however, is usually large, in some cases with a capacity well above the average of modern man, though some female skulls are rather small. The cheek bones slope obliquely backward and the depression in the cheek region known as the canine fossa is lacking. The orbits are round and extremely large. The nose must have been prominent, not flattened, but extremely wide. The mastoid processes are very small. In back view the cranium has a peculiar form which has been described as bunshaped. The lower jaw shows no chin or the merest suggestion of a chin. The teeth are large in general but the canines are not relatively so. A peculiarity of the molars in many cases, especially the lower molars, is an enlargement of the pulp cavity which extends downward into the conjoined roots, a dental form called taurodont (bull-tooth) by Sir Arthur Keith. This condition was also sometimes present in the much earlier Peking man. All in all, the Neanderthal skull is so distinctive in almost every feature that it can be identified at a glance. Several other parts of the skeleton show characteristic features but these are not so striking as those of the skull. Study of the skeleton gives no warrant for describing the Neanderthal people as walking semiupright and as having enormously thick, gorillalike necks and imperfectly opposable thumbs, as some writers have pictured them. The massiveness of the limb bones is marked and the forearm and shinbone are short in comparison with arm and thigh. The hands and feet were almost as in modern man. As regards cultural status, the phase of Paleolithic flint industry known as Mousterian, with its skillfully made axes, scrapers, spearheads, borers, etc., is definitely associated with Neanderthal man. Remains of ancient hearths show that these people possessed the art of making fire, probably an inheritance from protanthropic ancestors, as we know that Peking man was a firemaker, and in a number of cases the dead had been given careful ceremonial burial in caves and rock shelters, together with flint implements and parts of the bodies of animals, evidently intended for the use of the departed. Neanderthal man has usually been identified with the fourth (Würm) European glacial, but a number of skeletal remains of this type are those of earlier people who are known to have lived during the third interglacial epoch. Examples of these are the remains found in the region of Weimar and Ehringsdorf in Germany, the remains from Krapina in Croatia (Yugoslavia) and three skulls recently found in Italy. The earlier age of these remains is indicated by geological conditions and in some cases by associated flint implements of the Acheulean culture phase. Some of these are believed to be probably 75,000 to 100,000 years old. A skull found in 1933 at Steinheim, a few miles north of Stuttgart, Germany, is especially puzzling. It is apparently a female skull obviously Neanderthaloid in general, but it is the smallest known skull of that type and in a number of important features it deviates notably from the Neanderthal cranial pattern and in a few particulars it even approximates *Homo sapiens*. This is the more remarkable in that it is clearly of the Riss-Würm interglacial age and thus very much older than the typical Neanderthals. As some of the cranial and dental features of Neanderthal man are regarded as exhibiting specialization or even degeneration it is possible that the Steinheim specimen may represent an early and more generalized phase in the evolution of that type.

In 1925 a portion of a Neanderthaloid skull was found near the Sea of Galilee in Palestine and, 1932 and shortly thereafter, in a group of three caves at the foot of Mount Carmel, at least 10 skeletons were found, all or most of them representing intentional burials. Careful study of these remains by Theodore McCown and Sir Arthur Keith shows that while some of them are predominantly Neanderthal, others, apparently of the same period, exhibit a remarkable mixture of Neanderthal and *Homo sapiens* characters. This mixture of characters constitutes a perplexing problem. McCown and Keith believe it represented a rapid local evolution of the sapiens type from the Neanderthal, but another suggested explanation is that the Mount Carmel population lived at the boundary where two races, already differentiated in different regions, happened to come in contact; but if that is true, the origin of the higher type is a problem.

Homo Sapiens.—The fate of Neanderthal man is unknown. We know that this race or species survived until some time after the maximum of the fourth or Würm glaciation, but at a time estimated to have been some 25,000 to 30,000 years ago, Neanderthal man seems to have disappeared as a specific type and to have been superseded by *Homo sapiens.* Unfortunately, notwithstanding abundant speculation, scarcely anything is definitely known regarding the ethnic origins of our own species, perhaps less than is known about the origin of Neanderthal man, for in the latter case there are at least the Peking and Heidelberg types which represent possible ancestors. It was long believed very generally that the Neanderthals were exterminated by early examples of *Homo sapiens* who invaded Europe from Asia or possibly northern Africa bringing with them the Aurignacian culture, but there is no evidence of such a superior race inhabiting these countries at so early a period. Besides, we know now that the range of the Neanderthals included central Asia as well as Europe. Even on the theory of invading conquerors there would probably be some racial mixture, and a number of ethnologists are convinced that some of the Europeans of early postglacial time show evidence of Neanderthal inheritance. One early type of *Homo sapiens fossilis,* sometimes cited as exhibiting this, is the so-called Brünn race, named from a late Paleolithic site of discovery in Moravia. These were long-headed people with rather prominent superciliary ridges on the brow, but any special relationship to the Neanderthal man is very questionable. At the present time some competent authorities reject the theory of an invading superior race and hold the opinion that *Homo sapiens* represents a direct evolution from Neanderthal man, but this proposition has not yet been demonstrated. One apparent obstacle to the acceptance of such evolution in Europe is the suddenness of the transition. There are no really well-marked intermediate types. In Europe during the late Paleolithic culture phases several varieties of *Homo sapiens fossilis* existed. One of the older was the so-called Brünn type already mentioned. Another, known from only two skeletons buried in a cave near Monaco and called the Grimaldi race, was believed to be an early negroid type, but it has been shown recently that they probably represent a variant of the Cro-Magnon race. The name Cro-Magnon was first applied to a group of skeletons found in the Dordogne in France in 1868, which were believed to represent a well-defined race of tall people marked by high, capacious cranium, vertical forehead, narrow nose, and prominent chin. With this fine physical type is associated the superior flint implements, carvings, engravings, and cave paintings characteristic of the Solutrean and Magdalenian phases of Late Paleolithic culture. Later studies have demonstrated, however, that the population of Europe in Late Paleolithic showed great variation so that the name Cro-Magnon should probably be used, if at all, in a much more inclusive sense. Prof. E. A. Hooton of Harvard, who has given much attention to the study of Late Paleolithic Europeans, states that he is "so unregenerate as to be sceptical of the reality of the Cro-Magnon race if the term race be used in its proper anthropological connotation." G. M. Morant, on the basis of craniometric studies, concludes that "the Upper Paleolithic type is modern in almost all respects . . . it resembles . . . the modern dolichocephalic races of Western Europe and there can be little doubt that the latter population is directly descended from the earlier."

Rhodesian Man of Africa, Solo Man of Java, and Others.—Two examples of ancient hominids remarkable for their similarity, notwithstanding the fact that they inhabited widely separated regions, are (1) the Rhodesian man (*Homo rhodesiensis*), known only from a single skull and a few bones found in 1921 in northern Rhodesia; and (2) Solo man (*Homo soloensis*), represented by eleven crania and two tibiae discovered between 1931 and 1936 in central Java near the village of Ngandong on the Solo River, only six miles from Trinil where Dubois found the first Pithecanthropus skull 40 years earlier. Until the Solo discoveries, the Rhodesian man seemed utterly unique, isolated, and problematical, but Solo man is so similar in cranial characters that the close relationship of the two types seems beyond question. Of the Solo skulls only the cranial regions were found and all of them had been broken open at the base, apparently for the extraction of the brain, exactly as in the case of Peking man, another example of primitive head hunting or cannibalism. The Rhodesian and Solo skulls show such striking superficial resemblance to Neanderthal man in the low vault, retreating forehead, and heavy brow ridge that some persons consider them to be aberrant African and Javan examples of that type, but the similarities are outweighed by many impressive differences. The apparent likenesses to the Neanderthal men are merely examples of what the zoologists call parallelism. The cranial capacity is low, in most cases well under 1,300 cubic centimeters. The Solo type which de Terra places in third interpluvial (interglacial), possibly 150,000 years ago, has every appearance of being a true descendant of Pithecanthropus, just as the Neanderthals of Europe and Asia probably evolved from the early and more primitive Peking and Heidelberg types. G. H. R. von Koenigswald, who has made careful studies of Solo man, concludes that "we have in *Homo soloensis* the oldest . . . known representative of *Homo sapiens fossilis.*" (The context of this statement indicates that he would include Rhodesian man.) The Solo and Rhodesian men seem to represent an ancient proto-Australoid stage, a sort of transitional form between Pithecanthropus and the later Australian aborigines. Two well-preserved skulls of Late Pleistocene age found in southern Australia lend support to this view. One of these is the Talgai skull from

Queensland, the other the Cohuna skull found in Victoria. These are definitely of the same racial type as the modern Australians but more primitive and apparently closer to the archaic proto-Australoids of the Solo-Rhodesian type. No subhuman primates, living or fossil, are known from Australia, and it is practically certain that man of proto-Australoid type migrated to that continent fairly late in the Pleistocene epoch. Java, the home of Pithecanthropus and Solo man, also produced in Late Pleistocene time a more advanced type discovered by Dubois at Wadjak in 1889 but not described by him until 1921. The type, based on two extremely massive skulls, was named *Homo wadjakensis* and was placed by Dubois as a proto-Australoid type, but G. Pinkley has shown that the supposed Australian relationship is dubious. There is a possibility that the Wadjak man is Neolithic. Africa has yielded during recent years a number of skeletal remains of Late Pleistocene age which clearly belong to *Homo sapiens* but none of these can be definitely related to the Rhodesian man. Several from South Africa (e.g., the Boskop skull) show such striking likeness in head form to the modern African Bushman as to indicate direct descent of the latter from them, but the ancient skulls are very much larger, which suggests that the Bushman has undergone degeneration in size since late Pleistocene time. Other fossil skeletons, chiefly from East Africa, show unquestionable relationship to the true Negroes. Thus the evidence, scattered and fragmentary though it is, indicates that the true African Negro and the Bushman were distinct types of *Homo sapiens* as long ago as Late Pleistocene time.

Several discoveries have been made in England of skulls not complete enough to allow definite species identification, but there is reason to believe that they represent very ancient, perhaps mid-Pleistocene, examples of *Homo sapiens*. The best authenticated, geologically, is the incomplete Swanscombe skull found on the south bank of the Thames in 1935. It almost certainly dates from the second interglacial interval. The top of a cranium found in the Fontéchevade cave in France, the Charente, in 1947, is of importance as it is clearly of third interglacial age. It appears to belong to *Homo sapiens* and resembles the still earlier Swanscombe skull. It affords additional evidence that our own species inhabited western Europe at least as early as Neanderthal man.

Piltdown Man (*Eoanthropus dawsoni*).—Some pieces of a human cranium and a part of a lower jaw found in ancient river gravels at Piltdown in Sussex, England, in 1911–1912, have evoked more controversy and more legitimate difference of opinion than any other discovery relating to early man. The cranial fragments are essentially those of *Homo sapiens*, their most remarkable feature being their unusual thickness, but the lower jaw, consisting of almost the complete right half and containing two molar teeth, is strikingly apelike in the chin region (which has a well-marked "simian shelf" as in the recent manlike apes), and somewhat so in the form of the molars, so apelike, in fact, that had it been found alone, it would undoubtedly have been considered the jaw of a fossil ape. (No fossil apes are known in England but jaws and teeth of large fossil apes, have long been known from Miocene and Pliocene formations in France and Germany.) Sir Arthur Smith Woodward, convinced that the Piltdown jaw belonged with the cranium despite its apelike character, united these fragments to constitute the type of a new genus and species, *Eoanthropus* (dawn man) *dawsoni*. The association of jaw with cranium as a single type received apparent confirmation from a second discovery in 1915, some two miles from Piltdown, in which a lower molar, practically identical with the corresponding tooth in the famous jaw, was found with some cranial fragments very like the original skull. Unfortunately, the geological age of the Piltdown gravels is somewhat uncertain, though competent opinion now places them as Early Pleistocene. Many authorities believe the skull to have belonged to a later period and to have become accidentally mingled, perhaps during a freshet, with older gravels and fossils of various ages. The proponents of the Dawn man theory hold, on the other hands, that the Piltdown cranium is not *Homo sapiens* but a vastly older and perhaps ancestral type, an early hominid in which the brain (about 1,240 cubic centimeters) had developed far in advance of the jaws which had not yet progressed beyond an apelike ancestral condition. It may be said, in general, that the circumstances of the discovery tend to support the validity of Eoanthropus, but the fact remains that the association of the apelike jaw with a cranium essentially of *Homo sapiens* type seems grotesquely incongruous. British authorities tend in the main to accept the authenticity of the Dawn man, while many in Continental Europe and America are skeptical, favoring the theory of fortuitous association. There is much to be said on both sides of the Piltdown question, which is fully presented in some of the works listed in the bibliography following this article.

Prehistoric Man in America.—This subject can be very briefly treated here as it is now generally admitted that all the American aborigines of both North and South America belong racially to the Mongoloid division of *Homo sapiens* and that their ancestors came from northeastern Asia (Siberia) to Alaska in the region of Bering Strait after the maximum of the last Pleistocene glaciation. Some probably came by land during a period when there was a land bridge connecting the two continents; others may have traveled over the ice or even by boats. There were probably many migrations at different times, during a long period, but there is wide divergence of opinion as to just how old the earliest evidences of man in America are. Skeletal remains believed to be of the late glacial or early postglacial age have been reported from Florida, Minnesota, California, and from sites in South America, but they are all of the Amerindian type and the evidence for their great antiquity is not universally accepted. Apparently much older than most of the skeletal discoveries made before 1947 are certain ancient stone points of highly skilled workmanship known as Folsom points since they were first found near Folsom, N. Mex. in 1925. More recently they have been found in other regions of the Southwest, and stone spearheads found mingled with bones of mastodon, elephant, and other long extinct animals show that early Americans hunted these long extinct creatures. The Folsom culture is believed by geologists and physiographers to be at least 10,000 years old and probably considerably older, which places the earliest immigrants from Siberia to Alaska still earlier, perhaps by several

thousand years. In general, the anthropologists seem to be content with less impressive chronologies than are the geologists. In any case it is certain that the Mongoloid branch of *Homo sapiens,* like the white and black divisions, was fully differentiated before the first migrations from Asia to America in Late Pleistocene time.

A discovery of great importance was that of parts of a human skeleton, including a fairly complete skull in the Upper Pleistocene near the village of Tepexpan in Mexico, in 1947. It was found in association with bones of the imperial mammoth, a well-known Pleistocene elephant. The age of Tepexpan man is placed at more than 10,000 years which makes it the oldest human skeleton thus far found in America though many artifacts are believed to be considerably older. The important fact is that this ancient skeleton is very similar to many members of the American type living today.

The So-called "Ape-Men" of South Africa. —Though subhuman primates are outside the scope of this article one fossil group, the recently discovered Australopithecines of South Africa, possess such special interest because of their manlikeness, that it seems appropriate to mention them briefly. In 1925 Professor Raymond A. Dart of Johannesburg described a fossil juvenile skull from Taungs, Bechuanaland, which he named *Australo-pithecus africanus* (southern ape of Africa). It combined apelike and manlike features in a remarkable manner—the teeth especially being almost human. Dart characterized it as "a prehuman stock" and "an extinct link between man and his simian ancestor." A dozen years later Dr. Robert Broom of the Transvaal Museum, Pretoria, discovered and described two other types of somewhat similar "ape-men" as he calls them. He named two genera, *Plesianthropus* (nearly man) and *Paranthropus* (beside man). New discoveries are being made constantly. Unlike the great apes, these creatures were entirely ground living and inhabited or frequented caves. In all of them the dental arches and teeth are much more human than apelike. The inference that they walked erect was confirmed by the discovery in 1947 and 1948 of the essentially human pelves of two genera. There is impressive evidence that they used limb bones of ruminants as clubs to kill baboons and other animals. Their brains, though larger than those of apes of similar body size, were much smaller than any normal human brain. The geological age of some of the Australopithecines is apparently Pliocene, of others early Pleistocene.

See also ANTHROPOLOGY; ANTHROPOMETRY; ARCHAEOLOGY; CIVILIZATION; ETHNOLOGY; INDIANS, AMERICAN; STONE AGE.

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MAN WITHOUT A COUNTRY, The. Few, if any, short stories written with a purpose have achieved that purpose so completely as did *The Man Without a Country,* by Edward Everett Hale. Written during the Civil War, it did much to inculcate patriotism at a critical period in the fortunes of the Union. The story centers about Philip Nolan, a lieutenant in the Army of the United States, who came under the influence of Aaron Burr, foreswore his country, and as a punishment was condemned never again to hear its name. To effect this, he is kept prisoner all through his long life, first on one ship, then on another, until at last he dies during the Civil War. Though the idea of lifelong imprisonment on shipboard is in itself novel and striking, and the naval setting is worked out with remarkable attention to detail, the chief interest of the story lies in the development of the character of the hero, who, from hating his country, grows through suffering to love her with passionate devotion. All this is told so convincingly, with such a mingling of fact and fancy and with such a wealth of contemporary allusions, that thousands of readers believed it to be an account of fact. The germ of the plot was suggested to the author through the reading of Scott's *Life of Napoleon.* It occurred to him that if Napoleon had been passed from ship to ship instead of being confined on Saint Helena, England would have been spared much contumely and the French would not have turned Saint Helena into a shrine. The "local color," which adds so much to the story, was gained from reading the records of the navy and the proceedings in the trial of Aaron Burr. Immediately upon its publication in the *Atlantic Monthly* of December 1863, *The Man Without a Country* became famous, was copied everywhere and was soon translated into foreign languages.

MAN-OF-THE-EARTH, a local name in the Southern States for *Ipomoea pandurata,* the wild sweet potato vine. A hardy perennial, it is sometimes used for clothing stumps, fences, etc. Generally, however, it is a pernicious weed. The name is also applied to the wild cucumber, *Enchinocystis lobata.* See also IPOMOEA; MORNING GLORY.

MAN-EATER, a term applied to any fierce animal which has acquired, or is believed to have acquired, a habit of killing human beings as food. Lions, tigers, leopards and other great cats are accused of it, and undoubtedly many of these beasts, finding how easily a man or woman among East Indian or African villagers may be struck down or seized when sleeping in a flimsy hut, make their lairs near settlements and for a time regularly subsist upon human victims. Such are sometimes, but not always, old cattle-thieves, whose teeth are worn, and which feel unable or unwilling to undertake the exertion of tracking and pulling down wild animals; but this is not always the case. When

such a beast has taken his residence in a district no pains must be spared to kill him, for he will not cease his depredations. Horses, elephants, camels, etc., sometimes become man-eaters in effect, understanding and exercising their power over him for harm.

A man-eater shark is the great white or blue shark (*Carcharodon carcharias*), which is one of the largest and most formidable of fishes. See also SHARKS.

MAN AND NATURE, a work of great research written in 1864 by George Perkins Marsh (q.v.). Its full title was *Man and Nature, or Physical Geography as Modified by Human Action.* The work became at once a standard with international recognition; a considerably enlarged Italian edition was issued at Florence in 1870; and a second American edition, with further changes, appeared in 1874.

MAN AND SUPERMAN, a play by George Bernard Shaw, subtitled "A Comedy and a Philosophy," and published in 1904. A comedy in the sense that it has an ironically happy ending, and a philosophy in the sense that it contains typical Shavian intellectuality, *Man and Superman* is a play primarily to be read. The play is patterned after the English comedy of manners. John Tanner, a radical political pamphleteer with a deep distrust of women, and Roebuck Ramsden, an extremely respectable gentleman, are appointed joint guardians of a flirtatious young woman, Ann Whitefield. Octavius Robinson, the ward of Ann's lately deceased father, is Tanner's best friend and is in love with Ann. Humorous complications are created by the secret marriage of Octavius' sister, Violet, to a wealthy American whose father desires that he marry a titled Englishwoman who owns an abbey. After several romantic escapades that transport the characters to the Spanish mountains where they become involved with an ethical highwayman, and which include a dream sequence dealing with the original characters from Mozart's Don Giovanni, the play concludes, once more in drawing-room comedy fashion, with Tanner marrying Ann and the triangles being neatly squared. The plot outline is similar to the fashionable comedy popularized by Oscar Wilde with its romantic involvements and a wealth of epigram and caustic wit. Using this old form as a vehicle for his brilliant, iconoclastic social criticism, Shaw accomplishes the double effect of satirizing both the form he uses and the ideas conventionally held in that period. Not satisfied to confine himself to his expressed theme of the battle between men and women in modern society, Shaw includes his philosophy of politics, metaphysics, and morality.

MAN IN THE IRON MASK, The, a mysterious prisoner confined in several French prisons in the time of Louis XIV. He died in the Bastille, Nov. 19, 1703, and was buried the following day in the cemtery of St. Paul's Church under the name of Marchioli. Actually his mask was of black velvet, not of iron. The mystery of his identity was discussed by many writers of the 18th and 19th centuries, notably by Voltaire in his *Siècle de Louis XIV*. Among the persons identified as the masked prisoner were Fouquet; the duke of Monmouth, an illegitimate son of Charles II of England; an illegitimate brother of Louis XIV; a twin brother of Louis XIV; General de Bulonde; and a soldier of fortune of Lorraine named Marechiel. The most widely accepted theory is that he was Count Antonio Mattioli, called in French texts Martioli. As secretary of state to the duke of Mantua, Mattioli betrayed both his master and Louis XIV. Having accepted the French king's bribe to persuade the duke to deliver the fortress of Casale to the French, Mattioli revealed the plan to other interested rulers. His treachery discovered, he was trapped by French agents on Venetian territory, April 23, 1679, kidnapped into France and confined in the fortress of Pignerol of which Saint-Mars was governor. Saint-Mars, receiving the governorship of other fortesses and finally of the Bastille (1695), retained personal charge of his masked prisoner. Baron d'Heiss in a letter to the *Journal Encyclopédique* of June 28, 1770, was the first to identify the masked prisoner as Mattioli. The literature concerning the Man in the Iron Mask is extensive including 52 works published prior to 1870 and more than 20 thereafter. Consult Funck-Brentano, "L'Homme au masque de velours noir dit le masque de fer," *Revue Historique,* vol. lvi (Paris 1894); Hopkins, *The Man in the Iron Mask* (London 1901).

MAN-O'-WAR, great American race horse, foaled in 1917, having in his veins the blood of all three great English sires: Matchem, Herod, and Eclipse. On June 12, 1920, he ran 1⅜ mile in 2 minutes, 14⅕ seconds, at Belmont Park, N. Y. On Sept. 4 of the same year, he ran 1⅝ mile in 2 minutes, 40⅘ seconds. He placed first in 20 of the 21 races in which he was entered. See HORSE—*American Racing.*

MAN OF BLOOD AND IRON, The, the name given to Bismarck. See BLOOD AND IRON.

MAN OF DESTINY, The, a name given to Napoleon Bonaparte, who considered himself specially chosen and directed by fate.

MAN-OF-WAR, an armed naval vessel regularly employed in the service of a government for war purposes.

MAN-OF-WAR HAWK, or **FRIGATE BIRD,** a tropical web-footed bird (*Fregata aquila*), of the family *Pelecanidae.* The color of the adult bird is shining black, glossed with green, the female being duller in hue. Including the long tail the male bird reaches three feet in length, but the body is extremly small. The bill is longer than the head, strong, hooked at the point and sharp. In proportion to their size their wings are longer than in any other bird and have an extent of seven feet or more. Their flight is so powerful that they are seen more than a thousand miles from shore. They move with great difficulty on land, and rarely alight on the water. Possessing great strength and superior power of wing, the frigate bird pursues terns or gulls which have secured a fish, and by beating them with wings and beak forces them to drop or disgorge it; then seizes the prey before it reaches the water. It also catches flying fish for itself. Its usual locality for breeding is the summit of some rocky cliff, but breeds among trees where there are no rocky shores, making a rough platform of sticks. There is only one chalky white egg. This species is found throughout the tropics

and a second species (*F. minor*) ranges about the Indian and South Pacific oceans.

MANACLE ROCKS, England, dangerous reefs on the south coast of Cornwall, 7½ miles south of Falmouth. They are barely visible except at low water, and the only warning of their presence is a bell buoy. Many wrecks have occurred here.

MANADO, mä-nä′dō, or **MENADO,** mä-nä′dō, seaport in the United States of Indonesia, near the northeastern tip of the northern peninsula of Sulawesi (Celebes) Island, 600 miles northeast of Macassar. It is the capital of the residency of the same name, having an area of 34,191 square miles and a population (1930) of 1,138,655. The town lies at the foot of Mt. Klabat on an inlet of Celebes Sea, on the route from Hong Kong and the Philippines to Australia. It is the chief port of northern Celebes exporting copra, coffee, sugar cane, and ebony. Manado has also an airport and is an agricultural trade center; there is a large Chinese population. The climate is extremely hot and humid. A settlement was first established here by the Dutch in 1657. In January 1942 it was taken by the Japanese, who held it until 1945.

MANAGER, City. See CITY MANAGER PLAN OF GOVERNMENT.

MANAGUA, mä-nä′gwä, the capital of Nicaragua, on the south shore of the Lake of Managua, 45 miles southeast of Leon. It is also the capital of the department of the same name, which has an area of 1,330 square miles and a population (1950) of 162,455. The city is the political, commercial, and manufacturing center of the nation and lies on the Pan-American highway and on the railroad from Granada to Corinth on the Pacific. Puerto Somoza is being rapidly developed as its Pacific port. Managua, which has a very hot climate, is built on a regular, modern plan. The government and business buildings and most homes are modern, having been rebuilt after the earthquake and subsequent fire which in 1931 practically destroyed the city, taking 2,500 lives. There is a fine central park, a national museum, a library, a capitol, and a new cathedral being completed. The university was transferred to Leon. Residential sections have spread to the hills to escape the heat. Managua was a large Indian village at the time of the Spanish conquest, but led an obscure life until 1855, when it became the national capital as a compromise between the rivalling cities of Granada and Leon; then it expanded rapidly. U.S. Marines were stationed in Managua almost continuously from 1912 to 1933 to maintain order in the country. Pop. (1950) 107,444.

MANAGUA, Lake, second largest in Nicaragua, it lies about 15 miles northwest of Lake Nicaragua, at an altitude of 120 feet. It is 38 miles long and reaches a maximum width of 16 miles and a maximum depth of 65 feet. It is fed by several small streams and drains into Lake Nicaragua through the small Tipitapa River. The city of Managua lies on its southern shore. Fishing and hunting alligators, whose skins are sent to New York, are the chief occupations. A canal crossing Nicaragua through the lake was under consideration early in the 20th century, but preference was then given to the Panama Canal project.

MANAKINS, a rather undefined group of South American tropical birds, mostly of the family Pipridae, related to the North American tyrant flycatchers. They are small, brightly colored, and the wings often bear curiously modified and often highly ornamental feathers.

MANAMA, mä-nä′mä, capital of the Bahrein Islands in the Persian Gulf off the Arabian coast, on the northeastern shore of the island of Bahrein. It is connected with the island of Muharraq by a modern swing bridge. Manama is headquarters of the pearl-fishing industry of the Persian Gulf and is the seat of the local sheikh and of the British Persian Gulf Presidency. It was greatly developed after oil was discovered in the islands in 1932 and has an oil refinery. With the royalties, sanitary and educational conditions were greatly improved. Pop. (1950) 39,648.

MANAOAG, mä-nä′wäg, town and municipality in the Philippines, in the province of Pangasinan, in central Luzon, 17 miles east of Lingayen. Sugar cane, rice, and copra are cultivated. Pop. of the municipality (1948) 34,304.

MANASAROWAR, măn′ä-sä-rō′ĕr, Tibet, a sacred lake and pilgrimage resort north of the main Himalayan range, near Darchan, between the sources of the Brahmaputra and the Indus. It lies at an altitude of 15,000 feet, is almost circular in form and about 15 miles in diameter.

MANASSAS, mä-năs′ăs, town of Virginia, the seat of Prince William County, 25 miles west of Alexandria, on the Southern Railway; altitude 317 feet. It is a rail junction, road center, and agricultural market. The government is of the mayor-councilmanic type. The creek called Bull Run and the Manassas National Battlefield Park, covering the battlefields of Bull Run, are near by. The courthouse has a collection of war relics. Manassas was incorporated in 1873; rechartered in 1938. Pop. (1950) 1,804.

MANASSAS, First and Second Battles of. See BULL RUN.

MANASSAS GAP, Engagement of, was fought July 23, 1863, during the retreat after Gettysburg of Lee's Confederate army, pursued by Union troops under Meade. The Confederates had Wright's brigade deployed at the west end of the Gap and Rodes' division about 600 yards in the rear under orders to hold the gap. At 4 P.M. the Union attacked: Spinola's brigade and Ward's two regiments engaged Wright's men and drove them back upon Rodes, who stood firm, the artillery checking the Union advance. Wright's loss was 19 killed, 83 wounded, and 66 missing; the Union lost 21 killed and 84 wounded. Next morning the Union advance marched to Front Royal, but all of Lee's army had passed.

MANASSEH, mä-năs′ĕ, the older but less important of the two sons of Joseph, whose name is derived from the word "to forget" and explained as signifying "he who causes one to

forget" that is "all my toil" (Genesis 12:51). Although in Jacob's blessing he was made subordinate to his younger brother Ephraim (Genesis 48:14), he was to be protected by the redeeming angel and to become the ancestor of a great people (Genesis 48:16, 19). The next verse "in thee shall Israel bless, saying God make thee as Ephraim and Manasseh" forms the benediction which Jewish parents utter over their sons on the eves of Sabbath and holydays. The name is held by one of the tribes of Israel, the sixth in numerical strength (Numbers 26:34), to which a position was allotted in the land of Canaan. During the journey through the desert of Sinai, its station was with Ephraim and Benjamin west of the Tabernacle and it took a prominent part in the battle. Israel's chiefs Gideon and Jephthah belonged to the Manasseh tribe. In time the tribe fell behind Ephraim in prominence and carried assimilation so far, practicing foreign idolatries, that it lost its identity completely.

MANASSEH, king of Judah; d. 639? B.C. The son of Hezekiah, he succeeded his father when he was about 12 years old (2 Kings xxi, 1), had longest reign in the history of Judah (692?–639? B.C.). In the Assyrian inscriptions Manasseh is mentioned as a vassal king during the reigns of Esarhaddon and Assurbanipal. It is also stated (2 Chron. 33:11) that the Assyrian captains took him in chains to Babylon as punishment for Judah's disloyalty to God. On his repentance, however, he regained his throne and showed a genuine religious spirit which gave a new character to his nation. Ezekiel, in a memorable chapter (8), describes the spread of religion during Manasseh's reign and how the popular worship was a shameless blend of foreign idolatries, against which the prophets declaimed but the influence of which was not quickly overcome. A prayer in Greek attributed to Manasseh, composed when captive in Babylon, is found in the Apocrypha, but has never been recognized as canonical by the church.

MANASSEH, son of Johanan, the high priest and brother of Jaddua, who married Sanballat's daughter. In Nehemiah (21:28) he is referred to without name, and he is further declared to have been deposed from the priesthood on account of being Sanballat's son-in-law. In Josephus (Antiq. xi, 8, 2-4), a fuller account is given. Incensed at Manasseh's marriage with a foreign woman, his brother Jaddua, the high priest, placed before him the alternative of divorcing his wife or giving up the priesthood. When he went to Sanballat and frankly declared his preference for the priesthood, despite his love for his wife, his father-in-law assured him that the king would give him the rank of high priest if he would retain his wife. Hence he remained with his father-in-law, and became high priest in the Samaritan temple on Gerizim. A conflicting passage in Josephus (Antiq. xii, 4, 1) mentions Manasseh as high priest at Jerusalem between the priesthood of his nephew Eleazar and that of Onias II.

MANASSEH BEN ISRAEL, bĕn ĭz'rā-ĕl, or **MENASSEH BEN ISRAEL,** Hebrew scholar: b. La Rochelle, France, 1604; d. Middleburg, Netherlands, Nov. 26, 1657. At the time of his birth his parents were living in France after fleeing the persecutions in Lisbon. Soon after they settled in Amsterdam, where Manasseh was educated. In 1620 he was appointed rabbi and soon became a noted preacher. He started the first Hebrew press in Holland in 1627, published a Hebrew grammar and an edition of the Mishnah. The first volume in Spanish of his *El Concilia dor* appeared in 1632; in it he attempted to conciliate apparently discordant passages of the Old Testament. It brought him great fame among the learned of his time and he corresponded with Grotius, Vossius, and others. In his *Esperan ça de Israel,* translated into English in 1650, he sought the readmission of Jews to England and went to London to plead his cause with Cromwell; although accepted with favor, his project was not approved by Parliament. Among his other writings in Latin, Spanish, and Portuguese, are *Vindiciae Judaeorum,* a defense of the Jews, by some considered his greatest work. He was the teacher of Spinoza and a friend of Rembrandt, who painted his portrait.

MANATEE, an aquatic mammal or "sea-cow" of the order Sirenia (q.v., for general structure), several species of which inhabit the fresh waters along the eastern coasts of tropical America and of western Africa. The body is somewhat seal-like in shape, reaches a length of 8 or 10 feet, has a large round head with bristly, tumid lips, no apparent neck, no external ears, the forelimbs converted into paddles, no hind limbs, and the tail spade-shaped, like that of a beaver. The thick wrinkled skin is blackish, and almost hairless, but a coat of short, seal-like fur clothes the foetus, indicating descent from furry ancestors. Structurally the manatee differs from other sirenians in having only six cervical vertebrae, and in the large number of molar teeth, which apparently go on increasing indefinitely during the animal's life—the suggestion being, as Beddard points out, that they are worn away by the attrition resulting from so much sand being mixed with the daily food. The manatees are stupid, gentle, and defenseless creatures, showing great affection for their young, one or two in number, which are nursed at pectoral udders. They never come ashore, but secrete themselves amid aquatic vegetation. Their food consists of fresh-water weeds and their roots, and these are procured by means of the curious form of the upper lip: "this is split in two, and the two halves, which are furnished with strong bristles, can play upon each other like the points of a pair of forceps." This cleft lip is only suggested in the case of the dugong.

The American manatees have been nearly exterminated. They formerly abounded in the Indian River and other marshy waters about southern Florida, but by the end of the 19th century had been reduced to a small, carefully protected band near Biscayne Bay in the Miami River. They still survive in small numbers along the coast of the Caribbean Sea and about the mouths of the Orinoco. The Florida manatee is called by American zoologists *Manatus latirostris,* and is regarded as different from those of Central and South America, long known as *M. americanus.* The African species is *M. senegalensis.*

MANATEE, Florida. See BRADENTON, Florida.

MANAUS, mà-nous, or **MANAOS,** city of northwestern Brazil, the capital of Amazonas state, on a height over the left bank of the Rio Negro, about 10 miles above its junction with the Amazon River. Although it is located almost 1,000 miles inland from the Atlantic by river, ocean-going vessels can reach its busy harbor, built in 1902; because of the marked changes in the water level floating wharves were constructed. Manaus is the trade and distribution center for the whole upper Amazon region; rubber, cacao, Brazil nuts, tonka beans, horns and hides, hardwoods, and dried fish are exported. There is a regular air service with Belém and Rio de Janeiro. The city is completely surrounded by tropical forests and has a very hot and humid climate. It is well built, with broad streets, electricity, a good water supply, and several modern government buildings; a large cathedral rises in the center of the town, which has been an episcopal see since 1892. Manaus is also a cultural and educational center, with high schools, an industrial school, a chemical institute, an historic-ethnographic museum. The botanical and zoological gardens are famous. Manaus was founded in 1660 by Francisco da Motta Falção as São José do Rio Negro; the name was changed to Manaos after 1825 and Manaus after 1939. It was the capital of Rio Negro province before it became in 1850 the capital of the newly-created state of Amazonas. At the end of the 19th century and at the beginning of the 20th Manaus had a period of incredible prosperity due to the wild rubber boom. The golden-domed opera house, now in disuse, the ornate buildings, and the harbor were then constructed. When the rubber trade practically ceased, the city suffered decline; but following World War II trade began to revive. Pop. (1950) 110,678.

MANBY, George William, English inventor: b. Denver, Norfolk, Nov. 28, 1765; d. Southtown, Great Yarmouth, Nov. 18, 1854. He was educated at the military college of Woolwich, and became in 1803 barrack master at Great Yarmouth. His attention having been drawn to calamities resulting in cases of shipwreck, from the difficulty of establishing communication with the shore, he attempted casting a rope from the shore to the wreck by the agency of gunpowder. Chains were unable to stand the shock of the discharge, but stout strips of rawhide closely platted together were found to answer, and on Feb. 12, 1808 the entire crew of the brig *Elizabeth,* wrecked within 150 yards of the beach, were rescued by the simple contrivance of Captain Manby.

In 1810 his invention was brought before a committee of the House of Commons, and having been favorably reported on, he received a grant of money, and all the dangerous stations on the British coasts were supplied with his apparatus. He also contrived shells filled with luminous matter, to enable the crew to perceive the approach of the rope, in the manufacture of which he suggested several improvements.

MANCHESTER, town, Connecticut, in Hartford County; altitude 140 feet; on the New York, New Haven and Hartford Railroad; 8 miles east of Hartford. The township (which includes South Manchester) is situated in a fertile area growing fruits, vegetables, tobacco and nursery products. The Cheney silk mills, established here in 1838, form the town's chief industry. Other manufactures include woolens (made here before 1790), soap, paper and fiber board, parachutes, electrical instruments, needles, clothing, baseballs, toys, leather novelties, machinery and tools, and chimes. Manchester has the Whiton Memorial Library, and South Manchester, the Mary Cheney Library. There is a state trade school here.

Settled in 1672, it was a part of Hartford, and then of East Hartford, until its incorporation in 1823. Town government is operated under a special legislative charter. Pop. (1940) 23,799; (1950) 34,116.

MANCHESTER, măn'chĕs-tẽr; -chĭs-tẽr, county borough and city, England, in Lancashire County, 188 miles north of London and 30 miles east of Liverpool, on the Irwell River, an affluent of the Mersey, and since 1894 connected with the sea at Eastham, on the Mersey, by the Manchester Ship Canal. It is one of the principal manufacturing cities of the world, and the cotton center of Great Britain. Railways (steam and electric) and motor omnibuses communicate with the surrounding towns and villages.

Geography.—The city lies in the southeast corner of Lancashire, bordered by the low Penine Hills on the north and east, and entering the fertile Cheshire plain on the south. The city center is 133 feet above sea level.

Climate.—The climate is temperate; the prevailing wind is southwest. The city, with 30 inches rainfall, is damp rather than wet, with fogs and mists in winter and with sunshine reduced by the industrial smoke pall. This damp climate and ample water supply contributed to the establishment of the cotton industry.

Geology.—Thick deposits of glacial drift, sands, gravels and boulder clay overlie heavily faulted Triassic, Permian and Carboniferous rocks which often reach the surface. The "Pendleton fault" gives rise to occasional earth tremors. Wells in the Triassic rock form a source of industrial water. Coal is mined at two pits within the city and extensively throughout the surrounding area. To the south, vast salt beds feed the local chemical industries, and other mineral deposits abound.

HISTORY

Ancient.—The Romans established a fort at Mancenion in 79 A.D. to guard a military road: a small portion of the wall and Roman objects from the site are still extant. The Romans left Mancenion in 426 and though the place is occasionally mentioned in surveys, little is known until 870, when the Danes destroyed the town. In 920 it was rebuilt by Edward the Elder: in 1028 King Canute gave Manchester the right to coin money. Manchester is briefly mentioned in the Domesday survey of 1086 as poor and sparsely populated.

Medieval.—Manchester's importance dates from the 13th century. In 1229 Henry III granted an annual fair and in 1330 the first signs of industrial activity were seen in the settlement of immigrant Flemish manufacturers. About 1500, vegetable cotton, known as "cotton wool," was introduced. The antiquary John Leland, appointed by Henry VIII, described Manchester in his 1536 survey as "the fairest, best builded, quikkest and most populous towne in all Lancashire." From 1645 Manchester was represented by a member of Parliament. In 1650, Manchester manufac-

tures were given as "woollens, frizes, fustians, sack-cloths, mingled stuffs, inkles, topes and prints" and in 1690 the art of calico printing was introduced from France.

Recent.—In 1717 Manchester's population was 8,000. In the following 200 years, the coming of the Industrial Revolution brought the greatest growth, for by 1900 the population was 543,872. The discovery and exploitation of steam power, and the opening up of road and river communications, paralleled a multitude of mechanical inventions for cotton manufacture. In 1761, the first of a network of canals was built; in 1785 the culminating invention of the power loom for weaving was made, and about the same time the first steam engine was used in cotton manufacture in Miller Street, Manchester. In 1821, the *Manchester Guardian* newspaper was established; in 1830 the Manchester and Liverpool Railway was opened: by 1850 there was a direct rail link with London.

In 1832 Manchester became a Parliamentary borough with two members. Social progress was interrupted in the 1830's and 1840's by food shortage, and despite the repeal of the Corn Laws, great distress was caused in the 1860's by restriction of cotton imports due to the American Civil War. In 1851 Owens College (later the Manchester University) was opened, and in 1894 the Manchester Ship Canal, making Manchester an inland port for ships up to 15,000 tons, was completed. In 1929 land was acquired for a 4,000 acre satellite town at Wythenshawe, and in the following year the first air service from Manchester to the European continent was inaugurated. During World War II, more than 600 Manchester citizens lost their lives in heavy air raids, many of the town's buildings were destroyed, and 30,000 houses were damaged.

Municipal.—In 1301 the lord of the manor granted a charter appointing officers, making rules for town management and defining the functions of the courts, but in practice the lord of the manor remained all-powerful until the latter half of the 18th century when Parliament set up town commissioners. Successful administration was not achieved, however, until 1838, when Manchester was granted, under an Act of 1838, a charter of incorporation giving it an elected municipal council with wide powers of local government. In 1838, the acreage was 4,293; in 1900 the acreage, by absorption of neighboring authorities, was 13,000, and in 1931 the present acreage of 27,255 was attained. Manchester became a city in 1853.

CONTEMPORARY MANCHESTER

Industry and Commerce.—Manchester is the metropolis of southeast Lancashire—one of the principal industrial areas of the world—housing within the city boundary many great industrial plants and, even more significantly, providing packing, marketing, selling, banking, insurance, stockbroking, exchange, and other services for the whole region. Two misconceptions arise from Manchester's reputation as the home of cotton manufacture—that this manufacture is carried out within the city boundary, and that it is the sole important local industry. In fact, cotton manufacture within the city is negligible. The spinning, bleaching, weaving, dyeing, printing, and finishing processes are carried on in the surrounding towns, and the research, marketing, and other commercial facilities are provided in Manchester. Moreover, although cotton manufacture is still the principal local industry, the heavy engineering and chemical industries are now almost equally important, and the volume of production in the city is considerable. Other major products include rubber and leather, wires, ropes, aircraft, storage batteries, clothing, asbestos, belting and chains, and light industrial goods. Much research is carried on by individual firms and a degree of coordination is achieved through the Manchester Joint Research Council, comprising members of the Manchester Chamber of Commerce and Manchester University, and formed in 1944 to bring together science and industry, disseminate new knowledge, encourage research, and inquire into industrial, scientific, economic and sociological problems. Research into cotton problems is performed by the Shirley Institute at Didsbury.

Manchester is an important financial center, with a branch of the Bank of England and with a bankers' clearing house. The Stock Exchange has 120 members. The Royal Exchange is primarily a cotton exchange, but its 4,000 (in 1951) members deal in all classes of goods. Other exchanges deal in coal, food and produce, and real property.

Manchester is a newspaper publishing center comparable with London, publishing three morning, two evening, five weekly, and two Sunday newspapers. Northern editions of five national papers are also printed and published in Manchester.

Transport.—Manchester is linked with the sea by the 35 mile Manchester Ship Canal, with surrounding towns by a comprehensive network of railways and roads, and with other regions by barge-carrying canals. There are four principal railway stations, many smaller stations and extensive sidings. Municipal airports provide facilities for transcontinental aircraft at Ringway, and for private flying and air-taxi work at Barton upon Humber.

Central Government.—*Administration.*—Manchester is a center of national government, housing the regional offices of 16 ministries and local offices of 41 other government departments. Ten members represent the city in Parliament.

Local Government.—The elected Manchester City Council of 144 members (36 aldermen and 108 councillors), has 40 committees, most of whose proceedings require ratification by the City Council. The chairman of the Council and "first citizen" is styled "lord mayor." Manchester's municipal services resemble those of other county boroughs, it is not necessary to enumerate them all. Outstanding examples are the water supply, drawn by pipeline from lakes Thirlmere and Haweswater, nearly 100 miles distant, and supplied to a population of 1,140,000; the municipal gas, electricity and transport undertakings, serving the city and surrounding districts; the city markets, drawing food from and distributing it to a wide area; the municipal airports, of which Manchester had in 1929 the first in the world; the support of the Manchester Ship Canal enterprise, in which the Corporation holds £6,750,000 share capital and appoints 11 directors out of 21; and the Wythenshawe Estate, a satellite town projected in 1926 and since visited by sociologists and planners from all parts of the world. Built on "neighborhood unit" principles, with segregated industrial, residential and agricultural areas, Wythenshawe when complete will

house 60,000 people in the true community of interest which towns of the past have lacked. The municipality is also responsible for the Henry Watson Music Library, the Rutherston Loan Scheme, and the Cunnington Costume Collection, more fully described hereafter.

The Courts.—Manchester has a Court of Assize and a District Registry of the High Court of Justice, and seven other courts of law sit within the city boundary. The lord mayor is ex-officio the chief magistrate; there are 136 magistrates on the roll for service on the bench at the magistrates' courts.

Religion.—The Manchester Cathedral (the Parish Church) is the local nucleus of the Established (Protestant Episcopal) Church (The Church of England), and in the city there are 106 parish and district churches. Manchester has also been a notable home of nonconformity, since the Act of Uniformity in 1662 resulted in the expulsion in Lancashire alone of over 100 ministers of the Established Church who would not subscribe to the Anglican Prayer Book. The first dissenting meetinghouse, Cross Street Chapel (now Unitarian) was built in 1693, and meetinghouses were also built by the Friends (1732), the Wesleyans (now Methodists) (1752) and the Independents (now Congregationalists) (1761). There are 19 Free Church denominations in the city, many of which are represented on an active Free Church Federal Council, and on the Manchester Council of Churches. Manchester's importance as a religious center is emphasized by the presence of seven theological colleges—Baptist, Methodist, Congregational, Talmud Torah, Moravian, Unitarian, and Roman Catholic. Connected with these are many religious societies whose work is closely interwoven with that of the local voluntary bodies, and who maintain 120 day schools in conjunction with the Municipal Education Committee. At nearby Fairfield is a Moravian settlement, more fully described hereafter.

Medicine.—Manchester, a center of medical research and treatment, has twenty-one voluntary (privately supported) and twelve municipal hospitals, served by a distinguished group of specialist doctors and surgeons. The Royal Infirmary (with the Manchester University medical school the nucleus of medicine in the city) provides 875 beds, and the Christie Cancer Hospital and Holt Radium Institute is the foremost center of cancer research and treatment in the British Commonwealth.

Education and Culture.—The Victoria University of Manchester is the hub of the Northern British universities group. The university bears a fine reputation and has led the world in research into atomic structure: in the university laboratories, professors Ernest Rutherford, James Chadwick, John Douglas Cockcroft, and (William) Lawrence Bragg first watched the atom disintegrate, discovered the neutron and first mechanically disintegrated the atom. Research continues. The university is closely connected with the municipal College of Technology, where technical degrees are taken. At the Manchester Grammar School, founded in 1515 by Hugh Oldham, Bishop of Exeter, many distinguished British statesmen and citizens began their education. The city's schools include a number of religious training colleges, a college of music, and, under the municipality, an art school, domestic economy college, schools of commerce, adult education centers and several hundred day schools.

The Municipal Art Galleries house a fine collection of works of the English school of the last century and of the Pre-Raphaelite Brotherhood, with many specimens of the work of 18th and 19th century painters and contemporary artists, and foreign works. Special collections include statuary, furniture, silver, glass, enamels and ceramics. Under the Rutherston Loan Scheme, Manchester's art treasures are loaned to other British towns.

Platt Hall (municipal) the first museum in Britain devoted exclusively to costume, exhibits the collection of English women's costumes formed by Dr. C. Willett Cunnington. Acquired for Manchester by public subscription, the collection of dresses and dress accessories, books, periodicals, and fashion plates covers a period of two hundred years.

The Whitworth (private) Art Gallery contains an important collection of English water colors and textile fabrics from the 1st century onwards. The Manchester Museum of the University possesses one of the most comprehensive collections of Egyptian antiquities in Britain, in addition to collections of fossils, plants, animals, and arts and crafts.

The municipal libraries comprise a central library and 36 branch libraries. The Manchester Central Library houses the finest municipal reference collection in the country, a technical and patents library, a commercial library, and the Henry Watson Music Library. The last is acknowledged the finest and largest music collection for public borrowing in the world, with 73,549 volumes and 309,474 pieces of sheet music available for borrowing, and with many rare books, manuscripts and instruments. A former baronial hall, c.1425, houses the Chetham Library and Bluecoat School for poor boys, founded by Humphrey Chetham in 1653. The library, the earliest free library in Europe, is essentially a scholars' library with its 100,000 volumes of classical, historical, topographical, philosophical, theological, archaeological, and antiquarian works.

The John Rylands Library (for reference and research), a center of attraction for scholars and lovers of rare and beautiful books from all parts of the world, includes the Spencer Althorp Collection (reputed by some the finest private library ever compiled) and holds unsurpassed collections of block books, incunabula, Aldines, Caxtons, and Bibles. The manuscripts, which include the 6,000 item collection of the earls of Crawford, illustrate the history of writing and illumination in the principal world languages from the fourth millennium B.C. to the present day. There are several thousand early charters, 20,000 proclamations from the principal countries of Europe of the 15th century, and autographs, prints and historic bindings.

Manchester has a wealth of literary and artistic societies. To the Literary and Philosophical Society, the foremost British scientists have first disclosed fundamental and revolutionary discoveries—including the atomic theory of matter, first propounded there by John Dalton. Visual art is represented by several vigorous groups of modern artists, and there are more than 300 local amateur dramatic societies. Manchester's musical background is especially noteworthy. An influx of German and Austrian merchants in the last century led to the formation

of the internationally famous Halle Orchestra, whose 90 musicians under their conductor John Barbirolli now play to audiences of 6,000 at the Kings Hall, Belle Vue, tour the British Isles and fulfill many engagements on the European Continent. There are numerous other orchestras and chamber concert societies, five amateur symphony orchestras, and several amateur vocal societies, whilst an important annual musical festival takes place at Alderley Edge nearby.

The city possesses six theaters, over 200 cinemas, and the celebrated Belle Vue Zoological amusement gardens of 80 acres, founded in 1836, which with their zoo, amusement park, sports stadium, dance floors and concert halls are visited annually by five million people.

Notable Buildings.—Among these are the Town Hall (Victorian Gothic revival) with historical mural paintings by Ford Madox Brown, the Central Library (Greek revival), and the Town Hall Extension (Modern), which together form a municipal block; the Cathedral, built between the 13th and 19th centuries, with its fine interior woodwork; the Rylands Library (late Gothic revival) in Deansgate, internally and externally an architectural gem; the Free Trade Hall, Assize Courts and Royal Exchange, all severely damaged by air raids; and the university, a group in varying styles. Modern functional examples include Ship Canal House, King Street; Kendal Milne's department store, Deansgate; and Midland Bank Building, King Street. Older buildings include Chethams Hospital, previously mentioned; the Wellington Inn, the last of the City's Elizabethan inns; and the more recent Moravian settlement at Fairfield. Founded by religious refugees from central Europe in 1785, this settlement (late Georgian style) includes a church, two schools, a textile factory, and nearly 100 dwelling houses. The original character remains, and descendants of the original families occupy the buildings.

Population.—The population greatly increased between 1841 and 1931 as will be seen by the following figures: (1841) 242,983; (1871) 351,189; (1891) 505,368; (1931) 766,378. This increase may be partially accounted for by the extension of the city boundaries which began in 1885. There was no census taken during World War II but the estimated population in 1939 was 727,600 and the 1951 census records the total as 703,175.

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MANCHESTER, city, Iowa, and Delaware County seat, altitude 919 feet, on the Maquoketa River and on the Illinois Central and the Manchester and Oneida railroads (the latter steam), 130 miles northeast of Des Moines; also on state and federal highways. Situated in an agricultural region, the city is a dairying center and a trading point for the farmers of the county. There is a public library here.

Settled in 1850, as the town developed it was first known as Burrington; the present name was adopted in 1856. Incorporation as a city was effected in 1886. Manchester has a mayor and council, and a city manager. Pop. (1930) 3,413; (1940) 3,762; (1950) 3,987.

MANCHESTER, town, Massachusetts, in Essex County; altitude 14 feet; on Massachusetts Bay; 6 miles southwest of Gloucester; on the Boston and Maine Railroad. Originally a fishing village, it began to develop into a summer resort about 1850. Settled about 1626, the place was known as Jeffrey's Creek until 1645, when the name was changed and the town was incorporated. There is a library, and the historical society has quarters in an old home. A brick building in which ammunition was stored during the War of 1812 stands on Powder House Hill. Pop. (1940) 2,472; (1950) 2,868.

MANCHESTER, city, New Hampshire, one of the county seats of Hillsboro County, on the Merrimac River at the mouth of the Piscataquog, 18 miles south by east of Concord, and on the Boston and Maine Railroad. The first settlement was made in 1722 and for a number of years it was called Amoskeag and Tyngstown. In 1751 it was incorporated as Derryfield and in 1810 the name was changed to Manchester. It was chartered as a city in 1846.

The Amoskeag Falls (55 feet) in the Merrimac, above the city, provide extensive waterpower which, by means of canals, is made available for manufacturing. Cotton goods manufactures and woolen goods manufactures are the city's largest industries and for many years the mills of the Amoskeag Manufacturing Company were considered the largest cotton manufacturing plant in the world. Competitive conditions made the enterprise unprofitable after the depression of 1929 and the plant was closed. Local business men, determined to save for the city this valuable industry, bought the plant and leased parts of it to scores of small manufacturing enterprises which have since operated successfully. The mills have been operated for more than a century, having been founded in 1810. There are numerous other important industries in the city, especially the shoe industry. The city's area of about 35 square miles is well laid out and its residential districts present an attractive appearance. It is the seat of a Roman Catholic bishop since 1884. Near by are two notable Catholic schools, Mount St. Mary, at Hooksett; and St. Anselm's College, at Goffstown. The Carpenter Memorial Library is one of the finest structures of its kind in New England, and other outstanding buildings are those of the Currier Gallery of Art; the Institute of Arts and Sciences; the Association Canado-Américaine; and the Manchester Historic Association. City Hall, built from red brick of local manufacture, dates from 1845.

Manchester was the home of Gen. John Stark (q.v.), hero of the French and Indian, and the American Revolutionary wars. Stark Park, in which the general is buried, is one of the most beautiful in the vicinity, overlooking the Merrimac River and the Uncanoonuc Mountains; the Stark home is owned by the Daughters of the Revolution; and the site of the old Stark family homestead forms a part of the grounds of the State Industrial Home. Other points of interest are Rock Rimmon, with its story of an Indian maiden's love tragedy; Mast Road, on the Pis-

cataquog River, named because of the giant pines reserved for the British navy having been transported over it; Goffs Falls, near which was the homestead of the Goffe family, first white settlers in the district; and the Blodgett Canal, completed in 1807, once important as the last link of an inland waterway from Boston to Concord. Manchester has many fine summer homes, a considerable summer resort business, and a municipal airport. Pop. (1940) 77,685; (1950) 82,732.

MANCHESTER, town, Vermont, and one of the two Bennington County seats, altitude 694 feet, on the Rutland Railroad, 32 miles southwest of Rutland. It is also on state and federal highways, and is in a farming section. There are marble quarries near by. It makes fishing rods and flies. The town government body is a board of selectmen. The Mark Skinner Library is a memorial to one of the early families.

Manchester played a prominent part in the formative period of the state's history, when New York and New Hampshire struggled for control. The New Hampshire Grants, after the French and Indian wars, included the grant of Manchester township in 1761. Manchester was a center of Vermont activities in the American Revolutionary War. It was a junction point of stage coach traffic. Manchester is the seat of Burr and Burton Seminary, founded in 1829. It is a popular summer and winter resort town with two 18-hole golf courses and skiing on Big Bromley Mountain and in Snow Valley. A Southern Vermont artist's exhibition is held annually in the Seminary gymnasium. The town has a number of old colonial buildings, and fine modern summer homes. The sidewalks are made of marble slabs. On the green is a soldiers' monument, with a statue of a Continental soldier. The place was named after Manchester, England. Pop. (1950) 2,425.

MANCHESTER, former city, Virginia, in Chesterfield County, on the James River, opposite Richmond, to which it was annexed in 1910.

MANCHESTER SHIP CANAL, England, a great canal, by which Manchester (q.v.), an inland town, was virtually converted into a seaport. It extends 35½ miles west from Manchester to the Mersey River estuary at Eastham. There are several large petroleum refineries located on the canal.

MANCHESTER UNIVERSITY, England, known officially as Victoria University of Manchester. In 1846 a Manchester merchant, John Owens, left £96,000 for the foundation of a college for boys of 14 years and older, from Manchester and vicinity. Owens College opened on March 12, 1851, with five professors, and in the fall term there was an enrollment of 62 students. (Women students were first admitted in 1883.) A charter was granted in 1880 for the federal Victoria University, with constituent colleges at Manchester, Leeds, and Liverpool. The arrangement was short lived; by 1904 they were separate, and Owens College was incorporated into Victoria University of Manchester. The constitution of 1903 provided for a chancellor, vice chancellor, court of governors, council, and boards of faculty and students. There are nine faculties: arts, science, law, medicine, music, economic and social studies, theology, technology, and education. Manchester Museum is affiliated with the university and was established for the promotion of natural science. In 1949–1950 the enrollment was 4,697 men; 1,245 women.

MANCHURIA, man-choor'i-a (Chinese MANCHOW), a region comprising the extreme northeastern portion of China, known to the Chinese as TUNGPEI, meaning the Northeast; called MANCHUKUO during the Japanese domination. The territory lies mainly between latitudes 40° and 53° N. and longitudes 118° and 135° E. It is separated from Asiatic USSR on the north and northeast by the Amur River, on the east by the Ussuri, and on the northwest by the Argun. On the west it is bounded by the Mongolian People's Republic and China Proper; on the south by Korea and the Yellow Sea. The estimated area is 428,735 square miles; the estimated population in 1947 was 38,184,000. Its leading cities are Mukden (Shenyang), the capital, Changchun (Hsinking), Harbin (Pinkiang), Dairen (Talien). Before the Japanese seized Manchuria in 1931, the territory was divided into three provinces—Liaoning (Fengtien), Kirin, and Heilungkiang. After Chinese recovery of the northeast in 1945, it was divided into nine provinces: Liaoning, Antung, Liaopei, Kirin, Sungkiang, Hokiang, Heilungkiang, Nunkiang, and Hsingan. The former Kwantung Leased Territory, including Dairen and Port Arthur, lies on the tip of the Liaotung Peninsula which is in Liaoning Province.

It was the scene of fighting between the Chinese Nationalists and Communist troops during 1946 to 1948, the Communists gaining complete control in November 1948 with the occupation of Mukden. In 1949 Manchuria formed one of the six regional governments of the emerging Chinese People's Republic. In February 1950, agreements were signed in Moscow by Soviet Russia and the Chinese People's Republic providing for Soviet recognition of Chinese sovereignty over Manchuria, the return of the former Japanese-owned industrial installations taken from it by Soviet Russia and the restoration of full Chinese control over Port Arthur (Lushan), Talien (Dairen) and the Chinese-Changchun Railway either on the conclusion of a Japanese peace treaty or by the end of 1952.

The Land.—Vast chains of mountains ramify over the northeast, with the Khingan Mountains in the north and the Changpai Range in the south. The principal rivers are: the Amur; the Argun; the Sungari, the vast basin of which occupies the rich central part of the territory; the Ussuri, a tributary of the Amur; the Yalu and the Tumen, which separate Manchuria from Korea; and the Liao, which flows through the rich southern Manchurian delta into the Gulf of Liaotung. The climate is in most parts healthful and invigorating. In the north and more elevated parts, the cold of winter is intense, the thermometer sometimes falling to 48° below zero, and the snow lying for six months in the year. The summer temperature reaches about 90°.

The People.—South Manchuria was historically populated by Chinese. North and east Manchuria were occupied by tribes known historically as Suchen, Khitan, Juchen and Tungus. West Manchuria was partly occupied by Mongols. The Juchens were also known as Manchu who established the Manchu dynasty from 1644–1911. Present-day Manchuria, however, is mainly Chi-

nese. The great majority of Manchus have adopted Chinese names, customs and language. The Manchurian language, which became a dead language even before the end of the Manchu dynasty in 1911, was created in the 17th century patterned after the Mongolian language. The language is written from top to bottom and from left to right.

Natural Resources and Production.—The soil in the northeast is exceedingly fertile, especially in the valleys of the Liao and Sungari rivers. It is China's breadbasket; soybean, wheat, millet, sugar beets, rice, peanuts, and many other crops grow in abundance. It also produces cotton, tobacco, and a great deal of wool, while its silk industry is promising. The vast forests of the country are rich in useful timber of all kinds, such as walnut and oak, together with the soft pine and fir. They abound in wild animals: the tiger, panther, bear, fox, wolf, and stag, as well as the eagle and other birds of prey. The rivers abound with fish. But what makes the region particularly valuable to China is its underground wealth. Manchuria has 80 per cent of China's iron deposits, and some of her best coal deposits, including one of the largest open-pit coal mines in the world. No large-scale oil reserves have been found in the northeast, but its rich deposits of oil-bearing shale supply crude oil while its rich coal reserves offer a bright future for the gasoline-extracting industry. As for other minerals, the aluminum and magnesium reserves are very large. There are also important reserves of tungsten, tin, gold, silver, zinc, copper, asbestos, molybdenum, limestone, marble, and other minerals. The territory has a huge salt production to substantiate a vast chemical industry.

There is a good network of railways in Manchuria, with a total mileage (1947) of 8,000 miles. With its fine harbors, the area is capable of a high degree of industrialization.

Finance.—In the years under Japanese domination, Manchuria belonged to the Japanese yen block and a paper currency known as the Manchukuo yen was in circulation. After the Soviet declaration of war on Japan on Aug. 9, 1945, the Soviet troops occupying Manchuria issued in undetermined amount a special Soviet military note for circulation in Manchuria. These notes were later redeemed by the Chinese government. The present (1947) currency in circulation is known as the northeast currency note, each dollar of which is equivalent to 12.50 Chinese National currency dollars. Because of its past high production and sounder financial foundation, inflation in Manchuria is not so severe as it is in China Proper. Consequently its currency is in a more advantageous position than the Chinese National currency.

Government.—After the Chinese recovery of Manchuria, it was divided into nine provinces and nine provincial governments were established to handle all civil administration in the territory under the direction of the President's Headquarters in the northeast established in Changchun. A Northeast Economic Council was established to direct and coordinate all economic activities in the area. A Northeast Peace Preservation Headquarters was established to direct all military activities. The provincial governments have different departments in charge of civil administration, finance, education, reconstruction, and other duties. Under the provincial governments are county governments administering county affairs. Provincial political assemblies serve as provincial representative bodies in their respective provinces. Many of the provincial governments however, are unable to function as their territories are under Communist control. The Communists have their own administrative organs in their areas.

Way of Living.—As Manchuria is now predominantly Chinese, the way of living of people there is not different from north China Chinese. Both men and women dress in long gowns. In winter, most women dress in long trousers to protect them from the severe weather. Their staple food is wheat flour and *kaoliang*. Their religions, like that of north China Chinese, include Buddhism, Confucianism, Islam, Taoism, and Christianity. There is complete freedom of religion in Manchuria as in other parts of China.

Education.—The education system in the northeast is the same as other parts of China. Theoretically, children are required to go to school when six years of age. They have six years of primary school education. The middle schools are divided into junior and senior middle schools each of three years. The colleges and universities are four-year institutions. There are also normal schools and professional schools for students who want to go into training for teaching or other professions after finishing primary schools. Because of the inadequate number of schools, there is a high rate of illiteracy in Manchuria, especially among the adults.

History.—Manchuria came within the horizon of the Chinese Empire in the 3d century B.C. and the Liao River valley was already then populated by Chinese settlers. Manchuria began to play an important part in Chinese history when the Khitans founded the Liao dynasty in the 10th to 12th centuries and when the Juchens founded the Gold dynasty in the 12th and 13th centuries. Both dynasties, however, limited themselves to Manchuria and north China. It was when the Juchens founded their Ching (Manchu) dynasty in the 17th century that they conquered other parts of China. The founder of the Manchu dynasty was Nurhachi who began his career of empire building in the area around the middle Sungari, near present Changchun. He rose from very small beginnings but was soon able to conquer other clans and tribes, and create a big warlike state outside of the Great Wall, laying the ground for further invasion of China Proper by his successors in early 17th century. Finally, his successors were able to overrun entire China and established the Manchu dynasty in 1644. Thereafter they made Manchuria a crown reserve territory and Chinese immigration, which had been in progress for centuries, was forbidden. But in practice, Chinese immigrants were able to move into Manchuria in increasing numbers during the Manchu dynasty which eventually allowed this movement in the later 18th century.

For a considerable time prior to 1891, when the first sod was turned for the construction of the Trans-Siberian Railway, the Russian government was anxious to secure control of Manchuria. Japan, meanwhile, was casting covetous eyes upon the mainland of Asia, and especially upon the northeast. When China was defeated in the first Sino-Japanese War in 1894–1895, Japan secured from China through the Treaty of Shimonoseki (April 17, 1895), among other things, the cession of Formosa (Taiwan), Pesca-

dores Islands, and the Liaotung Peninsula on which tip lie Dairen and Port Arthur in southern Manchuria. Six days after the signing of the treaty, the Japanese government received notes from the governments of Russia, Germany, and France "recommending" that Japan restore to China this peninsula. Japan, weak though victorious, accepted this "recommendation" and surrendered her claim to the peninsula in return for an increased indemnity from China.

Immediately after this, Russia began to push her way into Manchuria. In 1896, a Russian financial interest secured the privilege of building the Chinese Eastern Railway, which is a spur of the Trans-Siberian Railway and a shortcut to Vladivostok. Another line extended from Harbin to Port Arthur (Ryojun). In 1898, Russia demanded and obtained a lease of the Liaotung Peninsula from China for 25 years, and the right to develop Port Arthur as a naval base.

The Russians occupied the northeast during the Boxer Rebellion of 1900, although no actual fighting took place in that area. After the conclusion of the treaty of 1901, the Russians refused to withdraw their troops from the northeast until they secured further concessions from China which gave them a "railway zone" along the railways and other special economic interests in the region. In the next few years, through arrangements with other powers and secret treaties concluded with China, Russia established her sphere of influence in the northeast.

The Russo-Japanese War in 1904–1905, which was fought on Chinese territory and without any respect for China's territory rights as a neutral, saw Russia's defeat. The resulting Treaty of Portsmouth (Sept. 5, 1905) gave Japan, among other things, the "right of succession" to the Changchun-Port Arthur section, later known as the South Manchurian Railway, of the Chinese Eastern Railway, and the lease of the Liaotung Peninsula. The treaty also provided that the warring parties agreed to withdraw their troops from Manchuria with the exception of the Liaotung Peninsula, but reserved to themselves the right to maintain railway guards along their respective railway lines. (See PORTSMOUTH, TREATY OF.) The provisions of the Treaty of Portsmouth concerning China were substantiated by the Sino-Japanese treaty of Dec. 22, 1905.

In a series of secret treaties between Japan and Russia, the two countries divided Manchuria into two spheres of influence, under Russia in the north and Japan in the south. The Twenty-one Demands made by Japan in 1915 further consolidated her position and economic, political, and military privileges in Manchuria. Her special position in Manchuria was recognized by the United States in the Lansing-Ishii agreement in 1917. The Nine-Power Treaty of 1922 upheld the Open Door policy toward China but left Japan in possession of her previous gains in Manchuria. To Japan, Manchuria was in actuality her protectorate. Her support of the late Marshal Chang Tso-lin in defiance of the Chinese government and her "warning" to Chang Hsueh-liang against his full adherence to the Chinese National government in 1928 clearly indicated Japan's stand. Chang, however, ignored the Japanese warning and announced his allegiance to the National government on Dec. 31, 1928. After years of quasi independence, the northeast again became, *de facto* as well as *de jure*, an integral part of the Chinese Republic.

In 1924, the Soviet government renounced all rights and privileges which the czarist regime had acquired by unequal treaties in Manchuria and other parts of China.

Under the overall supervision of the National government, Chang Hsueh-liang further intensified the reconstruction program launched by his father, Chang Tso-lin, to break the Japanese hold on Manchuria. This prompted the Japanese to take direct action. On Sept. 18, 1931, Japan engineered the so-called Mukden Incident and within a few days occupied all of Manchuria. The puppet state of Manchukuo was established under Japanese direction on March 9, 1932, with Pu-yi (Hsüan T'ung) as the chief executive. He was later proclaimed the emperor of Manchukuo on March 1, 1934.

China appealed to the League of Nations for the peaceful settlement of the Mukden Incident. The League, after prolonged deliberations, sent a commission of inquiry to the northeast under the earl of Lytton. The commission's report, known as the Lytton report (published Oct. 2, 1932), said that "the military operations of the Japanese during this night (September 18) cannot be regarded as measures of legitimate self-defense." And in regard to the establishment of the puppet state in the northeast, the report said the two factors without which the new state could not have been formed "were the presence of Japanese troops and the activities of Japanese officials, both civil and military. . . . For this reason the present regime cannot be considered to have been called into existence by a genuine and spontaneous independence movement."

Meanwhile, Chinese guerillas resisted with what they had against Japan's attempt to impose Japanese rule over Manchuria.

The first few years of the Manchukuo state saw large-scale "pacification" campaigns launched by the Japanese Army to suppress Chinese resistance. Beginning from 1936, Japan launched a five-year plan in Manchuria to make the territory the arsenal and granary of the Japanese Empire through the exploitation of the rich resources and cheap labor in the northeast. From the beginning, the Manchukuo economy was a planned economy. The Manchukuo five-year plan, revised in 1938, laid special emphasis on strategic industries and supplemented the Japanese four-year plan. Most of the Manchukuo products were raw material or half-finished products to supply Japanese factories. Japan also dominated all economic life of the northeast. Early in 1934, by the Oil Monopoly law, all foreign companies, including Standard Vacuum Oil and Texas Oil of the United States, were forced out of business. By the Emergency Foreign Trade Control law of 1936, the Foreign Trade Control law of 1937, and other trade measures, the importation and exportation of practically all commodities became a matter of exclusive privilege of Japanese interests. Two Japanese-owned companies controlled all the industrial enterprises. The South Manchurian Railway Company monopolized the railways, highways, harbors, bus and steamship services, docks and warehouses, and coal and oil at Fushun. The Manchurian Industrial Development Company controlled the coal, iron and steel, light metals, automobile and airplane industries. The Agricultural Produce Corporation controlled all crops from planting to consumption in Manchuria.

To complete the Japanese control over Manchuria, the USSR sold her share in the Chinese Eastern Railway in Manchuria to Manchukuo in 1935.

The recovery of the northeast was one of China's war aims. The Cairo declaration in 1943 stated, among other things, the return of Manchuria to China after the war. (See PACTS AND CONFERENCES.) The letter and spirit of this declaration, however, was violated by one of the Yalta secret agreements in which, without China's knowledge and consent, the United States and Great Britain agreed that the USSR, in return for going to war against Japan, would receive a number of rights in Manchuria. The United States was to use her influence to make the Chinese accept the Yalta *fait accompli.* Accordingly, the Chinese government signed, on Aug. 14, 1945 in Moscow, with the Soviet government a treaty which provides, among other things, the independence of Outer Mongolia; the joint ownership, for 30 years, of the Chinese Changchun Railway which comprises the former Chinese Eastern Railway and the South Manchurian Railway; the establishment of Port Arthur as a joint Chinese-Soviet naval base under Soviet garrison; and the establishment of Dairen as a free port with a Soviet port master but a Chinese mayor.

The USSR declared war against Japan on Aug. 8 (effective Aug. 9), 1945, six days before Japanese surrender. Soviet troops occupied the entire Manchuria. After repeated negotiations, they evacuated the northeast, with the exception of Port Arthur and Dairen, in April 1946, but not until they had stripped the northeast of its industrial and communcation equipment and materials. Meanwhile, the Soviet evacuation coincided with the arrival in Manchuria of Chinese Communist troops who were also able to find exactly where the Japanese arms, which were surrendered to the Soviet troops, were stocked.

Chinese Communist troops took Changchun, capital of the northeast, on April 17 and Harbin on April 25, 1946. They also took over northern, eastern, and southern Manchuria following the evacuating Soviet troops. Government troops recaptured Changchun on May 23. In cities evacuated by the Chinese Communists, whatever industrial equipment had been left by the Soviet troops was destroyed by the Communists. Fighting continued in the northeast between nationalist and Communist troops into 1947.

Since the Chinese recovery of the northeast, the territory has been under the administration of provincial governments which are under the overall supervision of the President's Headquarters in the northeast. A Northeast Economic Council directs all economic activities in the territory. The Chinese Communists have their own system of administration in areas under their occupation.

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MANCHUS, a Tatar people of Tungusic origin, descendants of the Jurchin or Niu-chi, who overran northern China in the 12th century and established the Kin or Golden dynasty, later overturned by the Mongols, and of the tribes who followed Nurhachu (1559–1626) and his successors in his conquest of Liao-Tung and Liao-si, in the first half of the 17th century, who aided the Chinese general, Wu-san-kwei, in suppressing the rebel Li-tse-Ching, and who retained the country for themselves, establishing in 1643 the Ta-Tsing, or "Great Pure" dynasty which ruled China down to the establishment of the republic in 1912. They form a very small minority of the population of China to-day; they are a quiet, inoffensive people noted for their politeness. They now speak the Chinese language, their own tongue being wellnigh extinct. Physically they are rather tall, with mesocephalic head. The famed Chinese queue, but recently abolished, was introduced by the Manchus and was at first an insignia of the subjection of the Chinese to the Manchus. Buddhism in the Chinese form of to-day also dates from the Manchu conquest. For the history of their conquest and rule in China see CHINA, *History.* Consult Giles, *China and the Manchus* (Cambridge 1912); Kent, P. H. B., *The Passing of the Manchus* (London 1912); Ross, *Manchus; or The Reigning Dynasty of China, their Rule and Progress* (London 1891).

MANCINI, män-chē'nē, a name borne by the five nieces of Cardinal Mazarin. They were born in Rome and summoned by their uncle to Paris, where they played a conspicuous part in the court of Louis XIV during the early years of his reign. They were: (1) LAURE (b. 1636; d. 1657), the amiable and pious companion of Louis XIV's boyhood. She became the mother of Louis, Duke of Vendôme, one of the greatest generals of the Grand Monarque. (2) MARIE (b. 1639; d. about 1715), for whom the king conceived a violent affection, but in 1661 Mazarin gave her in marriage to Prince Colonna, constable of Naples. (3) OLYMPE (b. 1640; d. 1708), a witty and attractive woman, who became wife of Eugène de Savoie-Carignar, Count of Soissons, and mistress of the queen's household. (4) HORTENSE (b. 1646; d. 1699), the most attractive and beautiful of the Mancini. In 1666 she left her husband, the Duke de Mazarin, and became one of the chief beauties of King Charles II's court. The king pensioned her, and after the Revolution of 1688 she lived in retirement in Chelsea. (5) MARIE ANNE (b. 1649; d. 1714) was the wittiest and most vivacious of the sisters. In 1662 she married the Duke de Bouillon, and her salon became the center of social and intellectual life at Paris. She patronized La Fontaine, Corneille and Molière. She died in Clichy. Consult Chatelauze, *Louis XIV et Marie Mancini* (Paris 1880); Williams, A. N., *Five Fair Sisters* (New York 1906).

MANCO INCA I, ĭng'ka, Peruvian ruler: b. about 1500; d. 1544. He was the second son of the inca Huayna Capac (q.v.), who died about 10 years after the first arrival of the Spaniards, dividing his kingdom between his legitimate successor, Huascar, and a younger son, Atahualpa. The latter, afer having made war upon Huascar, and put him to death, was himself captured and executed in 1533 by Pi-

zarro. Shortly afterward Manco appeared in the Spanish camp to announce his pretensions to the throne and claim Pizarro's protection. The conqueror received him cordially, and made it his first care after the taking of Cuzco to place him on the throne. After in vain petitioning for power to exercise the sovereignty, he withdrew secretly from Cuzco, but was brought back and imprisoned. Again escaping, he roused the whole nation to arms against the invaders, and appeared before Cuzco (February 1536) with a countless host of Indians who covered the surrounding hills. He destroyed a large part of the city by fire and reduced the Spaniards to extremities; but after the siege had lasted over five months, had to withdraw on account of the scarcity of food. Defeated subsequently by Almagro and forsaken by most of his warriors, he fled to the Andes, and for several years maintained his independence, sallying forth as occasion offered at the head of a few brave followers, always eluding pursuit in the wilds of the Cordilleras, and in the event of civil war among the foreigners throwing his weight into the weaker scale in order to prolong their contests. He was killed by a party of Spaniards belonging to the younger Almagro's faction, who on the defeat of their leader had taken refuge in the Peruvian camp.

MANDÆANS, măn'dē'ąnz, an ancient Oriental religious sect of mixed Christian, Jewish and heathen elements. They are still found on the east shore of the Tigris, working as jewelers, blacksmiths, carpenters, etc. Their religion is a kind of Gnosticism, retaining various Jewish and Parsee elements. They worship a number of personifications, particularly of the attributes or names of God. They publicly call themselves Sabians (*Subbâ,* "baptists"), thus professing to identify themselves with the Sabæans tolerated in the Koran. They were formerly called Christians of Saint John the Baptist from their habit of baptism or ablution. They have five important sacred books: 'Sidrâ rabbâ' ("the great book"), called also "ginza," "treasure"; 'Sidrâ de Yahyâ' ('Book of John'); the 'Qolasta,' a collection of hymns; 'Diwân,' a ritual; and 'Asfar Malwâsê,' a manual of astrology. The Mandæans had three degrees in the priesthood, with a supreme official (Rish ammâ) as the source of both civil and ecclesiastical authority. The priests officiate in white robes, barefooted, and women may be admitted to their order.

MANDAITES. See NAZARENES.

MANDALAY, măn'dą-lā, chief town of Upper Burma, situated on the Irrawaddy River about 360 miles by air line north of Rangoon. It was founded by King Mindōn in 1856–57, and was the capital of independent Burma until the British captured it in 1885. After the treaty of 1886, by which the King lost his throne, it was the capital for a number of years of Upper Burma. The area within the old city walls is called Fort Dufferin, though no longer used as a fort. In the center of this area stood the Palace of the Kings, a group of wooden structures, many of them highly carved and adorned with gilt. They rested on a brick platform 900 feet long by 500 feet wide, and 6 feet high. There were in the city many pagodas and monastic buildings, perhaps the most famous being the Aracan Pagoda, containing a brazen image of Buddha 12 feet high, and the Kuthodaw Pagoda, 110 feet high. Kipling immortalized the city in his poem 'Mandalay,' which was set to music by Oley Speaks. Following the outbreak of the war in the Pacific in 1941, the Japanese, in the spring of 1942, invaded and overran Burma, capturing Mandalay on 1 May. At that time they described it as a «smouldering mass of ruins.» When the Japanese entered the city it had been burning since 4 April, and, according to dispatches by American newspaper correspondents, about the only thing then left standing were the walls of the Palace of the Kings. The city had been defended by British and Chinese troops, but the overwhelming superiority of the Japanese forces compelled them to withdraw after stubborn resistance. Mandalay's population is mixed but the greater portion (over 77 per cent) are Burmese Buddhists. Pop. (1931) 149,932.

MANDAMUS, *in law,* a writ issued by a superior court and directed to some inferior tribunal, or to some corporation or person exercising public authority, commanding the performance of some specified duty. In general practice in the United States a mandamus issues where a party has a right to have a thing done, and has no other remedy, and in some cases where he has another but a tedious and inadequate one; and must be applied for without delay. It is either in the alternative, ordering the court, corporation or party to which or whom it is directed to do the thing specified, or to appear and show cause why it should not be done; or absolute, commanding the thing specified to be done without any condition or alternative. The writ is usually first issued in the alternative, and in case of there being no appearance, or no sufficient cause to the contrary being shown an absolute mandamus is issued. The cases enumerated for the issuing of this writ are — to compel the party applying to be restored to some office or franchise of a public nature, whether temporal or spiritual; for the production, inspection or delivery of public books and papers; to oblige bodies corporate to affix their common seal; or to compel the holding of a court. It may be directed to an inferior court, ordering it to proceed in the hearing of a cause, or to enter up a judgment. Consult Bailey, W. F., 'Treatise on the Law of Habeas Corpus and Special Remedies' (2 vols., Chicago 1913); Spelling, T. C., 'Treatise on Injunctions and Other Extraordinary Remedies' (2d ed., Boston 1901) and Wood, H. G., 'Treatise on the Legal Remedies of Mandamus and Prohibition' (3d ed., Albany 1896).

MANDAN, a tribe of American Indians of the Siouan family, the remnants of which number less than 300, are settled upon the Fort Berthold Reservation in North Dakota. In remote times they are supposed to have migrated from the lower Missouri but had occupied the North Dakota region for centuries before they were first visited by Verendrye in 1738. In 1804 they were found by the Lewis and Clark Expedition (q.v.) occupying two villages at the mouth of the Knife River. In 1837 when a smallpox epidemic destroyed thousands of American Indians the Mandans were still further reduced in numbers from 1,700 to less than 400. In

1846 the remaining families of the tribe took up their residence at the Fort Berthold Reservation. The Mandans were not a nomadic people, but resembled the Pawnees, living in log houses with village administration and local government. They were an agricultural people, raising corn, tobacco and other crops.

MANDAN, N. Dak., city and Morton County seat; alt. 1,642 feet; on the navigable Missouri River opposite Bismarck; it is served by the Northern Pacific Railroad. The city is situated in a wheat growing and stock raising district; it is a Northern Pacific division center, and has railroad car shops. There are flour mills and creameries, and in the vicinity is the U.S. Northern Great Plains Experimental Station. It has had commission government since 1907. Pop. (1940) 6,685; (1950) 7,298.

MANDARIN, măn'dȧ-rĭn, term applied, in the empire of China, to government officials, either civil or military. The nine grades of mandarin were distinguished by the color of the button on the hat of office. The word mandarin is derived ultimately from the Sanskrit *mantrin,* counselor; the Chinese equivalent is *kuan.*

MANDARIN DUCK, a small Chinese duck (*Aix galericuta*) closely related to the American wood-duck (*A. sponsa*), and dressed in an exceedingly beautiful plumage of metallic green, purple, chestnut, white, and black. It has long been domesticated by the Chinese, and as it is said to pair for life, is held up by them as a model of marital virtues; it has been introduced upon park waters and ornamental grounds in America and Europe.

MANDAT, măn-dä, the name given to a kind of paper money in the French Revolution. After the assignats (q.v.), which had been kept in circulation by the violence of Maximilian F. M. I. de Robespierre, had lost all credit, a new money was created—the mandats—founded, like the assignats, on the credit derived from the confiscated property, but with the essential difference that specific pieces of property, enumerated in a table, were pledged for the redemption of the bills; the assignats furnished only a general claim. These mandats were issued in accordance with the law of 1796. A forced circulation was given to them, by which the government was enabled to defray the expenses of the approaching campaign.

MANDATE, *in law,* a term derived from the Roman civil law. It may be defined as a bailment (delivery) of a chattel or chattels to a person who is to do something with or about the things bailed, entirely without compensation.

MANDATES SYSTEM. This form of government for dependent territories taken from Turkey and Germany in World War I vested sovereignty in the League of Nations, which entrusted one or other of the Allied Powers with their administration. The principles of the system were laid down in Article 22 of the Covenant of the League. The first is that, to the territories concerned,

"which are inhabited by peoples not yet able to stand by themselves in the strenuous conditions of the modern world, there should be applied the principle that the well-being and development of such peoples form a sacred trust of civilization."

The next is that

"the tutelage of such peoples should be entrusted to advanced nations . . . and that this tutelage should be exercised by them as mandatories on behalf of the League."

The mandatory was required to render an annual report to the League on the territories committed to its charge; the League defined the degree of control to be exercised; and a Permanent Mandates Commission was created to advise the Council of the League on all matters relating to the observance of mandates. The mandates were divided into three groups, "A," "B" and "C," appropriate to the stage of development of the people and the geographical and economic circumstances of each of the territories. "A" mandates were applied to certain communities formerly belonging to the Turkish Empire, namely, Palestine, Transjordan, Iraq, Syria, and Lebanon; the first three were entrusted to Great Britain, and the remaining two to France. These communities were considered to have reached a stage of development where their independence could be provisionally recognized, subject to administrative advice and assistance from the mandatory until they were able to stand alone. "B" mandates were applied to ex-German colonies in Central Africa not ready for independence, namely Cameroons (divided into British and French spheres), Togoland (likewise partitioned), Tanganyika (a British mandate), and Ruanda-Urundi (a Belgian mandate). In the "B" mandates the mandatory Power was responsible for the administration under certain specified conditions designed to prevent abuses and to ensure that the welfare of the inhabitants should be the first consideration. The mandatory was obliged to secure equal opportunities for the trade and commerce of all members of the League of Nations. "C" mandates were applied to territories which, owing to their particular circumstances, could best be administered as integral portions of the mandatory's territory. The laws of the mandatory Power might be applied to them, with such local modifications as circumstances might require, and subject to safeguards in the interests of the natives. The "C" mandates comprised South West Africa (assigned to the Union of South Africa), New Guinea (to Australia), Western Samoa (New Zealand), Nauru (British Empire—administered by Australia), and the Caroline, Marianas, and Marshall Islands (assigned to Japan). The mandatories were forbidden to establish defense bases in the mandates and to organize native military forces for use outside their own territories, although the latter proviso was waived in respect of the French spheres of the Cameroons and Togoland. By treaties concluded with the mandatory Powers, the United States secured the same rights as League members in respect of all mandates except New Guinea, Western Samoa, Nauru, and South West Africa.

During 1920–1922 the terms of the mandates were approved by the League of Nations with respect to all territories with the exception of Iraq; the treaty regulating relations between Iraq and Great Britain was approved in 1924. All "A" mandates had terminated by the end of 1948, the countries having obtained the independence which had been envisaged. After World War II the mandates system had automatically suffered the same fate as the League of Nations;

and the United Nations, the successor international organization, assumed responsibility for all "B" and "C" mandates (except South West Africa) under the trusteeship system (q.v). Consult Wright, Q., *Mandates under the League of Nations* (Chicago 1930); League of Nations, *The Mandates System* (Geneva 1945).

MANDERSON, Charles Frederick, American lawyer and politician: b. Philadelphia, 9 Feb. 1837; d. 1911. He received his early education in Philadelphia, removed to Canton, Ohio, in 1856, studied law and was admitted to the bar in 1859. He was city attorney in Canton, 1860–61; at the outbreak of the Civil War he enlisted as a private in the Union army, served in the campaigns in the Middle West and rose through the intermediate grades to the rank of brigadier-general of volunteers. He was severely wounded at the battle of Lovejoy's Station, Ga., and resigned from the army in 1865 on account of his wounds. He resumed his law practice in Stark County, Ohio, but removed to Omaha, Neb., in 1869. Here he soon became prominent in public affairs, was city attorney for more than six years and a member of the Nebraska Constitutional Conventions in 1871 and 1874. In 1883 he was elected to the United States Senate, serving until 1895, and being chosen speaker pro tem in two Congresses, 1889–93. After 1895 he was solicitor for the Burlington system of railroads, west of the Mississippi; and was president of the American Bar Association in 1900–01. He published 'The Twin Seven Shooters' (1902), and several addresses on political and legal subjects.

MANDEVILLE, Bernard de, English writer: b. Dort, Holland, c. 1670; d. London, 21 Jan. 1732 or –33. He was educated at the Erasmus School, Rotterdam, and at the University of Leyden, where, in 1691, he received the degree of doctor of medicine. The date and occasion of his removal to England are unknown; but he appears soon to have settled in London where with but small success he practised his profession. He lived obscurely, with distillers and Dutch merchants as his ordinary acquaintances. Franklin, in his 'Autobiography,' records that in 1725, at "the Horns, a pale-ale house in —— Lane, Cheapside," he was introduced "to Dr. Mandeville, author of the 'Fable of the Bees,' who had a club there, of which he was the soul, being a most facetious, entertaining companion." Franklin at this time was merely a struggling young printer, unknown to fame: Mandeville gained no honor from his acquaintance. Mandeville had, however, a few acquaintances outside his tavern circle. Of these, the most important was Lord Macclesfield, the chief justice, at whose house Mandeville also met Addison. Of their world, however, Mandeville was never a real part, socially or intellectually.

Mandeville wrote much both in verse and prose; but his chief claim to notoriety was the authorship of the 'Fable of the Bees.' This, in its earliest form, consisted solely of a rude poem, in octo-syllabic couplets far from Miltonian, entitled, 'The Grumbling Hive, or Knaves turned honest.' In it, he related how, so long as they remained unscrupulous, the bees increased in numbers and prosperity, and how by their moral reformation the bees gained only their material ruin. He concluded that

> "To enjoy the world's conveniences,
> Be famed in war, yet live in ease,
> Without great vices is a vain
> Utopia, seated in the brain.
> Fraud, Luxury, and Pride must live,
> While we the benefits receive."

Of this piece, the earliest known edition is that of 1705. Mandeville's assertion that an earlier edition was printed is unsupported by evidence. In 1714, Mandeville reprinted the poem with prose additions, the whole bearing the new title 'The Fable of the Bees, or Private Vices Public Benefits.' This he further enlarged in the edition of 1723.

At this point, the grand jury of Middlesex interfered, and, in July 1723, presented the 'Fable' as a nuisance. Immediately the book became a subject of general attack. Richard Fiddes and John Dennis in 1724, William Law, Francis Hutcheson in 1725–27, Archibald Campbell in 1728 and Bishop Berkeley in 1732, all assailed Mandeville in turn. By Law and by Berkeley, Mandeville was intellectually outclassed; but he held up his side of the argument, adding to his 'Fable,' in successive editions, tract after tract. That the 'Fable' should be thus attacked is not surprising. Its fundamental thesis, that private vices are public benefits, was as subversive of morality as its illustrative material was foul and its style plausible and forceful. Whether Mandeville was sincere or ironical in his argument is in dispute. That he thoroughly enjoyed his own foulness cannot be doubted. But at least he accomplished one good thing; he pricked the sham morality of Shaftesbury. Other works by Mandeville are 'Esop Dressed, or a Collection of Fables Writ in Familiar Verses' (1704); 'Free Thoughts on Religion' (1720); 'Enquiry into the Causes of the Frequent Executions at Tyburn' (1725). Consult Robertson, J. M., 'Pioneer Humanists' (London 1907).

MANDEVILLE, Sir John. The alleged author of a mediæval book of travels which enjoyed great popularity. A large number of manuscripts are in existence, the most important of which are in Latin, French and English. The earliest version is in French, dating from the latter part of the 14th century, and upon this all the others appear to be more or less directly based. There is no English manuscript antedating the 15th century. The statements in the prologue regarding the translation are to be distrusted, and the autobiographical matter is contradictory. An exaggerated importance has sometimes been attached to the compiler of the work as the father of English prose, because of the statement in one of the English manuscripts that he had translated it out of French into English in order that every man of his nation might understand it. Errors in the translation prove that the man who wrote the French version and the man who made the English rendering cannot have been one and the same person.

The travels consist, in the main, of an account of the Holy Land and the routes thither, followed by a description of various parts of Asia. The narrative is almost wholly spurious, being made up of paraphrases and borrowing from various sources — travel-books, bestiaries, works on Eastern manners, legends, romances,

tic. The first half of the book is chiefly dependent upon the travels of William of Boldensele, a German who flourished in the 14th century, and the second part upon the work of Friar Odoric of Pordenone (about 1330). The only portions which may reflect personal experience are those dealing with Jerusalem and Egypt, which it is not impossible that the compiler may have visited. The story abounds in all kinds of adventures and marvels, related with an air of sober truth. There are accounts of monsters and curiously misshapen men, of regions haunted by devils, of the Fountain of Youth, of the Phœnix, of the realm of Prester John, etc. The narrator must have been a man of wide reading, and he certainly displays considerable skill in the selection and arrangement of his materials.

In the prologue the author states that his name is "John Maundeville, knyght," b. at Saint Albans, England, and that he "passed the see," in 1322 (1332), whereupon he traveled through various countries. The epilogue asserts that the gout forced him to return, and that he occupied his leisure in writing his experiences. It has been found impossible to identify him with any historical John Mandeville.

The tomb of the reputed author of the 'Travels' was long shown at Liège, with an inscription to "Joannes de Mandeville, alias dictus ad barbam." Important in this connection is the testimony of one Jean d'Outremeuse, in a 'Myreur des Histors,' now lost, to the effect that there died in Liège, in 1372, a physician named Jean de Bourgogne, "dit à la barbe," who declared himself on his death-bed to be "Jean de Mandeville, chevalier, comte de Montfort en Angleterre," his real name having been concealed because of a crime committed in England. The veracity of D'Outremeuse is open to suspicion, but it has been thought that this Jean de Bourgogne may have been one John de Burgoyne, who was forced to leave England in 1322, and that he compiled the 'Travels,' borrowing the name of one John de Mandeville, who was concerned in the murder of Gaveston. At all events, Jean de Bourgogne was known in mediæval times as the author of a treatise on the plague, which is bound up in one instance with a version of the 'Travels.' It seems probable, then, that this man, whatever his past history may have been, was the real author of the latter work, and that he preferred to conceal his identity under the pseudonym of Mandeville.

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MANDINGOES, măn-dĕng'gōz, a linguistic group of West Africa, remarkable for their intelligence. The original country of this people was the north slope of the high table-land of Senegambia, between the head-waters of the Niger and Senegal. Their language is more widely diffused, and more employed by translators than that of any of the other languages of West Africa. They formed at one time a single large empire, but are now widely scattered. The hair is woolly but other facial negro characteristics are absent. From the Arabs they have derived a high degree of culture and are far removed from savagery. Their religion is Mohammedan. Consult Johnston, Sir H. H., 'Liberia' (2 vols., London 1906).

MANDIOCA, the staple food of Brazil. See CASSAVA.

MANDOLIN, a musical instrument, belonging to the lute species, played with a quill or plectrum as well as with the finger. It is of Italian origin, but latterly has become common in all civilized countries. In the usual form it has four pairs of metallic strings and a finger-board or neck with numerous frets across it. Operatic composers have occasionally employed the mandolin to obtain characteristic effects. The commonest form of this instrument is the Neapolitan with a range $G — E^3$. Other varieties are the Milanese with six strings, the Spanish with six double strings and the Turkish with seven double strings. There are four double strings in the Neapolitan.

MANDRAGORA. See MANDRAKE.

MANDRAKE, a genus of perennial herbs (*Mandragora*) of the order *Solanaceæ*. The species, of which only three are described, are almost stemless, thick-rooted and large-leaved, with rather large whitish or bluish bell-shaped flowers, followed by globular berries. The plant is chiefly interesting from the numerous allusions to it in old writings, the superstitions relating to it being mainly in connection with its fetid, reputedly poisonous root, which, from a fanciful resemblance of its roots to the human figure, was considered an aphrodisiac.

The May-apple (*Podophyllum peltatum*), of the order *Berberidaceæ*, is often called "mandrake" in the United States, where it is common east of the Mississippi River. It is a perennial herb which sends up umbrella-shaped leaves, usually two at the summit of a stem and bearing one or two creamy, fragrant flowers in the axil. A mawkish yellow fruit about the size of a large cherry develops during early summer. The fruits "are relished by pigs and boys." The creeping rootstocks have been used medicinally.

MANDRILL, the largest and one of the most repulsive and savage of the African baboons. (See BABOON). Consult DRILL.

MANED WOLF, a long-legged, slender-bodied, long-nosed, brightly reddish wolf (*Canis jubatus*) of eastern South America, which may be regarded as one of the "aguaras" or fox-dogs (q.v.). It is a denizen of forests, not being known south of the northern edge of the Argentine pampas; and goes about alone at night and secretly, seeking its food, which consists mainly of small rodents, frogs, insects and the like, and even some fruit. It will sometimes attack sheep, but is remarkably timid, and no one fears it.

MANES, mā'nēz, among the Romans, the souls of the dead. The good spirits were also called *lares*, and the evil *larvæ*. The manes were reckoned among the infernal gods; but a belief was prevalent that they sometimes appeared upon the earth in the form of ghosts, particularly on the 30th of August, 4th of October and 7th of November; whence the Romans considered these unlucky days.

MANES WORSHIP, from Roman *Manes* (q.v.), a term to denote the worship of the dead, whether of an ancestor of the particular worshiper or of some deified hero of his race. Herbert Spencer thinks it developed from the belief in an other self, which survived after death, and the manes worship was the outcome of a desire and endeavor to propitiate the ghost. Sir John Lubbock says of manes worship that it "is natural development of the dread of ghosts."

MANET, mą'nā', **Edouard,** French artist: b. Paris, 23 Jan. 1832; d. Paris, 30 April 1883. Originator of the Impressionist movement, which finds its greatest expression in Claude Monet, Manet worked in an original manner before Impressionism was thought of. He rendered great service to the movement, not solely by his works, but by taking upon himself the criticisms directed upon the whole Impressionist School. Dégas, Monet and Renoir, bold in art but timid of nature, resigned themselves to the misunderstanding and hostility of the public; but the more courageous Manet defended the movement with a strong controversial pen. He fought valiantly for himself and all the artists associated with his name.

Manet studied with Couture about 1850 and traveled throughout Europe, growing enthusiastic over Rembrandt, Tintoretto, Velasquez and Goya, painted some fine works such as the 'Buveur d'absinthe' and the 'Vieux musicien' and in 1861 exhibited at the Paris Salon portraits of his parents and the 'Guiterero.' His 'Déjeuner sur l'herbe' attracted much attention. 'Olympia' (in the Luxembourg) attracted more hostile criticism. It was a technical experiment significant for the period of its composition. 'Angels at the Tomb of Christ,' 'Lola de Valence,' 'Toréador tué,' 'Acteur tragique,' 'Jésus insulté,' the 'Gitanos,' 'Rouvière' and portrait of 'Éva Gonzalès' appeared before 1870. About this time Manet cast his lot with the Impressionists. The 'Fight of the *Kearsarge* and the *Alabama*' announced this transformation of his style and was followed by 'Musique aux Tuileries,' the 'Bal de l'Opéra,' the 'Bon Bock' and the 'Liseur.' 'Argenteuil' (1875) shows his atmospheric researches. Next came a portrait of 'Desboutin' and the 'Linge' (1876), a portrait of 'Faure' as "Hamlet" (1877); 'La Serre,' a symphony in blue and white in which George Moore, the author, appears in boating costume (1878); the scene in the 'Père Lathuile Restaurant' (1880); 'Portrait of Rochefort' (1881); and the 'Bar des Folies Bergère' (1882).

"This work of Manet," writes a French critic, "so much discussed and produced under such tormenting conditions, owes its importance beyond all else to its power and frankness." Ten years of developing the first manner, tragically limited by the war of 1870; 13 years of developing the second evolution, parallel with the efforts of the Impressionists. The period from 1860 to 1870 is logically connected with Hals and Goya; from 1870 to 1883 (when he died) the artist's work is complicated by the study of light. He had all the pictorial gifts which make the glory of the masters — full, true, broad composition; coloring of great power; blacks and greys, which cannot be found often elsewhere than in Velasquez and Goya; and a profound knowledge of values. He tried his hand at everything: portraits, landscapes, seascapes, scenes of modern life, still life and under each in turn served his ardent creative brush. His pictures will always remain documents of the greatest importance on the society, the manners and customs of the Second Empire. A beautiful painter is what he was before everything else. It is almost inconceivable that the juries of the Salons failed to understand him. They waxed indignant over his subjects which offer only a restricted interest and they did not see the altogether classic quality of this technique without self-glorification, without tricks, without bitumen; of this vibrating color; of this rich paint; of this passionate design so suitable for expressing movement and gestures true to life; of this simple composition where the whole picture is based upon two or three values with the straightforwardness one admires in Rubens, Jordaens and Hals. Manet occupies an important place in the French School. He is its most original painter of the second half of the 19th century, the one who has really created a great movement. His work, the fecundity of which is astonishing, is unequalled.

MANETHO, or **MANETHO SEBENNYTA,** Egyptian historian: native of Sebennytus, in the Delta, and of the priestly order. He is believed to have lived in the reigns of Ptolemy I and II and to have written in the reign of Ptolemy I (323–285 B.C.), or of Ptolemy II (285–247 B.C.). According to some he was priest of Diospolis or Heliopolis; others contend that he was high-priest of Alexandria. His name has been interpreted variously as "Beloved of Thoth" or "Beloved of Neith." Scarcely anything is known of the history of Manetho himself, and he is renowned chiefly for his Egyptian annals. On the occasion of Ptolemy I dreaming of the god Serapis at Sinope, Manetho was consulted by the monarch, and in conjunction with Timotheus of Athens, interpreter of the Eleusinian mysteries, declared the statue of Serapis, brought by orders of the king from Sinope, to be that of the god Serapis or Pluto; whereupon the god had a temple and his worship inaugurated at Alexandria. The fame of Manetho was much increased by his writing in the Greek language, and so being enabled to communicate from Egyptian sources a more correct knowledge of the history of his native country than the Greek writers who had preceded him. Of this history, only extracts given by Josephus in his work against Apion, and an epitome by Eusebius and other ecclesiastical writers, remain. It appears to have been written in a compendious annalistic style of narrative, resembling the accounts given by Herodotus. The work of Manetho was in three books, the first began with the mythic reigns of gods and kings and ended with the 11th dynasty of mortals; the second continued the history from the 12th to the 19th dynasty; the third from the 20th to the 30th dynasty, when Egypt fell under the dominion of Alexander the Great. The reigns of the gods are given as amounting to 24,900 years, and the epoch of Menes, founder of the monarchy, commenced 3,555 years before Alexander (332 B.C.). The difficulties attending the

conciliation of this chronology with the nchronestic history of the Hebrews, Greeks d other nations, have given rise to numerous eculations and chronological systems since the vival of learning. The accession of newer d better information from the original urces of Egyptian monuments, papyri and her documents has considerably enhanced the neral value of the history of Manetho, which, ior to their discovery, had fallen into dis-edit. But the restoration of the history of anetho, notwithstanding all these resources d the positive epoch of the monarchy, are still be sought, though certain dynasties, in the cond and third books of his works, can be conciled with monumental evidence. Besides e true work of Manetho above cited, another ork, 'Sothis,' or the 'Dogstar' (in allusion to e cycle of heliacal rising of that star of 1461 ars) dedicated to Sebastos or Augustus, the le of the Roman emperors, has been handed wn; but there is considerable support for e opinion that it is spurious, and was added the epitomizers; and another work, called e 'Old Chronicle,' in which the history was ranged according to cycles, was compiled by em. Besides the history, Manetho wrote Ōn Physikōn Epitome,' treating on the origin gods and the world and the laws of morality; d another work on the preparation of the cred *kyphi*, a kind of frankincense. The tronomical work called 'Apotelesmata' is a urious production of the 5th century after rist. Consult Boekh, 'Manetho' (Berlin 45); Bunsen, 'Egypt's Place in Universal His-ry' (London 1848–67); Müller, C., 'His-rici Græci Minores' (2 vols., Leipzig 1870–).

MANEY, George, American soldier and plomat: b. Franklin, Tenn., 24 Aug. 1826; d. ashington, D. C., 9 Feb. 1901. He was edu-ted at the University of Nashville, fought in e Mexican War (1846–47), in 1849 was ad-itted to the bar and in 1849–61 practised law. n 1 May 1861 he became colonel of the First ennessee Infantry, and at Shiloh (6–7 April 62) he commanded first his regiment and ter the 2d brigade of the 2d division. Pro-oted brigadier-general for his conduct at hiloh, he commanded the 3d brigade of heatham's division in Bragg's army at Mur-reesboro (31 Dec.–3 Jan. 1863) and Chicka-auga (19–20 Sept. 1863), subsequently was ppointed to the command of Cheatham's di-sion and participated in the battle of Atlanta 22 July 1864). In 1876 he was nominated by ie Republican party for the governorship of ennessee, but before the election retired from ie contest. He was Minister to Colombia in 81–83, and to Paraguay and Uruguay in 1889–3. In 1884 and 1888 he was a delegate to the epublican National conventions of those years. n 1868–77 he was also president of the Ten-essee and Pacific Railway.

MANFRED, king of Naples and Sicily, 258–66: b. about 1231; d. 26 Feb. 1266. He as a natural son of the Emperor Frederick I, on whose death, in 1250, he became Prince of arentum, and acted as regent in Italy in the bsence of Conrad IV, his half-brother. After ie death of Conrad he was regent of the ingdom during the minority of his nephew onradin. At the instigation of Pope Alex-ander IV a crusade was preached against him, and Manfred was temporarily driven from his kingdom, which, however, he soon recovered, and on the rumored death of Conradin had himself crowned king of Palermo, 10 Aug. 1258. The Pope at once excommunicated him and his followers, but Manfred marched into the papal territory and compelled acknowledgment as master of Tuscany. Through matrimonial alliances for himself and his daughter he sought to increase his power, and his administration of the government was efficient, benign and for a time prosperous. But the excommunication was renewed by Pope Urban IV, who also bestowed his kingdom on Charles I of Anjou, and a war ensued in which Manfred was finally defeated and killed at Benevento. After his death imprisonment and extreme cruelty were visited upon his widow and children.

MANFRED. Lord Byron's powerful and imaginative «witch-drama,» 'Manfred' (1817), was composed under the spell of the awe-inspiring scenery of the Alps, which Byron had visited in 1816 on the tour through Germany and Switzerland recorded in the third canto of 'Childe Harold.' The hero is a sort of combination of Faust and of the Byronic type portrayed in the earlier verse tales, a lofty and defiant spirit, dwelling alone in a dark castle among the higher Alps, haunted by remorse for an act the nature of which we are left to guess. Seeking to interview the spirit of the dead Astarte, the victim of his crime, and to obtain her forgiveness, he calls up the spirits over whom he has control and at length resorts to the abode of the evil principle itself. The ghost is evoked, but returns an ambiguous answer to his question. On the morrow Manfred expires, after resisting a summons to repent from the old abbot of Saint Maurice and defying the demons who have come to possess his soul. Some biographers have seen in the poem a reflection of its author's relation with his half-sister, Aurora Leigh. In any case Byron has made his hero in his own image, infusing into him the characteristic Byronic spirit of proud rebellion and passionate despair. In style the poet aims at and partly succeeds in achieving an imaginative grandeur commensurate with his superhuman theme. 'Manfred' attracted the favorable notice of Goethe, to whose 'Faust,' translated in his presence by Monk Lewis in 1816, Byron is indebted for some of the essential elements in his drama. Consult 'The Works of Lord Byron' (edited by R. H. Prothero); and 'Cambridge History of English Literature' (Vol. XII).

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MANGABEY, măng'gą-bā, one of the odd West African monkeys of the genus *Cercocebus*, nearly related to the guenons and to the macaques. They are distinguished by the whiteness of the eyelids and the backward growth of the hair on the crown of the head. Some of the species are well known, especially the sooty mangabey (*C. fuliginosus*) which always carries its long tail turned over its back. There are three or four species and they make docile pets.

MANGALDAN, män-gäl-dän', Philippines, a pueblo of the province of Pangasinán, Luzon, situated 12 miles northeast of Lingayén, the

provincial capital. It is on the coast road and is the meeting point of several roads extending to towns in the interior, and is on the route of the railroad from Dagupan to Manila. Pop. 15,800.

MANGALORE, măng-ga-lōr', India, a seaport town, on the Malabar coast, capital of the district of South Kanara, Madras presidency. It is clean and well built, surrounded by groves of coconut palms and stands on the edge of a fine salt-water lake or back-water formed at the mouths of two rivers. The port will not admit of vessels drawing more than 10 feet of water, except in spring tides; but there is good anchorage off the mouth of the river, in five to seven fathoms. Tile-making is an important industry. The exports are principally coffee, rice, sandal-wood, cassia and turmeric; the imports sugar, salt and piece-goods. There is a Roman Catholic college, and the Basel Lutheran mission in India has its headquarters here. The Roman Catholics have a bishop and several churches, a considerable number of the natives belonging to this faith. It was captured by the Portuguese in 1596 A.D., and by the English in 1668, finally falling into British possession in 1799. Pop. about 53,000.

MANGANESE, măn-ga-nēs', a metallic element which is widely distributed in nature, though it never occurs except in combination with other elements. The dioxide was believed to be a compound of iron until 1774, when Scheele proved it to be a compound of a previously unknown metal; and in the same year Gahn prepared the element in its metallic form. It was first called "magnesium," from the fact that it was prepared from a compound then called "magnesia nigra" (and now known as manganese peroxide or dioxide); but in 1808 the name was arbitrarily changed to "manganese," by Buttmann.

Manganese may be prepared in the metallic form by reducing any of its oxides with carbon at a white heat, and this is the method followed commercially. For experimental purposes, however, it is easier to obtain it by reducing the chloride with metallic sodium or magnesium. The physical properties of manganese vary somewhat according to the precise way in which the metal is obtained. Its melting-point may be taken as 3500° F., its specific gravity as 7.4 and its specific heat is 0.122. It is a gray, hard, brittle, lustrous metal, susceptible of taking a high polish, and resembling iron in most respects, both physically and chemically. It is not magnetic, however. The pure metal does not appear to be affected by dry air, but moist air oxidizes it, at least superficially. Some authorities describe it as oxidizing readily in common air, and as decomposing water with almost as great a facility as potassium; but it appears probable that the specimens from which these results were obtained contained impurities of some sort. Metallic manganese is not used in the arts, but some of its alloys with iron, aluminum and copper are valuable. It is particularly valuable in steel, its presence in small amount increasing the hardness, tenacity and elasticity of the metal. It is added to the molten steel, in the process of manufacture, in the form of an iron-manganese alloy containing from 10 to 80 per cent of the latter metal, and known in the arts as "spiegeleisen" or "ferromanganese." The "manganese" of commerce is usually not the metal itself, but a mixture of its oxides. Manganese is used in the steel industry almost entirely in the form of two alloys, ferromanganese and spiegeleisen. These are both alloys of iron, manganese and carbon. Ferromanganese may contain as much as 80 per cent of manganese, but averages in this country about 70 per cent. In spiegeleisen the percentage of manganese is much lower; the standard figure upon which the price is based is 20 per cent. The average manganese content is about 18 per cent. Both alloys are high in combined carbon, the amount of which runs up to 7 per cent. The manganese alloys are added to molten steel from the converter, or open hearth furnace, for the purpose of introducing both manganese and carbon. The manganese cleanses the steel by combining with the contained oxygen and, to some extent, with the sulphur, and then carries these impurities into the slag. The carbon is for the purpose of giving the steel the required hardness and strength. By adding larger amounts of the alloys, manganese steel is produced, which is noted for its hardness, tenacity and durability. It is much used in the wearing parts of heavy machinery. In recent years the tendency has been to use more ferromanganese and less spiegeleisen, on account of the much smaller amount of ferromanganese that it is necessary to add to the steel. Spiegeleisen usually has to be melted in a cupola furnace before using, but ferromanganese can be added direct. The latter also introduces less carbon, which sometimes is an advantage. Ferromanganese and spiegeleisen are produced by smelting a mixture of manganese ore and iron ore in an ordinary blast furnace. A high temperature is required and the amount of fuel used is much greater than in iron smelting. A considerable amount of the manganese goes into the slag. The slag from a ferromanganese furnace may contain as much as 10 per cent of manganese. A considerable tonnage of the iron manganese alloys is now produced in the electric furnace.

Chemically, manganese is a dyad. It has the symbol Mn, and an atomic weight of 55 if O=16, or 54.6 if H=1. It forms numerous oxides, the best known of which are (1) the monoxide, MnO, from which the manganous salts may be prepared, and which is itself obtained by heating manganese carbonate out of contact with the air; (2) the sesquioxide, Mn_2O_3, which exists in nature as the mineral braunite, and which is also formed when the monoxide is heated in air to a red heat; (3) the red or mangano-manganic oxide, Mn_3O_4, which corresponds to the magnetic oxide of iron, does not form salts, and exists in nature as the mineral hausmannite; (4) the black oxide, or dioxide, MnO_2, which occurs in nature as pyrolusite and varvacite, and which is largely used in the arts in the preparation of oxygen and chlorine; (5) the trioxide, MnO_3, which is difficult of preparation and very unstable; and (6) the heptoxide, Mn_2O_7, a heavy, dark green liquid, prepared by treating potassium permanganate with cold concentrated sulphuric acid. Several of these oxides also occur in a hydrated form, as minerals. Of the soluble manganous salts, the chief representatives are the sulphate and the chloride. Manganous sulphate, $MnSO_4$, is prepared by treating the dioxide with sulphuric

id, oxygen being liberated at the same time in cordance with the equation $MnO_2+H_2SO_4=$ nSO_4+O+H_2O. It crystallizes with five olecules of water, as a pink-colored salt, and used in dyeing and in medicine. The chloride, nCl_2, crystallizes with four molecules of water, id is obtained as a by-product in the manu- cture of chlorine by the action of hydrochloric id upon manganese dioxide. It is used in cal- o printing. Of the insoluble manganese salts e may specially note the sulphide and the car- onate. The sulphide, MnS, is thrown down as flesh-colored precipitate, when a soluble man- anous salt is precipitated by an alkaline sul- ide. The carbonate, $MnCO_3$, occurs native as ne mineral rhodochrosite, and it may also be btained as a white precipitate by adding an kaline carbonate to a solution of manganeous ılphate or chloride.

Two other important classes of manganese ompounds are known, in which the manganese oes not act as a base, but as an acid-forming lement. These are the manganates and per- anganates, which may be regarded as the salts r "manganic acid," H_2MnO_4, and "perman- anic acid," $HMnO_4$, respectively. The potas- um salts of these acids are by far the ost important ones. Potassium manganate, K_2MnO_4, may be prepared by melting manga- ese dioxide with caustic potash and a little po- assium chlorate, dissolving the bright green ass so obtained in a small quantity of water, nd crystallizing by evaporation in a vacuum. otassium manganate is used in laboratory perations, but it is very unstable, taking up xygen with great readiness, and depositing hy- rated dioxide of manganese. If the green solu- on containing potassium manganate be allowed o stand in the air, it absorbs oxygen, changes s color to a bright purple and deposits hy- rated manganese dioxide. The purple color is ue to the presence of potassium permanganate, $KMnO_4$, which may be obtained, by crystalliza- ion, in the form of purple prismatic crystals. otassium permanganate is a powerful oxidiz- ng agent, and is extensively used in chemistry, n the arts and in medicine, on account of the acility with which it parts with oxygen, espe- ially in the presence of organic matter. It orms the basis of "Condy's fluid," which is argely used as a disinfectant.

The chief ores of manganese are the black xide pyrolusite (MnO_2, 63.2 % Mn); psilome- ane ($MnO_2.H_2O$, 45–60 % Mn); braunite (3 Mn_2O_3. $MnSiO_3$, 69.7 % Mn); wad which is an arthy oxide (Mn 15–40 %); manganite ($Mn_2O_3.H_2O$, 62.4 % Mn); rhodochrosite ($MnCO_3$, 61.7 % MnO), and franklinite [$(Fe3nMn)O(FeMn)_2O_3$]. The ores are often ssociated with other metals, particularly with ron oxides, and with silver ores. Like residual imonite (see IRON ORES) manganese ore is usu- lly secondary, resulting from the removal of nore soluble substances during the weathering of slightly manganiferous rocks. For many ears prior to 1914 Russia was by far the great- st producer of high grade manganese ores. Most of this output came from one locality near Chiatouri, south of the Caucasus Mountains. Some engineers have estimated the total re- serves of high grade manganese ore in this one district to be upward of 100,000,000 tons, although this has been disputed. For some time before the war Russia's production averaged more than half a million tons yearly. Next in importance to Russia as sources of manganese are Brazil and India. In Brazil there was a rapid development of the industry and the production of manganese ore in 1917 was about 500,000 tons. As the war practically stopped the exportation of manganese from Russia and India, the deposits in Brazil assumed great importance, but in 1924 exports fell to 151,043 tons. The United States has never been a large producer of manganese ore. A writer in the *Mineral Industry* some years ago stated that the manganese output of the country was "insignificant because of the trifling character of the deposits." In 1914 the total production in the United States of ore containing 40 per cent or more of manganese was only 2,635 long tons. In the production of ferromanganese and spiegeleisen and in the other arts using manganese compounds it is desirable to have an ore containing at least 40 per cent of the metal. Before the late war it was almost impossible to find a steel maker willing to buy a lower grade. During the war some steel makers bought ore containing only 28 per cent manganese and were glad to get it. Most of the manganese bearing ores mined in the United States are classified as manganiferous iron ores, which may or may not contain silver and lead. In these ores the manganese is mainly valuable as a flux in smelting operations, although it can sometimes be used for making spiegeleisen. The domestic shipments of manganese containing 35 per cent and more of metallic manganese amounted in 1937 to 40,241 tons, having a value of $1,062,399. Production was lower than the 1925–29 average which was 59,312 tons but there had been a steady increase after 1933 when total production was 19,146 tons. Largest output came from Montana. The production of manganiferous iron ore containing from 10 to 35 per cent manganese in 1937 was 151,955 long tons valued at $778,840. Production of ore containing from 5 to 10 per cent manganese was 1,189,017 long tons with a value of $3,078,919. Imports of manganese in 1937 totaled 911,922 long tons, valued at $10,451,602. Largest imports were from Cuba and the Gold Coast. The domestic deposits are in many States, of which the most important are Arizona, Arkansas, California, Colorado, Georgia, Minnesota, Montana, Tennessee, Utah and Virginia. In 1910 the United States Geological Survey issued a very excellent monograph, Bulletin No. 427, entitled 'Manganese Deposits of the United States,' by Edmund Cecil Harden, giving very complete data in regards to ores, alloys, production and uses. The same author contributed a paper entitled 'Manganese Ores of Russia, India, Brazil and Chile,' to the 'Transactions of the American Institute of Mining Engineers' (Vol. LVI, p. 31). In the same volume there is an article by Joseph T. Singewald, Jr., and Benjamin Leroy Miller on 'The Manganese Ores of the Lafayette District, Minas Geraes, Brazil.' In the *Engineering and Mining Journal* (issue of 9 Feb. 1918) is a popular article by Henry V. Maxwell entitled 'Prospecting for Manganese.' See METALLURGY; STRATEGIC AND CRITICAL MINERAL SUPPLIES.

MANGANESE BRONZE, a metallic element in which the copper forming the base of the alloy is mixed with a certain proportion of ferro-manganese, and which has exceptional

qualities in the way of strength and hardness. Various qualities are manufactured, each suited for certain special purposes. One quality, in which the zinc alloyed with the treated copper is considerably in excess of the tin, is made into rods and plates, and when simply cast is said to have a tensile strength of about 24 tons per square inch. Another quality has all the characteristics of forged steel without any of its defects. Another quality is in extensive use for toothed wheels, gearing, brackets and all kinds of machinery supports. From its non-liability to corrosion it is largely employed in the manufacture of steamship propellers.

MANGANITE, native hydrated oxide of manganese, MnO (OH), or $Mn_2O_3.H_2O$. It crystallizes in the orthorhombic system, but also occurs in columnar and stalactitic forms. It is brittle, and has a hardness of 4 and a specific gravity of about 4.3. It is steel gray to iron black in color, and opaque with a submetallic lustre. It occurs in the Harz region, in Norway and Sweden and in the British Isles. In the United States it is found in the Lake Superior mining district, and in Douglas County, Colo. It also occurs in Nova Scotia and New Brunswick. Manganite is used as a source of manganese for the preparation of spiegeleisen and other alloys, and also in the manufacture of pigments and dyes.

MANGASARIAN, Mangasar Mugurditch, American author and lecturer: b. Mashgerd, Armenia, 29 Dec. 1859. He was educated at Robert College, Constantinople, 1872–76 and at Princeton Theological Seminary. He entered the Presbyterian ministry in 1882 and held a pastorate in Philadelphia 1882–85, when he resigned to become an independent preacher and lecturer. In 1900 he organized the Independent Religious Society, Rationalist, at Chicago, and was its lecturer until 1925. He is the author of 'A New Catechism' (1902); 'The Truth about Jesus' (1909); 'How the Bible was Invented' (1910), 'The Crisis of the Churches,' and numerous other works on religious topics.

MANGATAREN, män-gä-tä'rĕn, Philippines, a pueblo of the province of Pangasinán, Luzon, 18 miles south of Lingayén; it is on the Agno River road. Pop. 10,150.

MANGE, a cutaneous disease to which dogs, horses, cattle, etc., are liable. It resembles in some measure the itch in the human subject, ordinary mange being due to the presence of a burrowing parasite. Both local application and internal remedies are used in its cure. Frequent washing of the skin is essential. See ITCH.

MANGEL-WURZEL. See BEET.

MANGIN, Charles Marie Emmanuel, French general: b. 6 July 1866; d. Paris, 12 May 1925. He served from his 24th year in Tonkin and in every part of Northern Africa, and accompanied Marchand on his historic journey from the Congo to the Nile in 1898. He first came under public notice in 1911, when, as military instructor to the Moroccan forces of Sultan Mulai Hafid, he defended Fez against the rebellious Berber tribes. In August 1912 he led a flying column of 4,000 men from Fez to Marakesh, effecting a dramatic rescue of nine French prisoners held by the pretender El Hiba. He received the congratulations of his government and was made a commander of the Legion of Honor. At the outbreak of the European War he was given a brigade command in the 5th Army, which took the shock of the first German onset at Charleroi. At the Marne he led a division and was heavily engaged at the battle of the Aisne. After participating in various other battles he arrived at Verdun with his division in March 1916. Here he led his men to the recapture of La Caillette Wood and (22 May) to the brilliant but shortlived reconquest of Douaumont. He was placed in command of the new 3d Colonial Corps in June and given charge of the crucial sector on the right bank of the Meuse. In October his command recaptured Douaumont and also Fort Vaux, with nearly 5,000 prisoners. He deprived the Germans of a wide sweep of territory around Verdun in December, and in the spring, conducted a big offensive between Soissons and Rheims, which was suddenly stopped. Mangin was relieved of his command and relegated to an obscure post through a cabinet crisis. With the accession of Clemenceau, Mangin was sent back to the field. In the summer of 1918 he commanded the French-American forces operating between the Aisne and the Marne. In 1919 he commanded the French army of occupation, and in 1921 was sent to South America.

MANGLE, a machine for smoothing linen and cotton goods. See LAUNDRY MACHINERY.

MANGO, măn'gō, a genus of trees (*Mangifera*) of the family *Anacardiaceæ*. The 30 species are natives of southeastern Asia, where some of them have been distributed by man throughout the tropics of both hemispheres. The wood of various species is used for boat and canoe making, for house building and for boxes. It is gray, rather soft and easily worked. The trees are valued also for shade, being of large size and attractive form, and very leafy, the leaves large, leathery and evergreen. It is for their fruits, however, that they are most esteemed. These are widely used for human food, especially in the East, either ripe, in which condition they are eaten raw, with or without wine, sugar and spices, or unripe as preserves, jellies or pickles. They are also used for making wine and glucose. The finer varieties are considered equal to the choicest pineapples and even to the mangosteen.

The most commonly planted and most widely distributed species is the common mango (*M. indica*), a native of India. It often exceeds 40 feet in height, bears terminal panicles of rather small pinkish or yellow flowers, followed by smooth kidney-shaped yellow or reddish fruits which often weigh more than half a pound. Each fruit contains one large flattened seed, almost as long and often nearly as wide as the fruit, but flattened like the seed of a melon. The kernel is often roasted and eaten like chestnuts. The pulp of the fruit is soft, luscious in the finer varieties but very fibrous in the inferior sorts. These have a more or less pronounced flavor, suggestive of turpentine, which is characteristic of all parts of the tree. Since 1782, when the mango was introduced into Jamaica with a lot of other plants taken from a French vessel captured on its way to Haiti, the fruit has spread throughout the West Indies and southern Florida. In Florida, however, the

freeze of 1886 destroyed all trees except those in the extreme southern part, where the mango is now confined. The market, which seems to be growing but is somewhat limited because of the prevailing ignorance regarding the fruit, is supplied mainly from the West Indies. California supplies little more than its home markets. The trees do best upon well-drained sandy land, and should be well supplied with potassic manures. They quickly fail to bear upon wet soils. They may be propagated by grafting, but since a large proportion of the varieties reproduce practically without change by seed this method is widely employed. Grafted Indian varieties were first introduced in Florida in 1889.

Several other species of mangoes are cultivated. For instance, the horse mango (*M. foetida*), a native of Malacca, is cultivated in India, and *M. sylvatica,* whose fruits are dried and used like prunes.

MANGO BIRD. Several birds are called mango birds in various parts of the world because they frequent mango trees. The East Indian one is an oriole (*Oriolus kundoo*); the West Indian one, so called in Jamaica, is a hummingbird (*Lampornis violacauda*), which may occasionally visit Florida.

MANGO FISH, one of the threadfins, a small perchlike seafish (*Polynemus plebijus*) which is numerous along Oriental coasts, and approaches the shore and is caught at the time when mangoes ripen. The same name is sometimes given to a relative in the West Indies (*Polydactylus virginicus*), called barbudo in the Cuban markets.

MANGOSTEEN, a tree (*Garcinia mangostana*) of the family Guttiferae, native of the East Indies, sometimes cultivated in tropical America. It is one of the best-known fruits of the East Indies. The fruits are about the size of a mandarin orange and of similar shape, with a thick, red-purple rind; the flesh is snow-white or cream-colored, so delicate that it melts in the mouth, and of delicious flavor. So far, attempts to grow the tree in Florida have been unsuccessful.

MANGROVE, măn'grōv, a genus of trees and shrubs (*Rhizophora*) of the family Rhizophoraceae. The species, of which there are less than half a dozen, are all natives of the tropics, where they inhabit tidal marshes and the mouths of streams. They are remarkable for their aerial roots, which extend from the branches to the mud and then become trunks for the extension of the trees, which gradually advance even to low tidal mark; and also for their peculiar method of seed germination, the seeds sprouting while still attached to the twigs. The wood, which in some species is close-grained and durable, is used for fuel and to a small extent for other purposes; the bark, which is rich in tannic acid, is employed in tanning; the fruit of some species is edible and is used for wine making. The best-known species is *R. mangle.*

MANGROVE SNAPPER, the gray snapper, an excellent food-fish, which abounds among the mangroves along the coasts of Florida and the Bahamas, and thence to Brazil. See also SNAPPER.

MANGUIANES, măn-gē-änz', the natives of the interior of Mindoro, Romblon and Tablas (qq.v.), Philippines; they are divided into four branches, one of which is of Negrito blood, another is Mongoloid and the other two are of the Malayan race. There are several tribes, including the Bangot, and the Buquil. The term is also used in the island of Palawan to designate all wild natives of unknown origin.

MANGUM, Willie Person, American legislator: b. Orange County, N. C., May 10, 1792; d. Red Mountain, N. C., Sept. 7, 1861. He was graduated from the University of North Carolina in 1815, was admitted to the bar in 1817, in 1818 was a member from Orange County of the lower house of the state legislature, and in 1819 became a judge of the Superior Court. From Dec. 1, 1823 to March 18, 1826 he was a Whig representative in the 18th and 19th Congresses; but this post he resigned, and again he was elected a judge of the Superior Court. He retired from the court in 1826, but filled the office a third time in 1828–1830. He was a United States senator from Dec. 5, 1831 to 1836, when he resigned, and from Dec. 9, 1840 to March 3, 1853; and in 1842–1845 was president *pro tempore* of the Senate. Throughout nearly his entire term of service in Congress he was a leader of the Whigs; and in 1837 he received the 11 electoral votes from South Carolina for the presidency of the United States.

MANGUM, city, Oklahoma, and Greer County seat, altitude 1,600 feet, on the Rock Island Railroad and the Missouri, Kansas, and Texas Railroad, 150 miles southwest of Oklahoma City. It processes cotton, and manufactures brick, tile, and food products. It has commission government, with a city manager. Mangum was proclaimed a city of the first class in 1906, by Territorial Governor Frantz. The place was named for A. S. Mangum, who held a grant of land on the site. Pop. (1940) 4,193; (1950) 4,271.

MANHATTAN, city, Kansas, and Riley County seat, altitude 1,012 feet, at the confluence of the Kansas and the Big Blue rivers, and on the Union Pacific and the Rock Island railroads, 51 miles west of Topeka. There is a municipal airport. The city is a trading center and distribution point for a rich farming region, and has small local industries. Much damage was caused by the flood of July 1951.

It is a college town, the seat of Kansas State College of Agriculture and Applied Science (q.v.). There is a public library (Carnegie) and the college library. The city has a city manager plan of government. Pop. (1940) 11,659; (1950) 19,056.

MANHATTAN, măn-hăt"n, one of the five boroughs comprising the city of New York. See NEW YORK CITY.

MANHATTAN BEACH, city, California, in Los Angeles County, situated 20 miles southwest of Los Angeles on the Pacific Ocean. It is a residential community, incorporated in 1912, and has a beautiful beach which makes it popular as a resort.

Government is by a city manager. Pop. (1950) 17,330.

MANHATTAN COLLEGE, an institution in Manhattan borough of New York City directed by the Christian Brothers. Founded as the Academy of the Holy Name (1849), it was incorporated as Manhattan College, 1853. It awards arts and science degrees. Enrollment (1951) 2,313.

MANHATTAN TRANSFER, a novel by John Dos Passos published in 1925. The novel is a study of New York life up to and during the Prohibition era. Using a broken plot pattern, the author treats the lives of many characters and their reactions to an industrial, urban environment. The characters include Elaine Oglethorpe, an actress who marries three times without finding surcease from boredom; Jimmy Herf, an idealistic newspaperman who cannot find a satisfactory place for his ideals in society; George Baldwin, a lawyer who is the supreme suitor of success and the main chance. The only ultimately contented individuals portrayed are the non-intellectual types, small politicians, bootleggers, an occasional businessman, who mold themselves into acceptable social patterns.

Primarily a study of social problems, the novel clearly shows the camera-eye technique which typifies the writing of Dos Passos. The novel is like a surgical cross-section in which the nerves and arteries of the subject are displayed with a modicum of protective covering. There is a wealth of naturalistic detail which gives a terrible reality to the pains and small triumphs of the characters.

MANHEIM, măn'hīm, borough, Pennsylvania, in Lancaster County; altitude 399 feet, on the Reading Railroad, 10 miles northwest of Lancaster. Manufactures include asbestos, rubber and metal products, and clothing.

The borough was settled c.1716; and laid out in 1760 by H. W. Stiegel, who produced here what is believed to have been the first flint glass in America. Government is by a mayor and council. Pop. (1940) 3,831; (1950) 4,246.

MANI, mă-nē', the indigenous peanut of Cuba, Peru and Chile. In Mexico and Central America it is called *cacahuate.*

MANICALAND, mă-nē'kă-lănd, South Africa, a former territory of southern Rhodesia, situated on the border of Portuguese East Africa, east of Mashonaland, between the parallels of 18° and 21° S., and the meridians of 30° 30′ and 33° E. It is now part of Manica and Sofala provinces. See RHODESIA.

MANICHAEANS, măn-ĭ-kē'ănz, the followers of Manes, Mani or Manichaeus, as he is variously styled, a Gnostic teacher, whose opinions prevailed in western Asia and eastern Europe during the 4th and 5th centuries of our era. Manichaeism is generally considered to be the Persian type of gnosis, as it is distinguished by Zoroastrian dualism, and other features of that system. Hebrew elements of religion and Buddhistic doctrines were also found in Manichaeism, which appears to have been an eclectic jumble of wild fancies, among which the soberest and strongest dogmas of the Christian creed were sometimes seen to be embedded. The dualism of Manes was conceived of by him as manifested in two contiguous realms of light and darkness, good and evil. The kingdom of light included a heaven and an earth, the latter guarded by æons, or good spirits, and presided over by a spirit of goodness. From the kingdom of darkness sprang Satan and his evil angels. This confusion and mixture, in the universe, of light and darkness, originated before the creation of man, a creature of light and darkness combined in proportions varying in each individual. The human race is finally to be purged of darkness and sin. Jesus Christ was looked upon as dual in nature; there was Jesus who did not and could not suffer, *Jesus impatibilis,* a sort of phantom or immaterial personage, and *Jesus patibilis,* who suffered death upon the cross.

The practical side of Manichaeism appears in the condemnation of marriage, or sexual indulgence of any sort, and the ascetic purification of hands, mouth or bosom, which kept the initiated from eating animal food, contracting ceremonial defilement through the touch and indulging the flame of human passion in the heart. There were two classes of disciples, the initiated, or *perfecti,* and the *auditores,* hearers, or novices. St. Augustine of Hippo was, for nine years before his conversion to Christianity, a Manichaean hearer. These hearers lived a much less strict life than the *perfecti,* and constituted by far the majority of the Manichaean sect. The clergy of this sect were organized after the model of the Christian ministry; their rite of baptism was performed with oil instead of water; they had also a eucharistic meal among their public ceremonies. The system spread rapidly through the Roman Empire and competed with Neo-Platonism in hostility to the church. Diocletian persecuted the Manichaeans, and under Justinian the profession of Manichaeism was a capital crime. The system, however, flourished in Asia beyond the 10th century and has reappeared in some shape or other, and under different names at different times in subsequent periods of European history.

MANIFEST, *in law,* a written instrument delivered by the captain of a ship to the customs officials setting forth in detail the goods shipped, the consignors, etc.

MANIFOLDS, Theory of. See ASSEMBLAGES, GENERAL THEORY OF.

MANIGAULT, Arthur Middleton, American soldier: b. Charleston, S. C., Oct. 26, 1824; d. South Island, Georgetown County, Aug. 16, 1886. In 1846 he was elected first lieutenant of the Charleston company in the "Palmetto" regiment for the Mexican War, throughout which he served. In June 1861 he was elected colonel of the 10th regiment, South Carolina infantry, and in 1861–1862 was in command of the 1st South Carolina military district. From the early part of 1862 he served in the army of the West successively under Bragg, Johnston and Hood, in 1862 was placed in command of a brigade, and in 1863 made brigadier general. At Chickamauga he distinguished himself by his repeated assaults, and in the retreat before Sherman's invasion he did some vigorous fighting. After the war he was elected by the Democrats adjutant general of South Carolina, serving until his death.

MANILA, mă-nĭl'ă, city, Philippine Islands, and chief port; on the island of Luzon, in altitude 14° 58′ 31″ North; longitude 120° 58′ 8″ East; on

nila Bay, at the mouth of the Pasig River; minus of the Manila Railroad. The city has n called the «Pearl of the Orient.» It lies st of a line drawn from Japan on the north the middle of Australia on the south; with Malay Archipelago between it and Australia, l the continental mainland of Asia, at Hong ng, 700 miles to the northwest.

Transportation.—Manila, in normal times, connected with ports in all parts of the world steamship lines, freight and passenger; and further connection with the United States clipper air service, and with cities of Asia l Europe by airlines via Singapore and Hong ng. Manila Bay, with an area of 770 square les and a shore line of 120 miles, is one of best harbors in the Far East. The modern t area affords deep, wide channels, abundant horage space, modern piers and warehouses, h mechanical cargo-handling equipment, and the facilities of a natural harbor with the st of engineering improvement.

Inter-island transportation is provided by at and airlines; intra-island, by railroad and s. The Manila Railroad Company operates railroads, which are owned by the Philippine vernment. Within the city of Manila pas- ger carriage is by bus, trackless trolley, street , taxicab—and native vehicles, horse drawn.

Industries and Trade.—Prominent among nila's industrial establishments are sugar cen- ls, rope and cordage factories, cigarette and ar factories, coconut desiccating plants, and conut oil mills. Other factories in the city ke shoes, soap, rattan furniture, mats, and er hats. There are a number of canneries, d many food packing companies have head- arters here. An important and characteristic lustry is hand embroidery.

Manila is the islands' center of trade. To d from it, via the other Philippine ports, sses the bulk of the islands' exports and ports, as well as of domestic, inter-island ade. More and more in Manila the old house- ld industries tend to become mechanized, and ere is increasing call by small factories for wer service.

Descriptive.—The old city, the original nila, a medieval walled town known as Intra- uros, lies on the south side, or left bank, of e Pasig River. Here, within the ancient walls, e narrow streets, and houses of old Spanish pe; here too are old churches and convents, d the University of Santo Tomás. This insti- tion, founded by Dominican missionaries in 05 and designated as a pontifical university 1645, occupies a building that dates from 11. Under the walls enclosing the old town ere, in the era of Spanish rule, powder maga- nes and dungeons.

North of the river is the Binondo section. st off the bridge is Plaza Moraga, from which ns a busy street called the Escolta; upon ese the business section centers. Near by is lle Rosario, with Chinese bazaars. Tondo, to e north, is a semislum district and is the ty's most densely populated area. On higher round are residential neighborhoods, and Mala- ñan, residence of the President of the common- ealth; formerly the governor general's palace.

South of the walled city is the Ermita sec- on, and adjacent to it, along the bay shore, is e Luneta, a park from which leads Dewey oulevard, lined with fine residences. Street names collocate, piquantly, the native, Spanish, and American phases and aspects of the city's history: Taft Avenue, Plaza McKinley, Dewey Boulevard; and the Avenues Rizal, Isaac Peral, San Luis.

Education and Culture.—Since 1901 education in the Philippines has developed extensively. Where then Americans organized public school systems, Filipinos now administer them. Enrolment in the elementary schools of the islands is large. Many boys and girls go on to the high schools; many avail themselves of the excellent opportunities for vocational and professional training. In Manila there is an efficient and adequate public school system, organized and administered on American lines. Provision is made for adult education, and for the training of teachers; an office of adult education was opened in 1936. The percentage of illiteracy was placed at 80.7 in 1939; the average for the Commonwealth was 48.8.

Institutions of higher learning in Manila include the Philippine Women's University; the Far Eastern University; the Centro Escolar University; the National University, the University of Manila, the government-operated University of the Philippines, and Santo Tomás, mentioned above under *Descriptive*.

In Spanish times education and culture were guided principally by the Church. There was no newspaper published in Manila until 1822, and public schools were not authorized until 1863; now, in Manila, there is a demand for American magazines and books apparently far in excess of the requirements of the white residents and visitors; swift development of a native middle class, educated in the English language, is the explanation. Manila itself is the place of publication of a large number of periodicals printed in English, Spanish, or Tagalog: dailies and weeklies, monthly magazines and quarterlies, in various fields—political, educational, agricultural, commercial, scientific, religious, and literary.

Manila has excellent facilities for entertainment and recreation: theaters, parks and playgrounds, athletic fields, and many clubs. The Philippine Exposition, held annually, in February, combines sports, pageants, educational and cultural exhibits.

Libraries, Museums, Memorials.—Manila has many fine libraries and museums. The National Philippine Library and the Philippine Museum have collections of the greatest value. The University of Santo Tomás maintains both a library and a museum. The Bureau of Science houses a reference library and collections of photographs and of Philippine flora and fauna. The aquarium, near one of the gates of the old wall, exhibits tanks containing specimens of marine life from Philippine waters. Another interesting seat of science is the observatory, founded by the Jesuit Fathers in 1865, now maintained with government co-operation, and operated by members of the society. It has gained worldwide recognition through its studies of earthquakes and typhoons. In the Luneta stands a statue of José Rizal (q.v.); a further memorial to him is the Rizal Stadium. In the old city hall (Ayuntamiento) is a statue of Juan Sebastian del Cano (q.v.), Spanish circumnavigator. In this building are kept valuable carvings and paintings, and archives containing documents of great antiquity.

Buildings.—The architecture of Manila is diversified. In the native section are flimsy structures, shacks thatched with nipa palm leaves. In the walled town are Spanish houses with barred windows, balconies overhanging the street, tiled roofs, and family shrines set into the walls; there are ancient Catholic churches, and palaces built for the Spanish rulers. And in the modern city there are theaters and hotels of modern American pattern; fine residences and club houses; and the public buildings, of which the government buildings and the post office are the most notable.

Churches and Charities.—Manila's oldest churches are Catholic; the Roman Catholic Cathedral, in the walled city, was dedicated in 1581. The Church of St. Augustine, also in Intramuros, is still older. The Episcopal Cathedral of St. Mary and St. John (1907) is surrounded by a grove of palms, acacias, and flame trees. Among the many other places of worship are the Cathedral of Tondo; First Baptist; First Church of Christ Scientist; Hongwanji (Japanese Buddhist); and the Methodist and Presbyterian missions.

The Philippine General Hospital and the Quezon Institute are important institutions; the latter specializes in tubercular cases. The Hospicio de San José, refuge for foundlings, stands on an island in the Pasig River. Other hospitals are St. Luke's (1907); Santiago, St. Paul's, and San Juan de Dios. Bilibid Prison is not only the largest but the best organized penal institution in the Far East, designed to rehabilitate its inmates, to whom it gives training in the trades.

History.—Fifty years after Magellan claimed the Philippines for Spain, that is to say in 1571, Spanish government was organized in the native city of Manila. Building of the defensive wall and moat was begun in 1790. In the 18th century the city was attacked by the Dutch and by the British, in their wars with Spain; the British held it from October 1762, to February 1763. From 1763 to 1898 it was held by the Spaniards; in 1896 a Filipino insurrection broke out, but failed to capture the capital. After the smashing of the Spanish fleet by Dewey in the Battle of Manila Bay (see UNITED STATES—*War with Spain*), Manila surrendered (13 Aug. 1898). During the ensuing Filipino insurrection against American rule, led by Emilio Aguinaldo (q.v.), an attempt was made to destroy the city. After a period of military government, administered from Manila, civil government was established, with headquarters in the city (1901); and when the commonwealth was inaugurated (15 Nov. 1935), Manila retained its established status in the Philippine regime. With the outbreak of war in Europe in 1939, the city's standing as capital of a possession anticipating severance added to its economic difficulties the problems of defense. When hostilities with Japan began on 7 Dec. 1941, the city found itself one of the three great bastions for the defense of the Far East—Hong Kong and Singapore being the other two. The city was repeatedly bombed in the early weeks of the war.

Government.—Manila is the seat of the commonwealth government. The city government is headed by a mayor, and the municipal legislative body is the council. The commonwealth pays a percentage of the cost of the city's government; the remainder is raised by city taxation. Manila was incorporated as a city in 1901.

Population.—The 1939 census of the Philippines showed that Manila had a population of 623,492. In 1936 the population, as of 1 July, was officially estimated as 355,485.

MANILA, University of, founded in 1585 by Philip II of Spain. Later branches or affiliated schools were founded in different parts of the island. A seminary for the sons of Spanish nobles was opened in 1601, and 10 years later departments were added for the sons of those not belonging to the nobility and for the natives. The university was reorganized in 1857, and again after the American occupation. The departments are science, classics, law, medicine, theology, philosophy, engineering, pharmacy, arts and music. The usual degrees are granted. In 1926 there were about 1,000 students in attendance.

MANILA BAY, the largest bay in the Philippine Archipelago, indenting the western central coast of the island of Luzon. Its greatest dimensions are from the minor bay of Pampanga in the northwest to Point Kalumpan on the south, about 38 miles; from the delta of the Grande de la Pampanga River southwest to Corregidor Island is 31 miles; circumference 120 miles. The entrance between Point Kalumpan and Corregidor is about seven miles in width; that between Corregidor and Mariveles about two miles. There are lighthouses on either side of the larger entrance. The bay is surrounded by five provinces, and receives the waters of many rivers, including the Grande de la Pampanga, with its large delta, and the Pasig at Manila, which communicates with Laguna Bay, to the southeast, and has been dredged for navigation. The lands on both sides of the bay at the entrance are high and covered with vegetation, but the shores at the head of the bay are low and marshy, intersected by numerous small rivers, estuaries and tidal lakes. It is one of the finest harbors in the East, being free of obstructions to navigation, and affording excellent anchorage. But the water is so rough at times that it was necessary to construct large breakwaters to protect the shipping. Point Luzon is at the mouth. Submarine telegraphs are laid in the bay which run to San Francisco, to Hong Kong and to Iloilo. Manila, the capital of the archipelago, and Cavite, the United States naval headquarters in the Philippines, are on its shores; an artificial port is being constructed at Manila. In this bay Admiral Dewey won a victory over the Spanish fleet 1 May 1898.

MANILA BAY, Battle of. See UNITED STATES—*War With Spain.*

MANILA HEMP, or **ABACA,** *Musa textilis.* This species belongs to the plantain or banana family, the commercial fiber being derived from the stalk or trunk of the wild plantain of the Philippine Islands, and is classed as a structural fiber. The strongest and best of our hard cordage fibers, it is employed in the United States for standard binder twine and for all sizes of rope from the smallest dimensions to hawsers and cables. The old rope and the waste are employed as paper stock. The fiber is creamy white to reddish white, lustrous, easily separated, stiff and resistant, while its

htness makes it advantageous for employ-ent in cordage for the rigging and running pes of ships. Structurally the bundles of bres are very large, but easily separated into bres of even diameter; the walls of the cells e of uniform thickness, growing slender to-ard the ends gradually and regularly. In eakage tests for textile strength, with Eng-h hemp — made by the British government — anila stood a strain of 4,669 pounds against 885 pounds for hemp, ropes three and one-uarter inches in circumference and two thoms long being used in each test. In the hilippine Islands the finer grades of the fibre re extensively used for fabric manufacture, the roduct being worn by the natives of both sexes roughout the archipelago. Mixed with cotton durable fabric is produced well adapted to the imatic conditions of the islands. According o a recent report of the Philippine Bureau of griculture, the manila hemp plant was intro-uced into India in 1859 and the Andaman slands in 1873. The plant is also said to be ound in Borneo and Java, and attempts have een made to introduce it into other countries. t remains a fact, however, that the commercial bre is produced only in the Philippines. The ulture has been attempted without success in ne West Indies, and seed was imported for trial n Florida only a few years ago; it was planted ut it failed to germinate. Several species of anana yielding fair fibre are successfully culti-ated throughout tropical and sub-tropical merica, and in many other portions of the orld. Banana fibre bears no comparison, how-ver, with the Manila hemp of commerce, al-hough the fibre of *Musa basjoo* is produced ommercially in Japan where it is employed for ndergarments for summer wear, as well as for ight dresses for the higher classes of Japanese.

Manila hemp first attracted attention com-nercially early in the last century, and was im-orted into Salem, and Boston, Mass., about 1824; samples of the fibre, however, were rought to this country by naval officers as arly as 1820. The production of the textile ad reached about 8,000 tons in 1840, 30,000 tons n 1860 and 50,000 tons in 1880. In 1900 the roduction was nearly 90,000 tons. It now averages about 100,000 tons. The United States took in 1930, 64,052 tons, valued at $8,844,284 as compared with 72,190 tons, valued at $13,-496,000 imported in 1929. These figures relate to unmanufactured hemp only.

Regarding the specific localities of produc-tion and details of cultivation, preparation, etc., he student is referred to Bulletin of the Royal Gardens Kew (August 1894), to a Descriptive Catalogue of Useful Fibre Plants of the World (Washington 1897), and to the latest issues of the *Farmer's Bulletin* published by the Philip-pine Bureau of Agriculture, Manila.

The extraction of the fibre is a simple propo-sition. The *abaca* is cut near the roots when the plant is two to four years old, and just be-fore blossoming; if cut earlier the fibre is finer but shorter. After striking off the leaves the trunk or stem is slit from end to end, and the sheathing layers of cellular matter, which form the petioles of the leaves, are separated, dried a day or two and then cut into strips three inches wide, and finally scraped until the fibre has been cleaned of all extraneous matters, soft cellular tissue, etc. The bundles of wet fibre are shaken into filaments, washed, dried and sorted. This is the export fibre for cordage purposes, the fabric fibre necessitating further treatment by beating, which softens and subdivides the fila-ments. The export fibre is wrought into hanks and made into bales of about 270 pounds, when it is ready for shipment. Attempts to use ma-chinery for extracting the fibre have not been successful, partly because the machines have not been adequate, and partly on account of native prejudice. There is a great waste by the hand methods of preparation which it is thought ma-chine extension would obviate. See FIBRE; HEMP; JUTE; RAMIE; SISAL HEMP.

MANIN, mä-nēn', **Daniele,** Italian patriot: b. Venice, 13 May 1804; d. Paris, 22 Sept. 1857. He studied at the University of Padua, was ad-mitted to the doctorate of laws and practised at the bar. In politics he became the leader of the liberal class, and by 1847 had secured a solid reputation as a political economist. For anti-Austrian utterances made during that year and the next he was twice imprisoned, but while awaiting trial was set free by the populace upon arrival of news of the revolution of 1848 in Italy and France, was made President of the Republic of Saint Mark and given supreme power as head of the patriotic revolt. The Austrians were driven out, and during the siege, which began in the autumn of 1848 and lasted 12 months, Manin was at the head of the civil government, and to his counsels and patriotic spirit it was mainly owing that the Venetians maintained so long and brilliant a defense. After the capitulation Manin retired to Paris, where he maintained himself by giving lessons in Italian, and continued in various pamphlets and through the press to advocate the cause of Italian independence. Consult Martin, 'Daniel Manin and Venice in 1848–9'; Mortinengo, Ce-saresco, 'Italian Characters' (1901).

MANIOC, or **MANDIOC.** See CASSAVA.

MANIPLE, (1) one of the divisions of the ancient Roman army. It consisted of 60 rank and file, two officers called centuriones and one standard-bearer called vexillarius. (2) In the Roman Catholic ritual a sacred vestment at-tached to the left arm, to leave the right at lib-erty for ministering. See COSTUME, ECCLESIAS-TICAL.

MANIPUR, măn-ĭ-poor', northeast India, a thinly populated native state now more fre-quently called Assam State, which is confusing because there is Assam province (q.v.). It con-sists principally of an extensive valley situated in the heart of the mountainous country which lies between Assam, Cachar, Burma and Chitta-gong; area, 8,456 square miles. The greater part of the state is covered with forest and jun-gle, and the wild animals include the elephant, rhinoceros, tiger, leopard, bear, deer and buffalo. The people belong to the Mongolian race, and are known as Manipuris. They are governed by a rajah, at whose court resides a British po-litical agent under the control of the chief com-missioner of Assam. The capital is Manipur, also called Implial, lying in the Namkathay on Manipur River, which is tributary to the Irra-waddy, almost 250 miles north by west of Man-dalay; pop. about 75,000. Most of the work is done by the Manipuri women, the men being lazy. The chief crop is rice. There is a special breed of ponies in the country, which are much

employed in the game of polo, the national sport of Manipur. There has been a political agent in Manipur since 1835. In 1891, in an outbreak headed by a member of the reigning family, the chief commissioner of Assam and the political agent were murdered; but the disturbance was soon put down and avenged. Pop. (1941) 512,069, composed chiefly of Hindus, Mohammedans, Christians and Buddhists.

MANIS, PANGOLIN, or **SCALY ANTEATER,** an edentate mammal, belonging to the group Squamata, coextensive with which is the family Manidae. The body and long, thick tail are covered with horny, imbricated scales. The legs are short and very strong, and the toes are armed with powerful claws, enabling the animals to burrow rapidly. These animals can roll themselves into a ball, and are then protected by their scales, and they exhibit remarkable strength in holding their bodies in this protective attitude. The scales are regarded as formed of agglutinated hairs; in the Asiatic species true hairs grow between the scales and extend beyond them. All dwell in burrows, come abroad only at night and subsist almost altogether on ants and termites, which they capture by means of their long, ropelike, sticky tongues. They have no trace of teeth; and in general structure show a close resemblance to the American anteaters. They range in size from the African *M. Gigantea,* six feet, to two and one-half feet. They are comparatively common in some rocky districts of India and China. The latest review of the family shows that it contains seven species.

MANISTEE, măn-ĭs-tē′, Mich., city and Manistee County seat, altitude 581 feet, on Lake Michigan at the mouth of the Manistee River, on the Pere Marquette and the Manistee and Northeastern railroads, and on state and federal highways; by rail, 147 miles northwest of Saginaw. It has a natural harbor, which has been improved by extensive engineering works. The river flows through the city from Lake Manistee to Lake Michigan, and is navigable for vessels of moderate draft. A municipally owned and operated airport is three miles to the north, on a federal highway. The United States Coast Guard maintains a Manistee station with three power boats. Products of the city's industries are salt, chemicals, paper, drop forgings, motor boats, furniture, clothing, highway markers, pumps, and a widely varied line of miscellaneous articles. Lumbering, formerly the foremost local industry, has been largely replaced by exploitation of salt and bromine deposits underlying the city. In its public and parochial schools Manistee has almost 2,000 pupils; its public library contains more than 30,000 volumes, and its parks total 50 acres. Orchard Beach State Park is two miles north of the city, on a bluff overlooking Lake Michigan. Eighteen denominations are represented in the city's churches. There is a modern hospital. Service and civic clubs, two music clubs, women's clubs and a country club contribute to the community's social and civic resources. Before the white man came, the Indians occupying the land about the site of the present city were Chippewas. White traders and missionaries of early times frequently camped hereabout. Father Jacques Marquette visited the locality. It was in 1841 that the first permanent white settlement was made. In that year one John Stronach and his son Joseph set up a sawmill. Here they found a strategic location for the lumber industry, as the river flowed through pine forests. In Manistee Lake there was good storage space for logs, and they could easily be floated down the stream to the mills for cutting. It was in 1882 that the salt deposits were discovered. Nineteen hundred feet underground is a stratum of salt rock 32 feet thick, and brine is pumped from a still lower depth, for use in manufacturing commercial salt. Manistee County was organized in 1855, and Manistee became a city in 1869. In 1861 the population was not more than 1,000; the Civil War and a disastrous fire retarded its development, but by 1869, the year of its incorporation as a city, the population had trebled. In 1871 the city was again almost destroyed by fire. A monument at the junction of state and federal highways marks a point on the old Chippewa Indian trail. Manistee is an Indian word meaning Spirit of the Woods. Commission government has been adopted by Manistee, and there is a city manager. The commissioners, elected by districts, one from each district, choose a mayor from their own number. The water-supply system is municipally owned and operated; the water comes from wells. Pop. (1940) 8,694; (1950) 8,642.

MANISTIQUE, măn-ĭs-tēk′, Mich., city and Schoolcraft County seat, altitude 613 feet, on the north shore at the eastern end of Lake Michigan, at the mouth of the Manistique River; on the "Soo" and the Manistique and Lake Superior railroads, and on state and national highways, 107 miles by rail southwest of Sault Sainte Marie. The Ann Arbor Railroad Company, in connection with its train service between Toledo and Manistique, operates a car ferry between Manistique and Frankfort, Michigan. U.S. Highway No. 2 crosses the Manistique River on a highway bridge that has a roadbed several feet lower than the surface of the water. Its construction and the control of the water level was considered a fine piece of engineering. The surrounding region has lumber and limestone. The city's manufactures and industries include paper, fitted lumber, wooden novelties, pulpwood, and brooms. Manistique has a public library and a hospital; parks, playgrounds, and recreational centers. The National Guard Armory is located here. The public school system includes one high school. Musical interests are conserved by a Municipal band, and a choral club, and the town has its quota of social, civic, and service organizations. Manistique was incorporated as a city in 1901. The name is of Indian origin, meaning Great Sandy Beach. Administration of local government is under the supervision of a city manager. The water supply system is under municipal ownership; the water is taken from Indian River. Manistique is a summer resort and a fishing center. As an added attraction to tourists the enormous spring, called by the Indians Kitch-iti-ki-pi (big spring) is located four miles west of the city. Pop. (1940) 5,399; (1950) 5,086.

MANITOBA, măn-ĭ-tō′bà, one of the three prairie provinces of Canada, is situated in the geographical center of Canada and of North America as well since a line drawn from Alaska to Florida will intersect a line from Labrador to southern California in this area. Formerly known as Red River Settlement (q.v.) or Fort Garry, the name Manitoba (Indian, *Manitou, Great*

Spirit) was adopted upon the enactment by the deral parliament of the Manitoba Act (1870) r which the province was created and provision ade for its admission to the new Dominion of anada of which it became the fifth province ily 15, 1870. In its early days the area of the ovince was so small that it was called the ostage stamp" province. Subsequent enlarge-ents in 1881 and 1912 have brought it to its esent size of 246,512 square miles. Of this ea, 26,789 square miles are fresh water includ-g three large lakes, Winnipeg (larger than ake Ontario), Manitoba, Winnipegosis, and in-umerable smaller ones.

Coat of Arms

The province is bounded on the south by the tates of Minnesota and North Dakota, on the est by the province of Saskatchewan, on the orth by the Northwest Territories, and on the ast by the province of Ontario and Hudson Bay. t extends from latitudes 49° to 60° N., longitude 5° to 102° W., and is approximately 275 to 500 iles wide.

The shield bearing the coat of arms of Mani-oba is divided laterally, the upper third being a hite ground bisected by a red cross, the lower wo thirds a pictured representation of a bison tanding on rocky ground on a field of green.

The floral emblem is the crocus, adopted 1906.

Geography.—Topographically the province is nteresting and unusual. It consists of five ap-roximately parallel areas running from north-vest to southeast. In the center is the fertile alley of the Red River and the large lakes, about 00 miles wide by 350 miles long. To the east s a country of granite rock, lakes, rivers, and orests, the western edge of the Pre-Cambrian hield of Canada. Further east and north is a lat, barren land bordering on Hudson Bay. To he west of the central section lies hilly agricul-ural country rising to about 400 feet above the alley, which is approximately 760 feet above sea evel, and, in its northern part, to the Duck and Riding Mountains with a maximum height of 2,800 feet. To the west of this strip, forming he southwestern portion of the province, lies the rue prairie country, the area which made *Mani-oba No. 1 Hard* the standard of high quality grain. From the southeast to the northwest runs a line dividing the grove and prairie areas from he heavy forests. Thus it will be seen that, hough always described as the most easterly of he three prairie provinces, much of it is not prairie country, all the more so since 40 per cent of its area is heavily forested. Five rivers of importance traverse the province—the Red River of the North, the Saskatchewan, the Nelson, the Winnipeg, and the Assiniboine.

National and Provincial Parks.—Riding Mountain National Park established in 1929 lies in southwestern Manitoba, just south of the Duck Mountain Provincial Park. It has an area of 1,148 square miles. Fort Prince of Wales, Manitoba's National Historic Park covers an area of 50 acres in the extreme north near Churchill. The fort was built in 1733 by the Hudson's Bay Company to guard its rights in pioneer days. It was established in 1941. Whiteshell Forest Reserve has an area of 1,078 square miles.

Population.—The population of the province which, by a census taken by the first lieutenant-governor in 1870, numbered 1,563, exclusive of Indians and Métis, had, by the Dominion census of a year later, grown to 25,268 and was, by the census of 1946, 727,000. In 1949 it was 778,000. (est.)

The periods of large growth are revealed by the ten year census figures: 1871, 25,228; 1881, 62,260; 1891, 152,506; 1901, 255,211; 1911, 461,-394; 1921, 610,118; 1931, 700,139; 1941, 729,744. This population is of many racial origins. Almost exactly one half has as its country of origin the British Isles. The other half, all but a small minority of Asiatics and Indians, is of European origin, the main racial stocks in order of numbers (census 1941) being: Ukrainians 89,762; French 52,996; German 41,479; Dutch, 39,204; Polish 36,550.

A special situation exists in the distribution of population in that more than 40 per cent of the people live in Greater Winnipeg, and there is no other large city. There are in all four cities, Winnipeg, St. Boniface, Brandon, and Portage la Prairie, 33 towns, and 35 incorporated villages. In the 114 rural municipalities there are other small urban communities.

Climate.—The climate of Manitoba is dry, clear, and invigorating with long winters, brief springs, hot summers and a clear bracing autumn. An outstanding characteristic is the amount of sunshine which in 1949 was 47.2 per cent of possible hours. The coldest months are January and February, the hottest, July and August. Over a period of 75 years for which accurate records have been kept the average mean temperature was 35.2°F. The coldest day on record (Dec. 24, 1879) showed —53°F.; the hottest (August 7, 1949) 104.2°F. Normal winter temperatures run to —10° to —20°F. Normal summer temperatures are to be found between 70° and 80°F. but at times rising above 90°F. and on rare occasions to over 100°F. Normal precipitation is about 20.5 inches of which 20-25 per cent is snow. June, July, and August are the months of heaviest rainfall. The fact that the periods of longest sunshine and heaviest rainfall coincide is responsible for the remarkably rapid growth of vegetation and the production of high quality grain and vegetables. The considerable depth of frost is another factor in providing bountiful moisture during the short growing season. The longest period of continuous frost free days varies from 100 to 109 days in the agricultural area.

Average mean monthly temperature for 1949: Jan. 1.8°F.; Feb. —6.2°; Mar. 15.8°; Apr. 42.6°; May 53.0°; June 63.4°; July 67.8°; Aug. 70.3°; Sept. 53.8°; Oct. 41.2°; Nov. 30.3°; Dec. 3.8°.

Precipitation for 1949 was 15.96 inches of

rain and 70.3 inches of snow, in all 22.96 inches. Humidity ranged from 22 per cent to 100 per cent.

Natural Resources.—Manitoba's natural resources, other than agriculture and water power are in her mines, forests, and lakes. The principal minerals produced, all found in the Pre-Cambrian shield, which covers 57 per cent of the area of the province, are copper, gold, zinc, and silver. Selenium, tellurium and cadmium are recovered as byproducts. Of the mines the most important is that of the Hudson Bay Mining and Smelting Co., at Flin Flon 400 miles northwest of Winnipeg. In the same area there are three other producing mines. Structural minerals are also available in abundant quantities, the chief one being Tyndall stone found about 20 miles northeast of Winnipeg and much used for public buildings. The total value of all minerals produced in 1948 was $24,400,000.

Over 40 per cent of Manitoba's land is forested and there is estimated to be a total stand of 2,675,000 board feet of saw timber and 28,640,000 cords of smaller wood. White spruce, black spruce, jack pine, aspen poplar, and balsam are the most important species. Over one million cords of poplar alone are available annually. In 1950 one large pulp and paper mill had been in operation for twenty years. The department of mines and resources is making vigorous efforts to protect and develop the forest wealth and controls seven forest reserves. The estimated net value of forest production in 1948 was $18,000,000.

The fishing industry, important since the early days, has been developed chiefly by people of Icelandic descent. Lake Winnipeg, and other lakes in the central part of the province, are the chief sources but in the colder northern lakes an unlimited supply is being made available by air transport. The most important varieties of fish found in all these waters are pickerel and white fish, and 90 per cent of the production is sent to eastern cities in the United States. To keep the lakes well stocked the government operates five fish hatcheries. In addition to the commercial fishing, these lakes attract large numbers of tourists and fishermen. Income from tourist traffic for 1949 (est.) was $20,000,000.

Water Power.—Hydroelectric power, potential and developed, furnishes the basis of Manitoba's industry as well as adding greatly to the well-being of the citizens, the city of Winnipeg having the largest domestic use of electricity on the continent. It is estimated that there are 3,000,000 horsepower still undeveloped. Completed developments, mainly on the Winnipeg River, furnished (1949) about 500,000 horsepower. Two great enterprises share this power—the Winnipeg Hydro Commission, a civic undertaking, and the Winnipeg Electric, a private corporation. Operating in competition with each other, they supply light and power to greater Winnipeg at what are said to be the lowest rates on the continent, on the average .847 cents per kilowatt-hour. The Winnipeg Electric in addition operates the transportation service of the metropolitan area rapidly being converted from street cars to trolley buses. The Winnipeg Hydro has developed with the use of offpeak power a remarkable central heating system which furnishes heat to the business area while private companies in the same way heat over 3,700 residences. In spite of the low rates, maintenance of the plant at a high standard, and provision of adequate sinking funds, it shows each year a substantial profit which goes to the relief of taxes. Since 1941 these contributions have risen steadily from $247,000 to $1,000,000. Power shortages are unknown although the power comes from a point about 100 miles distant. In 1949 further large developments on the Winnipeg River were commenced.

A third enterprise in this field is the Manitoba Hydro Commission which in 1950 had been in operation 30 years. This is a government undertaking distributing power through the province directly to consumers. Operating at first with communities, 350 of which were being served in 1949, it began in 1945 the electrification of farms. By the end of 1949, of the 52,000 farms in Manitoba, 12,000 had electricity in spite of the fact that there are only 1.3 farms per mile. This development is proceeding at the rate of 5,000 farms per year.

Winnipeg.—The capital of the province, Winnipeg (Cree—muddy water), became an incorporated city in 1873. Its nucleus was the Red River settlement which owed its origin to its position at the juncture of the Red and Assiniboine rivers. In the early days, when all travel was by water or oxcart, this location gave ready access in every direction; to the south, to the Minnesota and Mississippi rivers; to the east, via the Rainy River chain to Lake Superior; to the north, via Lake Winnipeg and the Nelson River, to Hudson Bay; to the west, via Lake Winnipeg and the Saskatchewan River, to every part of the Canadian prairies and thence, by way of the Mackenzie River, to the Arctic. When the railways were built the city's location was still exceptionally fortunate. Owing to the proximity of large lakes to the east and north and the United States boundary to the south, it is impossible for railways or roads to connect eastern with western Canada except through a "funnel" only 20 miles wide and 150 miles long. Winnipeg, situated in this funnel, was thus the only possible entrance within Canada to a rich agricultural territory 850 miles long and 200 to 400 miles deep. It became, and was for many years, the only distributing center for western Canada. The building of the Panama Canal made transportation by way of Vancouver cheaper as far east as the center of the prairies and so lessened the importance of Winnipeg in this respect. The population of the city was in 1949 (est.) 231,491. Around the city is a ring of suburbs intimately connected with all phases of life in the city proper. The population of this metropolitan area, known as Greater Winnipeg, was estimated in 1949 at 320,000.

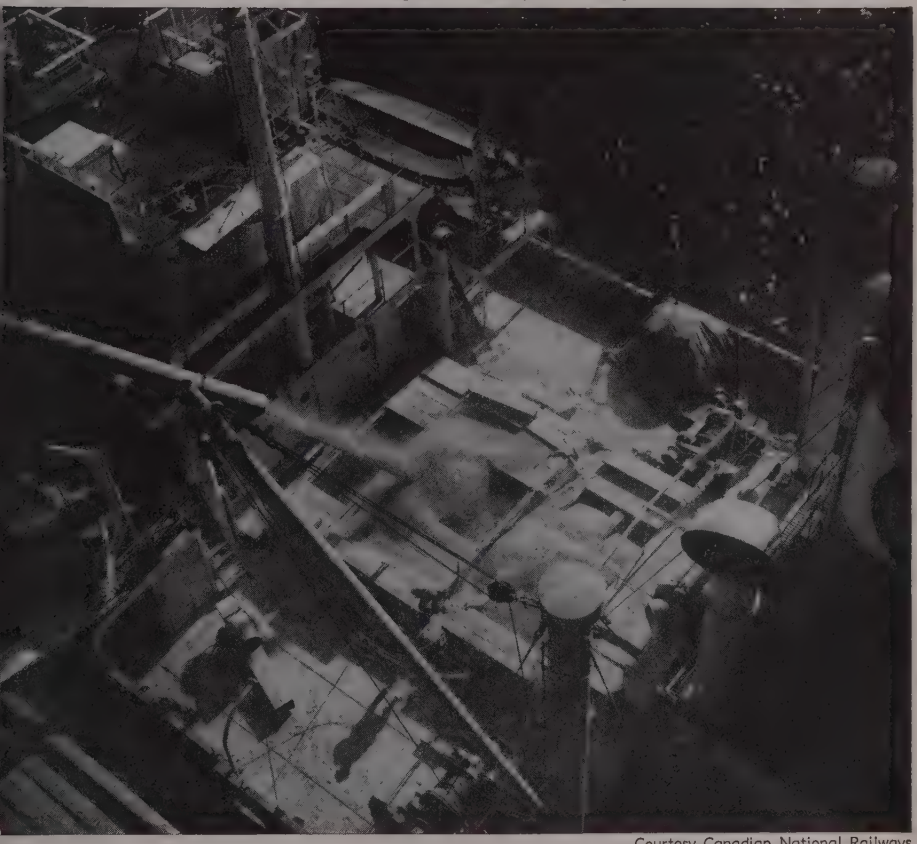
The city is governed by a council consisting of the mayor and 18 aldermen, of whom six are elected from each of three wards under the proportional representation system. Also elected in the same way is the school board of 15 members which operates 70 school buildings.

Winnipeg, (area, 25 square miles) is noted for its wide streets, its large number of trees and its many beautiful boulevards. The parks board, appointed by the city council, manages 87 parks, squares, athletic fields, two golf courses, and 220 miles of boulevards. The water supply, owned by the city, is unusually good and comes from a lake 84.5 miles distant running under gravity through a concrete aqueduct. Under the management of the Winnipeg district water board it serves the metropolitan area of 55 square miles. There are many handsome churches and public buildings, mostly of Tyndall stone. The legisla-

MANITOBA

Courtesy The National Film Board

The Manitoba Legislative Building at Winnipeg.



Courtesy Canadian National Railways

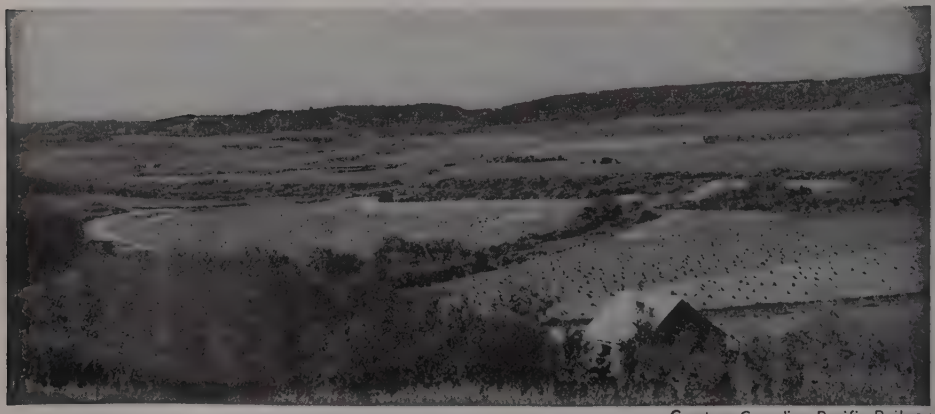
Wheat being loaded at Churchill for transshipment across Hudson Bay.

Courtesy The National Film Board

Portage Avenue, the main business street of Winnipeg.

Courtesy Triangle Photo Service

A diesel tractor near The Pas hauls a train of timber sleds.



Courtesy Canadian Pacific Railway

Fields near Minnedosa dotted with shocks of wheat ready for threshing.

· (B5)..... 500
F4)..... 10
:4)..... 132
(D5)..... 125
:5)..... 1,438
(D4)..... 100
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4)..... 300
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ver (B4).... 150
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oon (D4)..
River
..... 512
ine (B5).... 100
(C5)..... 20,598
ne (F4).....
lley (E3)... 150
ad (F4).....
e (C4)..... 100

Broomhill (B5)..... 30
Brown (D5).....
Brunkild (E5)..... 77
Bruxelles (C5)..... 150
Buchan (F4).....
Bunclody (B5)..... 12
Butler Station (A5). 32
Calientо (F5).....
Camp Morton (F4).. 350
Camper (D3)..... 30
Camperville (B2).... 25
Carberry (C5)..... 912
Cardale (B4)..... 77
Cardinal (D5)..... 117
Carey (E5)..... 47
Carlowrie (E5)..... 50
Carman (D5)..... 1,867
Carnegie (B5).....
Carroll (B5)..... 88
Cartwright (C5)..... 476
Castle Point (C5)..... 16
Cayer (D3).....
Channing (H3).....
Chater (C5)..... 44
Chatfield (E4)..... 100
Chortitz (F5)..... 150
Churchill (K2)..... 500
Clandeboye (E4).....
Clanwilliam (C4)..... 188
Clarkleigh (D4).....
Clearwater (D5)..... 500
Clematic (E4).....
Cloverleaf (F5).....
Cook's Creek (F4)..
Cordova (C4).....
Cormorant (H3).....
Coulter (B5)..... 48
Cowan (B2).....
Cracknell (A4)..... 10
Cranberry Portage
(H3) 350
Crandall (B4)..... 190
Crane River (C3).... 750
Crocus (C4).....
Croll (B5).....
Cromer (A5)..... 88
Cromwell (F4).....
Crystal City (C5)..... 493
Culross (E5).....
Cypress River (D5).. 505
Dallas (E3)..... 480
Dand (B5)..... 20
Darlingford (D5)..... 190
Dauphin (B3)..... 6,007
Davis Point (D3).....
Decimal (G5).....
Decker (B4)..... 95
Deepdale (A3)..... 77
Deer Horn (E4).....
Deerwood (D5).....
Deleau (B5)..... 188
Deloraine (B5)..... 874
Delta Station (D4).. 70
Desford (C5).....
Domain (E5)..... 47
Dominion City (E5) 700
Douglas Sta. (C5).. 150
Drifting River (B3).
Dropmore (A3)..... 47
Dry River (C5).....
Duck River (B3)..... 73
Dufresne (F5).....
Dufrost (E5)..... 150

Dunrea (C5)..... 250
Durban (A3)..... 77
East Bay (C3).....
East Braintree (G5)
East Selkirk (F4)..... 390
Ebor (A5)..... 25
Eddystone (C3).....
Eden (C4)..... 175
Edrans (C4)..... 67
Edwin (D5).....
Ekhart (E4).....
Elgin (B5)..... 400
Elie (E5)..... 150
Elk Ranch (C4).....
Elkhorn (A5)..... 635
Elm Creek (E5)..... 400
Elm Grove (F5).....
Elphinstone (B4)..... 275
Elva (A5)..... 97
Emerson (E5)..... 884
Endcliffe (A4).....
Erickson (C4)..... 250
Eriksdale (D4)..... 260
Erinview (E4).....
Ethelbert (B3)..... 491
Ewart (A5).....
Fairfax (B5)..... 63
Fairford (D3)..... 25
Fallison (D5).....
Fannystelle (E5)..... 166
Faulkner (D3).....
Findlay (B5)..... 25
Firdale (C5).....
Fisher Branch (E3).. 637
Fisherton (E3).....
Fishing River (C3)...
Flin Flon (H3)..... 9,899
Foley (E4).....
Fork River (B3)..... 174
Forrest Station (C5) 66
Fort Alexander
(F4) 1,000
Fort Garry (E5)..... 1,485
Fort Whyte (E5)..... 800
Fortier (E5).....
Foxwarren (A4)..... 271
Franklin (C4)..... 166
Fraserwood (E4)..... 94
Gardenton (F5)..... 500
Garland (B3).....
Garson (F4)..... 294
Genthon (F5)..... 150
Geyser (E4).....
Gilbert Plains (B3).. 838
Gillam (K2)..... 95
Gimli (F4)..... 1,324
Giroux (F5)..... 95
Gladstone (D4)..... 828
Glen Elmo (B4).....
Glen Souris (C5).....
Glenboro (C5)..... 600
Glencairn (C4).....
Glenella (C4)..... 195
Glenhope (C4).....
Glenlea (E5)..... 22
Glenora (C5)..... 35
Golden Stream (D4)
Gonor (F4).....
Goodlands (B5)..... 120
Grahamdale (D3)....
Grand Beach (F4)...
Grand Marais (F4)..
Grand Rapids (C1). 300

Grand View (B3)..... 946
Grande Clairiere
(B5) .....
Grande Pointe (E5)
Grass River (D4).....
Graysville (D5)..... 115
Great Falls (F4)..... 94
Green Ridge (F5).....
Greenwald (F4).....
Greenway (C5)..... 133
Gregg (C5)..... 36
Gretna (E5)..... 608
Grifton (B3).....
Griswold (B5)..... 200
Grosse Isle (E4)..... 63
Grunthal (F5)..... 870
Gunton (E4)..... 178
Guynemer (C3).....
Gypsumville (D3)... 212
Hadashville (G5).....
Halbstadt (E5)..... 450
Halicz (B3).....
Hallboro (C4)..... 86
Hamiota (B4)..... 663
Hamrlik (E4).....
Harcus (D4)..... 20
Harding (B5)..... 67
Hargrave (A5)..... 75
Harlington (A2).....
Harmsworth (B5)....
Harperville (E4).....
Harrowby (A4)..... 70
Harte Station (C4)..
Hartney (B5)..... 538
Harwill (E3).....
Haskett (E5)..... 72
Hayfield (B5)..... 87
Hayland (D3).....
Haywood (D5)..... 134
Hazelridge (F5)..... 95
Headingly (E5)..... 500
Heaslip Sta. (C5).....
Hecla (F3)..... 300
Helston (C4).....
Herb Lake (H3)..... 225
High Bluff (D4)..... 96
Hilbre (D3).....
Hillside Beach (F4...
Hilltop (C4).....
Hilton (C5).....
Hnausa (F4)..... 250
Hodgson (E3)..... 600
Holland (D5)..... 361
Holmfield (C5)..... 175
Homebrook (C3).....
Homewood (E5)..... 63
Horndean (E5).....
Horod (B4).....
Horton (B5)..... 12
Howden (E5).....
Husavick (F4).....
Ideal (E4).....
Ile des Chênes (F5)
Ilford (J2)..... 97
Indian Bay (G5).....
Indian Springs (D5)
Ingelow (C5).....
Inglis (A4)..... 212
Inwood (E4)..... 95
Isabella (B4)..... 86
Janow (G5)..... 230
Jaroslaw (F4).....
Justice (C4)..... 45

Kaleida (D5).....
Kane (E5).....
Katrime (D4).....
Kelloe (B4)..... 86
Kelwood (C4)..... 222
Kemnay (B5)..... 66
Kenton (B5)..... 126
Kenville (A3)..... 139
Kergwenan (C4).....
Kewanna (C4).....
Keyes (C4)..... 64
Killarney (C5)..... 1,262
Kinosota (D4).....
Kirkella (A4)..... 65
Kleefeld (F5)..... 625
Komarno (E4)..... 133
Koostatak (E3).....
Kulish (B3).....
La Broquerie (F5)... 800
La Rivière (D5)..... 256
La Rochelle (F5)..... 120
La Salle (E5)..... 99
Lac du Bonnet (G4) 571
Ladywood (F4)..... 25
Lake Francis (E4)...
Lakeland (D4).....
Landseer (C5)..... 8
Langruth (D4)..... 150
Lauder (B5)..... 184
Laurier (C4)..... 225
Lavenham (D5).....
Lavinia (B4).....
Layland (D5).....
Learys (D5).....
Ledwyn (E4).....
Lena (C5)..... 25
Lennard (A3).....
Lenore (B5)..... 166
Lenswood (B2)..... 300
Letellier (E5)..... 772
Lettonia (G4)..... .....
Lewis (F5).....
Libau (F4)..... 162
Lillesve (E4).....
Lily Bay (D4).....
Little Bullhead (F3)
Loch Monar (E4)....
Lockport (E4)..... 250
Lonely Lake (D3)....
Lorette (F5)..... 500
Lowe Farm (E5)..... 150
Lundar (D4)..... 800
Lydiatt (F5)..... 50
Lyleton (A5)..... 150
Lynn Lake (H2)..... 2,000
Mac Ross (D4).....
Macdonald (D4)..... 200
MacGregor (D5)..... 539
Mafeking (B2)..... 278
Magnet (C3)..... 50
Makaroff (A3)..... 25
Makinak (C4)..... 130
Malonton (E4)..... 55
Manigotagan (F3)...
Manitou (D5)..... 751
Manson (A4)..... 30
Marchand (F5)..... 96
Marco (B4).....
Margaret (C5)..... 70
Mariapolis (C5)..... 100
Marius (D4)..... 800
Markland (E4).....
Marquette (E4)..... 50

Population figures for places not in Census through courtesy of Canadian Official Railway Guide, Montreal.

MANITOBA
SASKATCHEWAN
NORTH DAKOTA
LAKE WINNIPEGOSIS
LAKE MANITOBA
LAKE WINNIPEG
Cedar Lake
Cross Lake
Grand Rapids
Spruce I.
Channel I.
Morrison Lake
Long Point
Sandy Is.
Poplar Pt.
Wicked Pt
George I.
Big Stone Pt
Dancing Pt
Reindeer I
Berens I.
Commissioner I.
Kitwe Bay
Sturgeon Bay
Exg I
Dawson Bay
Katimik Lake
Kawinaw L.
McKay L.
Soul L.
Pickerel L.
Sisib L.
Atim L.
Chitek L.
Inland L.
Waterhen Lake
Anderson L.
Red Deer R.
Red Deer L.
Barrows
National Mills
Rice Creek
Mafeking
Bellsite
Armit L.
Novra
Pelican Rapids
Pelican L.
Swan River
Shoal R.
Swan R.
Birch River
Bowsman River
Lenswood
Renwer
Minitonas
Cowan
Camperville
Harlington
Kenville
Durban
Ben to
Swan
Sclater
Duck River
Pine River
Pulp River
Zalicia
Wellman L.
DUCK MT PROV. PK.
DUCK MOUNTAIN
Childs L.
Laurie L.
Boggy Creek
San Clara
Zelena
Makaroff
Merridale
Deepdale
Drifting River
Grifton
Sifton
Ventlaw
Hale
Valley River
Ashville
Shortdale
Roblin
Shellmouth
Tummel
Shell Valley
Riding Park
Bluewing
Grand View
Gilbert Plains
Dauphin
Lake Dauphin
Ochre River
Dropmore
Ingalls
Endcliffe
Lennard
Petiura
Birch-view
Russell
Silverton
Harrowby
Binscarth
Rossburn
Oma
Seech
Angusville
Birdtail
Marco
Millwood
Cracknell
Ruthenia
Mears
Glen Elmo
Ste Madeleine
Foxwarren
Solsgirth
Menzie
St Lazare
Kelso
Shoal Lake
Birtle
Strathclair
Isabella
Decker
Lavinia
Mc Connell
McAuley
Beulah
Uno
Wilen
Minnota
Scandinavia
Hamiota
Oak River
Rapid City
Pope
Pella
Manson
Kirkella
Two Creeks
Oakner
Elkhorn
Harmsworth
Lenore
Hargrave
Virden
Butler Sta.
Cromer
Scarth
Woodnorth
Ewart
Bellview
Pipestone
Sinclair Sta.
Reston
Marshall
Findlay
Grande Clarriere
Bede
Broomhill
Tilston
Melita
Elva
Pierson
Deloraine
Waskada
Goodlands
Coulter
Lyleton
Whitewater Lake
Mountainside
Horton
Carnegie
Methven
Carroll
Bunclody
Martney
Elgin
Minto
Margaret
Fairfax
Regent
Croll
Dand
Napinka
Medora
Boissevain
Whitewater
Destord
Wakopa
Lena
Smith Hill
Carlwright
Mather
Clearwater
Snowflake
Mowbray
Winegates
Fallison
Haskett
Gretna
Renland
Brown
Plum Coulee
Morden
Darlingford
Thornhill
Winkler
Manitou
Pilot Mound
Curves
Kaleida
Altamont
Miami
Roseau River
Roland
Myrtle
Rosenfeld
Kane
Morris
Lowe Farm
St Jean-Baptiste
Sewell
Horndean
Letellier
Altona
Rosenort
Silver Plain
Gretna
Rosebank
Emerson
Dominion City
Domain
Brunkild
Ste Agathe
Union Point
Osborne
Sperling
McTavish
Carman
Stephenfield
Leary
Somerset
Swan Lake
St Lucimo
Cardinal
Holland
Notre Dame de Lourdes
Rosebank
Graysville
Homewood
Cypress River
Glenboro
Stockton
Landsend
Hilton
Heaslip Sta.
Ninette
Bemont
St Aphonse
Marapodi
Brookfield
Bruxelles
Indian
Greenway
Dry River
Wood Bay
Glenora
Pelican Lake
Pembina
Neelin
Rock Lake
Killarney
Crystal City
Pelican
Holmfield
Clearwater
Treherne
Rathwell
St Claude
Haywood
Elm Creek
Sanford
Starbuck
Culross
Fannystelle
Layland
Rosser
Headingly
WINNIPEG
Stonewall
Teulon
Gunton
Balmoral
Woodlands
Argyle
Warren
Marquette
Poplar Pt.
Portage la Prairie
Macgregor
Gladstone
Neepawa
Minnedosa
Rivers
Brandon
Carberry
Assiniboine
Souris
Douglas Sta.
Chater
Melbourne
Rossendale
Pratt
Lavenham
Elkhorn
Virden
Alexander
Oakville
Ste Anne
Ile des Chenes
Lorette
Niverville
Landmark
Dufrost
Otterburne

MANITOBA

MANITOBA
NORTHERN PART
SCALE OF MILES
0 40 80 120
MANITOBA
SOUTHERN PART
SCALE OF MILES
0 5 10 20 40 60
Province Capital
Railroads
RAILROADS
1 Canadian National 4 Great Northern
2 Canadian Pacific 5 Greater Winnipeg Water Dist.
3 Canadian Pacific 6 Northern Pacific
All railroads are numbered as per accompanying list, making possible quick and accurate identification of each line.
HUDSON BAY
SASKATCHEWAN
ONTARIO
NORTHWEST TERRS.
Winnipeg
The Pas
Flin Flon
Sherridon
Churchill
Port Nelson
York Factory
Kenora
Pine Falls
Beausejour
Ste. Anne des Chênes
Dauphin
Portage la Prairie
Brandon
Minnedosa
Swan River
Dauphin Lake
Lake Manitoba
Lake Winnipegosis
Lake of the Woods
Lake Winnipeg
Hudson
Niddrie
Gunn L.
Clay L.
Minaki
Redditt
Jones
Quibell
Vermilion Bay
Eagle River
Dryden
Wabigoon L.
Dinorwic
Dyment
Snake L.
Eagle Lake
Manitou Lake
Pekagoning L.
Turtle L.
Jackfish L.
Pipestone L.
Kakagi L.
Peninsula
Aulneau
Big I.
Bigsby I.
Buffalo Bay
Musheg Bay
Middle Bro
Whitemouth
Whitemouth Lake
Woodridge
St Labre
Sandilands
Zhoda
Badger
Spurgrave
Vassar
Sprague
South Jc.
Piney
Wampum
Arbakka
Sirko
Ste Geneviève
Medika
Hadashville
Sadlow
Janow
Rennie
Ingolf
West Hawk L.
Falcon L.
McMunn
Indian Bay
East Braintree
Shoal
Decimal
Whitemouth
Lydiatt
Overleaf
Monominto
Steinfeld
Ste Anne
Marchand
La Broquerie
Ste Agathe
Ste Rita
Lewis
Traverse Bay
Hillside Beach
Fort Alexander
Grand Marais
Beacon
Stead
Balberg
Scanterbury
Greenwald
Brightstone
Brokenhead
Allegra
Lac du Bonnet
Pinawa
Cromwell
Miner Ridge
Buchan
Seven Sisters Falls
Winnipeg
Lac du Bonnet
Great Falls
Bird River
Lettonia
Pointe du Bois
George L.
Crow Duck I.
Oiseau R.
Oiseau L.
Elbow L.
Snowshoe L.
Flintstone L.
Gem L.
Garner L.
Long L.
Beresford Lake
Bissett
Quesnel
Manigotagan
Manigotagan Lake
Wallace L.
Wanipigow
Obukowin L.
Carroll L.
Aikens L.
Hecla
Hecla I.
Elk I.
Black I.
Black R.
Manigotagan R.
Manigotagan
Wanipigow R.
Manigotagan R.
Hoodoo R.
Gammon R.
Bloodvein R.
Bloodvein
Hobbs L.
Sasaginnigak Lake
Dogskin Lake
Bullhead
Leyond
Viking
Family Lake
Vickers L.
Moar Lake
Fishing Lake
Horseshoe L.
Assiniboia R.
Assiniboia
Eardley L.
Poplar
Lewis
Assapan
Wrong Lake
Harrop L.
Charron L.
Palsen L.
Palsen
Elliot Lake
Gilchrist L.
Mukutawa
Siemon Lake
Hudwin L.
Cobham
Gilchrist R.
McPhail R.
Gilchrist
Thetinne
Nueltin Lake
Kasba L.
Thelewaton R.
Todatara L.
Geillini L.
Baroizon L.
Hubbart Pt
Kazanjerri L.
Nejanilini L.
Churchill R.
C. Churchill
Seal
Etawney Lake
Moss L.
Reindeer
Southern Indian Lake
N. Indian L.
Churchill
Lynn Lake
Granville L.
Split L.
Gillam
Split Lake
Fox R.
Gillford
Kississing L.
Paint L.
Burntwood R.
Burntwood
Grass R.
Thicket Portage
Pikwitonei
Setting L.
Show Lake
Channing
Cormorant
Cormorant L.
Wanless
Herb Lake
Wabowden
Cranberry Portage
Moose Lake
Cedar Lake
Grand Rapids
Bartlows Lake
Malekite
Nowra
Manipogasis
Pych River L.
Norway House
Steuart Island
Molson L.
Beaverhill L.
Cross L.
Oxford L.
Knee L.
SL Sipiwesk
Gods L.
Merry L.
Panask L.
Sachigo R.
Monsoonahi L.
Sachigo L.
Trout L.
Makoop L.
Weagamow L.
Caribou L.
Windigo L.
Sandy L.
Gunisao L.
Birchtone L.
Island L.
Hayes R.
Gods R.
Bustone R.
Beaver L.
Severn R.
Fairford R.
Lake St. Martin
Lake Dauphin
Lake Winnipegosis
Lake Manitoba
Lake of the Woods
Lake Winnipeg
Whitemouth R.
Whitemouth L.
Rennie
Janow
Sadlow
Hadashville
Medika

Mather (C5) 150
Matheson Island (E3) 150
Matlock (F4) 500
Mayfield Sta. (C4) ...
Mc Auley (A4) 158
Mc Connell (B4) 65
Mc Creary (C4) 365
Mc Munn (G5) .....
Mc Tavish (E5) 139
Meadow Portage (C3) .....
Meadowlands (C3) ..
Meadows (E4) 65
Mears (B4) .....
Medika (G5) 450
Medora (B5) 150
Mekiwin (C4) .....
Melbourne (C5) 78
Meleb (E4) 97
Melita (A5) 781
Melrose (F4) 300
Menisino (F5) .....
Mentmore (C4) 20
Menzie (B4) .....
Merridale (A3) .....
Methley (C3) .....
Methven (C5) 50
Miami (D5) 390
Middle Church (E5)
Middlebro (G5) .....
Million (C3) .....
Millwood (A4) .....
Milner Ridge (F4) ...
Miniota (B4) 300
Minitonas (B2) 678
Mink Creek (B3) .....
Minnedosa (B4) 2,085
Minnewakan (D4) ...
Minto (B5) 175
Moline (B4) .....
Molson (F4) 95
Monominto (F5) .....
Moore Dale (C3) .....
Moorepark (C4) 166
Moose Bay (C3) .....
Moose Lake (H3) ....
Moosehorn (D3) 223
Morden (D5) 1,862
Morris (E5) 1,193
Mountain Road (C4) .....
Mountainside (B5) ...
Mowbray (D5) 75
Muir (D4) .....
Mulvihill (D4) 169
Myrtle (E5) 110
Napinka (B5) 222
Narcisse (E4) .....
Narol (F4) .....
National Mills (A2)
Neelin (C5) 86
Neepawa (C4) 2,895
Nes (F4) 50
Nesbitt (C5) 100
Netley (E4) .....
Neveton (E4) .....
Newdale (B4) 350
Newton Siding (D5)
Ninette (C5) 160
Ninga (C5) 300
Niverville (F5) 600
Norgate (C4) .....
Norway House (J3) .1,200
Notre Dame de Lourdes (D5) .. 400
Novra (A2) .....
Oak Brae (C3) .....
Oak Lake (B5) 467
Oak Point (D4) 138
Oak River (B4) 175
Oakbank (F5) 150
Oakburn (B4) 266
Oakland (D4) 10
Oakner (B4) 120
Oakview (D3) .....
Oakville (D5) 190
Oatfield (D4) .....
Oberon (C4) 10
Ochre River (C3) 300
Oglivie Station (D4) 20
Olha (B4) .....
Onanole (C4) 210
Osborne (E5) .....
Ostenfeld (F5) .....
Otterburne (E5) 335
Otto (E4) .....
Overton (D4) .....
Ozerna (B4) .....
Pebble Beach (D3) ..
Peguis (F4) .....
Pelican Rapids (B2)
Petersfield (E4) 200
Petlura (B3) .....
Petrel (C5) .....
Pettapiece (M4) 30
Pierson (A5) 200
Pikwitonei (J3) 150
Pilot Mound (D5) ... 710
Pinawa (G4) 75
Pine Falls (F4) 600
Pine Ridge (F4) .....
Pine River (B3) 150
Pine View (D4) .....
Piney (F5) 350
Pipestone (B5) 230
Pleasant Home (E4)
Plum Coulee (E5) 467
Plumas (D4) 300
Pointe du Bois (G4) 222
Polonia (C4) .....
Pope (B4) 50
Poplar Park (F4) 300
Poplar Point (D4) ... 98
Poplarfield (E4) 116
Port Nelson (K2) .....
Portage la Prairie (D4) 8,511
Prairie Grove (F5) ... 300
Pratt (D5) .....
Pulp River (B3) .....
Purves (D5) 66
Rackham (B4) .....
Rapid City (B4) 391
Rathwell (D5) 250
Reaburn (E4) 10
Red Rose (E3) 50
Reedy Creek (C4) ....
Regent (B5) 50
Reinland (E5) .....
Rembrandt (E4) 25
Rennie (G5) 100
Renwer (B2) .....
Reston (A5) 516
Reykjavik (D3) .....
Rice Creek (A2) .....
Richer (F5) 500
Ridgely (E4) .....
Ridgeville (E5) 500
Riding Mountain (C4) 50
Riding Park (B3) .....
Ridley (D3) .....
Riel (E5) .....
Rita (F5) .....
Rivers (B4) 1,209
Riverton (E3) 786
Roblin (A3) 1,055
Roland (D5) 500
Rorketon (C3) 250
Rosa (F5) .....
Rosebank (D5) 44
Roseisle (D5) 166
Rosenburg (E3) .....
Rosenfeld (E5) 175
Rosenort (E5) 148
Ross (F5) .....
Rossburn (B4) 586
Rossburn Junction (C4) .....
Rossendale (D5) 137
Rosser (E5) 117
Rounthwaite (C5) 7
Routledge (B5) .....
Russell (A4) 1,100
Ruthenia (A4) .....
Sadlow (G5) 100
Saint Adolphe (E5). 500
Saint Alphonse (C5) 40
Saint Ambroise (E4) 400
Saint Andrews (E4). 850
Saint Boniface (F5) 26,342
Saint Charles (E5) ... 500
Saint Claude (D5) ... 300
Saint Eustache (E5). 122
Saint François Xavier (E5) 450
Saint George (F4) ... 40
Saint Jean-Baptiste (E5) 1,200
Saint Joseph (E5) .....
Saint Labre (G5) .....
Saint Laurent (D4) .. 281
Saint Lazare (A4) 320
Saint Léon (D5) .....
Saint Lupicin (D5) .. 268
Saint Malo (F5) 500
Saint Marks (E4) 80
Saint Martin Station (D3) .....
Saint Norbert (F5) .. 813
Saint Pierre-Jolys (F5) 812
Saint Raymond (F5)
Sainte Agathe (E5).. 500
Sainte Amelie (C4).. 100
Sainte Anne des Chênes (F5) 800
Sainte Elizabeth (E5) 300
Sainte Geneviève (F5) .....
Sainte Madeleine (A4) .....
Sainte Rose du Lac (C3) 701
San Clara (A3) 300
Sandilands (F5) .....
Sandridge (E4) .....
Sandy Lake (B4) 287
Sanford (E5) 98
Sarto (F5) .....
Scandinavia (C4) .....
Scanterbury (F4) 97
Scarth (B5) 94
Sclater (B3) .....
Scotch Bay (D4) .....
Seech (B4) .....
Selkirk (F4) 6,218
Senkiw (F5) 150
Seven Sisters Falls (G4) .....
Sewell (E5) 50
Sharpewood (E4) ....
Shell Valley (A3) ....
Shellmouth (A4) 86
Shergrove (C3) 150
Sherridon (H3) .....
Shevlin (A3) .....
Shoal Lake (B4) 721
Shorncliffe (E3) .....
Shortdale (A3) .....
Sidney (C5) 162
Sifton (B3) 1,000
Siglunes (D4) .....
Silver (E4) .....
Silver Bay (D3) .....
Silver Plains (E5) ....
Silverton Sta. (A4) .. 6
Sinclair Sta. (A5) 92
Sirko (F5) 5
Skownan (C3) .....
Skylake (E4) 140
Smith Hill (C5) .....
Snowflake (D5) 122
Solsgirth (B4) 85
Somerset (D5) 600
Souris (B5) 1,584
South Junction (G5) 250
Spearhill (D3) .....
Sperling (E5) 214
Split Lake (J2) 500
Sprague (G5) 400
Springstein (E5) .....
Spurgrave (G5) 140
Starbuck (E5) 230
Stead (F4) .....
Steep Rock (D3) 88
Steinbach (F5) 2,155
Stephenfield (D5) 10
Stockton (C5) 124
Stonewall (E4) 1,040
Stony Hill (E4) .....
Stony Mountain (E4) 200
Strathclair (B4) 245
Suffren (E4) .....
Sundown (F5) 150
Swan Lake (D5) 325
Swan River (A2) 2,290
Sylvan (E3) 250
Tenby (C4) 20
Terence (B5) 41
Teulon (E4) 645
Thalberg (F4) .....
The Narrows (D3) ...
The Pas (H3) 3,376
Thicket Portage (J3)
Thornhill (D5) 133
Tilston (A5) 125
Tolstoi (F5) .....
Toutes Aides (C3 ...
Transcona (F5) ....
Traverse Bay (F4 ...
Treesbank (C5) ....
Treherne (D5) .....
Trentham (F5) .....
Tummel (A3) .....
Two Creeks (B4) ...
Tyndall (F4) .....
Ukraina (B3) .....
Underhill (B5) .....
Union Point (E5) ...
Uno (B4) .....
Valley River (B3 ...
Valpoy (C3) .....
Vannes (E4) .....
Vassar (G5) .....
Venlaw (B3) .....
Vestfold (E4) .....
Victória Beach (E
Vidir (E3) .....
Virden (A5) .....
Vista (B4) .....
Vita (F5) .....
Vivian Station (F5) .....
Vogar (D4) .....
Volga (C3) .....
Wabowden (J3) ....
Wakopa (C5) .....
Waldersee (D4) ....
Walkerburn (A3) ...
Wampum (G5) .....
Wanless (H3) .....
Wapah (D3) .....
Ward (B3) .....
Warrenton (E4) ....
Wasagaming (B4 ...
Waskada (B5) .....
Waterhen (C3) .....
Wawanesa (C5) ....
Weiden (C3) .....
Wellwood (C4) .....
Westbourne (D4) ...
Westgate (A2) .....
Wheatland (B4) ....
Whitemouth (G5 ...
Whitewater (B5) ...
Willen (A4) .....
Windygates (D5) ...
Winkler (E5) .....
WINNIPEG (E5) .....
Winnipeg (Metropolitan Area) (E5) .....
Winnipeg Beach (F4) .....
Winnipegosis (B3 ...
Wisla (B4) .....
Wood Bay (D5) ....
Woodlands (E4) ....
Woodmore (F5) ....
Woodnorth (A5) ...
Woodridge (G5) ...
Woodside (D4) ....
York Factory (K2 ...
Zalicia (B3) .....
Zant (D3) .....
Zbaraz (E4) .....
Zelena (A3) .....
Zhoda (F5) .....

tive building and the civic auditorium are among the most beautiful buildings in Canada.

Culturally the city is proud of its achievements. The Manitoba Musical Festival, held here each spring, is the largest in the British Commonwealth and it has developed a number of musicians who have won fame abroad. The Winnipeg Ballet has won a leading place in the country. There is a flourishing school of art and a much appreciated orchestra. National groups preserve their native music and arts.

As the center of the grain trade and of industrial production (see section *Industry*) Winnipeg is the focus of prairie business life. Before the Canadian government took over the selling of wheat and coarse grains, the Winnipeg Grain Exchange was the largest on the continent. During and since World War II the selling of all wheat and, for the latter part of the period, all grains, has been under the control of the Canadian Wheat Board. The grain companies still buy from the producers but at an interim price set by the board. Any profit made by the board is distributed among the producing farmers. (See WINNIPEG.)

Agriculture.—Farming continues to be the basic industry of Manitoba but, whereas it was once dependent on wheat, it is now much diversified. This diversification has followed three trends. First, from wheat to other cereals; second, to dairying, poultry and livestock; and third, to sugar beets, sunflowers, corn, field peas and vegetables for canning. Practically all the farms are mechanized and there is a steady development of larger farm units. The main crops are still cereals, wheat, oats, barley, rye, and flaxseed. In 1949 the total value of agricultural produce was $262,841,000 of which $89,480,000 was derived from wheat, $53,894,000 from livestock and $27,331,000 from dairy products. With the growth of livestock production has come the development at St. Boniface of the largest stockyards in Canada, capable of handling 25,000 head at one time.

The beginning of 1950 found the farming industry in Manitoba in a flourishing condition. Farm mortgages were at the lowest point since agriculture was established as an industry. The farming income (1949) was $238,000,000, an increase of 257 per cent in ten years, (1940–1949).

Industry.—The greatest change in the economic life of Manitoba, and particularly of the metropolitan area of Winnipeg, in the decade 1940–1949 occurred in the rise of manufacturing. Whereas in 1939 the gross production was worth $134,000,000, in 1949 it was valued at $483,000,000, and its net value was crowding agriculture for first place. Approximately 80 per cent of the production comes from Greater Winnipeg. Manufacturing gave employment (1949) to an average of 40,978 people, or 37 per cent of all employees, and the wages paid in 1949 were $87,000,000. There were (1949) 1,600 plants in operation producing about 1,100 products. It is notable that most of the plants are the result of local initiative. The largest single industry is found in the meat packing plants numbering 12 in all. Altogether they make Greater Winnipeg the largest center in Canada of this industry. Next come the needle trades which have developed rapidly during and since World War II. An outstanding feature of Manitoba's industry is the large number of small plants, some of which were (1949) being established in the smaller towns. The varied character of the population means a wide diversity of skills resulting in a great variety of products and the constant addition of new ones.

Industry is in a specially favoured position because of the large market at its doors. The western Canadian market stretching from the Great Lakes to the Rocky Mountains with a population of 2,500,000 people is the natural outlet for Manitoba production. For Greater Winnipeg, combined with Portage la Prairie, one of the most active of the smaller cities, the average of per capita purchases (1947) was $890 compared with $462 for the whole of Canada and $825 for the United States. It is noteworthy that of more than 100 British agencies established in Canada in 1949 over 90 per cent were located in Manitoba. Another helpful factor is the good situation in labor, its quantity, quality, and variety, its general good relations with employers, and the small number of strikes and lockouts (1949, 20,587 lost days). The government department of labor is active in maintaining this good relationship through its administration by boards of the Manitoba Labour Relations Act, the Fair Wage Act, the Minimum Wage Act, the Hours of Work Act, and the Vacations with Pay Act.

Of the gross value of industrial production (1948 est.) food and beverages account for $166,977,418, clothing (textiles and furs) for $34,457,418, and iron and steel for $30,394,097.

Finance.—The province has been fortunate in that for many years its finances have been managed in a sound and prudent manner. Although the expenditures increased from $16,960,000 in 1939 to $38,280,000 (est.) for 1950, the latter figure is far below that of the other western provinces which have approximately the same population. Provincial taxes are the lowest of any province in Canada. The debt of the province, as of March 31, 1950, was $100,800,000 of which $62,000,000 was not self-sustaining. Under an Act passed in 1947 this debt will be paid by 1974.

The city of Winnipeg's position is also sound. Exclusive of self-supporting debt, the city's debt, (Dec. 31, 1949,) was $14,000,000, against which the sinking fund was $7,000,000. Similarly the municipalities in the last ten years (1939–1948) reduced their liabilities by $6,000,000, and increased their assets $8,700,000.

Eight of Canada's 10 banks operate in Manitoba, having 59 branches in Greater Winnipeg. Checks passing through the Winnipeg Clearing House in 1949 amounted to $6,222,179,000. The Bank of Canada maintains a central agency in Winnipeg, as does its subsidiary, The Industrial Development Bank, which provides financial assistance to smaller businesses. Winnipeg is the head office of three insurance companies, one of them, the Great West Life Assurance Company, being one of the largest in Canada. Personal incomes of Manitoba citizens which in 1941 averaged $470.00 had by 1948 risen to $946.00, an increase of over 100 per cent compared to an 81 per cent increase in the national income.

Transportation and Communication.—Due to Winnipeg's geographical position it has become one of Canada's great railway centers. Two great railway systems, the Canadian Pacific and the Canadian National, have their western headquarters in Winnipeg which is also served by three smaller Canadian roads and is linked with the United States by the Great Northern, North-

ern Pacific, and Soo lines. The Canadian Pacific has within the city the largest individually owned railway yards in the world. The area of Winnipeg is also an important air center being at the major aerial crossroads of the continent. It is peculiarly fortunate in that its commercial airport is only four miles from the business center and is capable of indefinite expansion. Three airlines operate regular services: the Trans-Canada, the Canadian Pacific, and the Northwest. All three have regional operation headquarters at the airport. Water transport also plays its part. Canada's most inland seaport, Churchill, on Hudson Bay, which provides the shortest route to Europe from the middle of the continent, is within Manitoba making it a maritime province.

The Manitoba Telephone System is owned by the provincial government and operated by a commission appointed by it. It covers practically every inhabited section of the province including many of the remote mining areas. Its rural service is given at the lowest rates in the Dominion. Winnipeg has a full automatic service at a cost less than that of any city of its size on the continent. The commission maintains, at rates fixed by the Public Utilities Board, the plant at 100 per cent value and, in addition, has turned over to the province in 8 years (1943–1950) profits of $8,000,000. Seven radio broadcasting stations operate in the province including two short wave stations and the two Canadian railways give full telegraph service.

Health and Welfare.—The department of health, having administrative jurisdiction over all matters relating to health and welfare, is the largest department of the provincial government and is generally agreed to be one of the most advanced on the continent. In addition to widely spread and varied health services, it operates large hospitals for mental, incurable, and tubercular patients, has a far reaching nursing service, and is rapidly developing a system of health units. The Manitoba Hospital Service (Blue Cross) has enrolled within its membership 40 per cent of the people of the entire province, including two thirds of the citizens of Winnipeg.

Winnipeg has also a well-developed department of health giving medical, dental, and nursing services to all child-caring institutions, schools, and those citizens requiring free services. It operates three large hospitals for those suffering from tuberculosis, communicable diseases, and incurables with a capacity of 548 beds. Three large general hospitals and several smaller ones are operated under private boards.

The province maintains its own system of workmen's compensation and mothers' allowances, and cooperates with the federal government in the payment of old age pensions and pensions for the blind. Of these pensions the federal government pays 75 per cent. It also makes grants to the province for hospital construction and cancer control. Out of a total expenditure on these services of $3,900,000, the federal contribution is $2,870,000. Care of the unemployed and unemployables is the responsibility of the municipalities in ordinary times; in times of extraordinary stress in unemployment, the federal and provincial governments assist.

Winnipeg operates a large department of public welfare, and is the center of a wide variety of philanthropic institutions numbering 700 in all. The outstanding feature of social welfare work in Winnipeg lies in the wide use of volunteer workers under the direction of the Central Volunteer Bureau, a citizen's agency.

Education.—Elementary education is free and compulsory for all children between the ages of 6 and 14 years and also free for high school students to 21 years. It is organized upon the usual basis of 6 plus 3 plus 3. Entrance to the university is from the 11th grade, the 12th grade being equivalent to the first university year. All questions of curricula and general policy are under the control of the department of education, but the provision and management of the schools rests with the boards elected in school districts. The government makes substantial grants to these boards, the chief one providing an addition to the funds raised by local taxation up to a minimum of $1,400.00 per teacher, but the main support comes from the local taxpayers. There are approximately (1950) 120,000 students enrolled in all grades. Of those entering grade 1, 62 per cent reach high school entrance—grade 8, and 32 per cent university entrance—grade 11. General supervision of the schools, in which there are 4,700 teachers, is exercised by the department's staff of 35 inspectors. The government owns and operates a residential normal school, the only such school in Canada, in which approximately 400 teachers are trained each year; teachers in the secondary schools get their training in the faculty of education of the university.

Generous provision for technical education is made in the government's new Technical Institute where work in laboratories is given for one half of the time and general education for the other half. Advisory committees from labor and industry keep the curriculum in step with advances in industry. The institute also offers courses in post-high school work and some technical training is offered as part of the regular course in the larger schools. For this phase of education the federal government makes grants proportionate to the provincial outlay.

Government and Courts.—The legislature of Manitoba consists of 57 members. It exercises supreme control over all the affairs of the province which come within the authority of the province as defined in section 92 of the British North America Act. It is elected for a term of five years but is does not always continue for the full term, it being at the option of the government to call an election at any time.

The conduct of affairs is based on the British parliamentary system. Under this system the Cabinet, or executive, is chosen by the leader of the party from among the members of the party having the largest number. All Cabinet members must be members of the legislature to which body the Cabinet is directly responsible. Four parties share the allegiances of Manitoba's voters: Liberal, Conservative, Canadian Cooperative Federation (Socialist); and Communist (one member in 1950). Since Nov. 4, 1940, the province has had a coalition government, composed, in 1950, of Liberals and Conservatives. Douglas L. Campbell became premier, Nov. 13, 1948. The Canadian Cooperative Federation is the official opposition party. The franchise is held by all persons over 21 years of age except the insane, criminals, and Indians living in reservations. Judges do not vote. Manitoba is represented in the federal Parliament by 16 members in the House of Commons and 6 members in the Senate.

The titular head of the government is the

lieutenant governor who is the direct representative of the king and who, like the king, acts only on the advice of his ministers. He is appointed by the federal government for a term of not less than five years. The present (1950) lieutenant governor, Hon. R. F. McWilliams, was appointed in 1940.

Each department of government is directed by a minister, as members of the Cabinet are called. Departments (1950) are agriculture, attorney general, dominion-provincial relations, education, health and public welfare, labour, mines and natural resources, municipal, provincial secretary, public utilities, and treasury.

Local government is highly organized, the province being divided into cities (4), towns (23), villages (35), and rural municipalities (114). Each municipality has its elected council controlling local affairs with the aid and partial supervision of the provincial government. Each has also its own school board. (See section *Education.*) There are no counties.

The courts of Manitoba include the court of appeal, the high court of justice and the county courts. Judges of these courts are appointed and paid by the federal government. There are also police courts, juvenile courts, and a family court. Magistrates in charge of these are appointed by the provincial government. The province is divided into six judicial districts, each of which has a county court with a resident judge, the district of Winnipeg having four judges. The provincial government maintains a prison farm near Winnipeg and several jails. There are also reform schools for juveniles. The Royal Canadian Mounted Police assume the duties of provincial police.

Provincial Premiers since Confederation

Alfred Boyd	Sept. 16, 1870
Marc Amable Girard	Dec. 14, 1871
Henry J. H. Clarke	Mar. 14, 1872
Robert A. Davis	Dec. 3, 1874
John Norquay, *Con.*	Oct. 16, 1878
David H. Harrison, *Con.*	Dec. 26, 1887
Thomas Greenway, *Lib.*	Jan. 19, 1888
Sir Hugh J. Macdonald, *Con.*	Jan. 10, 1900
Sir Rodman P. Roblin, *Con.*	Oct. 29, 1900
Tobias C. Norris, *Lib.*	May 12, 1915
John Bracken, *Lib.-Prog.*	Aug. 8, 1922
Stuart S. Garson, K.C., *Lib.-Prog.*	Jan. 14, 1943
D. L. Campbell, *Lib.*	Dec. 14, 1948

History and Political Development.—Although Pierre Gaultier de Varennes, Sieur de la Vérendrye, of Quebec, was the first white man to see the site of modern Winnipeg, he was preceded by Thomas Button (q.v.), in 1612, and by Pierre Esprit Radisson and Médart Chouart, Sieur de Groselliers (q.v.) out of whose marvellous cargo of furs came the grant from King Charles II which, in 1670, created the Hudson's Bay Company (q.v.). Henry Kelsey was the first man to see the prairies (1691). There was no settlement until Thomas Douglas, 5th earl of Selkirk, having secured control of the company, sent out from the Scottish Highlands the first group in 1811. Those settlers suffered incredible hardships in the first years, and not until 1820 had their settlement at the junction of the Red and Assiniboine rivers a permanent basis. Thereafter it remained for 40 years an island of British folk in the great northwest, ruled by officials of the company which controlled the vast area draining into Hudson Bay. By 1860 conditions of isolation were disappearing. In another ten years Canada had bought the rights of the company for $1,500,000 and had created the province of Manitoba which became the fifth province of the three-year-old Dominion of Canada on July 15, 1870.

Preparations for this changed status had created restlessness among the Métis (French-Indian) who were greatly in the majority, and a rebellion, led by Louis Riel (q.v.), made the early days of the new province difficult. (See Riel's Rebellion.) The wisdom and caution of the first lieutenant governor, Adams George Archibald (q.v.), gradually succeeded in establishing the usual institutions of representative government. Immigration came steadily from eastern Canada, followed by the first European immigrants from Europe, Mennonites from Russia in 1874, and Icelanders in 1875. In 1876 the first shipment of *Manitoba Hard* wheat was sent to eastern Canada.

Prior to 1870 there was neither steamboat nor stagecoach running regularly to Winnipeg, but with the coming of the railways the pace of development began to quicken. Winnipeg experienced a fantastic land boom which collapsed in 1882, but left more men, more money, and many substantial buildings in the city. The province, however, faced a bleak prospect. It had an area of only 14,000 square miles; its only revenue was a meager subsidy from the federal government which had kept under its control all the natural resources including the lands; the Canadian Pacific Railway had been given a railway monopoly and extensive grants of land; even larger grants had been made to the Hudson's Bay Company. At every turn the province was hampered in development, especially in settlement and in the building of local railways which made settlement possible. Under John Norquay as premier (1878–1887), and his successor, Thomas Greenway (1888–1900), a bitter struggle was waged with the federal government to secure provincial rights. A moderate extension of the province's area, and increase in the federal subsidy, which left it still inadequate, and the surrender by the Canadian Pacific of its monopoly were gradually conceded. In 1912 the area of the province was extended to its present size, but not until 1930 did the province secure control of its own resources together with a payment of $5,000,000 for those already alienated.

All through this time of struggle, the question of what schools were to be allowed kept political life at a tension. The second Riel rebellion which broke out with the return of Riel from Montana (1885), was quickly put down, but it stirred into new life the latent contest between the French-Canadian and the English speaking populations. The Manitoba Act allowed the continuance of the church schools, the only ones then in existence. The settlement of large numbers of English-speaking Protestants from Ontario brought about a rapid decline in the numbers and importance of the French-Canadians. By 1879 their numbers in the legislature had declined from one half to one sixth. In 1881 the legislature ordered that the education grant, hitherto divided equally, should be distributed in proportion to the number of children of each race in each school district. In 1890 the old system was abolished. A department of education was established and given charge of all schools in which education was now to be free, all property being taxed for their support. No school which did not come under the new department, was to have any

grant. The French-Canadians, most of whom were Roman Catholics, were thus faced with paying double taxation if they wished to maintain their own schools in their own way. The validity of the law was challenged in the courts but the privy council held that the province had acted within its rights. The Manitoba School Question became a national one. In and out of parliament this question cut across political lines. In the election of 1896 Sir Wilfrid Laurier (q.v.), himself a French-Canadian, fought for the right of Manitoba to pass her own legislation, and won. As prime minister (1896–1911) he succeeded in effecting an arrangement with the Greenway government by which bilingual instruction might be given in English and in any other language. With the coming of immigrants from many lands the bilingual privilege was grossly abused. Barely one half of the children were attending school. In 1915 a new government headed by Tobias Crawford Norris (q.v., 1915–1922), with Dr. Robert Stirton Thornton as minister of education, came into office on a policy of compulsory education, which received popular support.

Shortly after the Laurier government came to power, it embarked on an active policy of assisted immigration under the direction of Clifford Sifton (q.v.), a Manitoban, who became minister of the interior. Almost at once American farmers poured into the country followed by eastern Canadians and British, and then by large numbers from Europe. The majority of these immigrants went on farther west but thousands remained in Manitoba. Her population which had been 91,279 in 1901 increased to 461,394 in 1911 and the peak of immigration was not reached for another two years. In 1914 the World War I stopped this movement. Manitoba sent large contingents to join the struggle and, in spite of a labor shortage, produced large quantities of food for the Allies. Just as her troops were returning, the most protracted general strike of labor in the history of Canada broke out in Winnipeg For six weeks the city was without the usual services except those which could be partially continued by volunteers. In the end the strike was broken.

In 1920 the sudden fall in wheat prices brought disaster to the farmers and, in consequence, great hardship to the whole province. In their despair the western farmers turned to political organization and the progressive movement was born. It went from success to success In Manitoba this party won the election and a farmers' government resulted under the leadership of John Bracken (q.v.). The following year the farmers of Manitoba joined those of the other prairie provinces in the decision to organize voluntary pools for the handling of wheat. Already the United Grain Growers, which had its beginning in Manitoba in 1906, had shown what could be done by voluntary association. The idea spread like wildfire and by 1924 the Manitoba pool was in operation. In the time of high prices in the next six years the pool flourished but came to disaster when world prices again fell early in 1930. But by this time the pool was able to exercise strong pressure and the government came to its rescue. It passed successfully through the years of depression (1930–1937), repaid its loan and again became highly successful. Of the 52,000 farmers in the province somewhat more than one half were (1949) members of the pool which in the crop year of 1948–1949 handled 45 per cent of all the grain sold.

The province also suffered heavily in the depression years, but came through with its credit unimpaired—the only one of the Prairie provinces to do so. In World War II Manitoba played the same part she had in the World War I in the sending of forces and food products, but her factories had by then sufficiently developed for her to share in the production of munitions; the basis of her present industry was laid in those years.

The most important event in Manitoba's history since World War II has been her cooperation with seven of the 10 provinces in a new financial arrangement with the federal government. Under the new plan, the provinces surrendered to the federal authority their right to impose income taxes, succession duties, and most corporation taxes, for five years terminating March 31, 1952, and received in return a much larger subsidy. In the first year (1947–1948) the result was an increase in Manitoba's revenue of $5,400,000. Provision for additional amounts in proportion to the national income has made a further increase of $9,900,000. See CANADA.

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MARGARET MCWILLIAMS,
Author of "Manitoba Milestones" and "This New Canada."

MANITOBA, Lake, Canada, situated in Manitoba province, to which it gives its name, is about 59 miles southwest of Lake Winnipeg. It is of irregular shape, 119 miles long, with a maximum breadth of 29 miles, a shoreline of 535 miles, an area of 1,817 square miles and an average depth of 12 feet. It is 810 feet above sea level, and 40 feet higher than Lake Winnipeg, into which it drains through the Saskatchewan or Dauphin River. It was discovered in 1739 by Pierre Gaultier de Varennes, Sieur de la Vérendrye.

MANITOBA, University of. Long before the formation of the Province of Manitoba in 1870, education in the Red River Settlement had been promoted by the churches. A school opened by Father Provencher in 1818 later developed into the Roman Catholic College of St. Boniface. Various schools functioned precariously under the Anglican clergy from 1820 until St. John's College was finally established in 1866 by Bishop Machray. Lord Selkirk's Scottish settlers, with the help of the Presbyterian Church, organized a school in 1847, which later, upon the arrival of Dr. George Bryce from Ontario in 1871, gave rise to Manitoba College. It was due to the vision and zeal of George Bryce and his contemporaries, and not less to the support and statemanship of Hon. Alexander Morris, lieutenant governor from 1872 to 1877, that the University of Manitoba came into being on February 28, 1877, as an examining and degree conferring body.

The population of Manitoba in 1871 was only

25,228. New settlers from the east did not begin to arrive in any numbers until 1879. The Provincial Government, which granted the University of Manitoba charter in 1877, regarded it as premature, but yielded to the urging of its advocates who wished to secure an impartial standard in higher education and to ensure cooperation instead of sectionalism among the denominational colleges. The government of the university was vested in a council on which the original colleges were equally represented. All teaching continued to be done by the colleges according to a common curriculum, until the expense of developing scientific subjects made necessary the next major change in the university.

The first professors were appointed in 1904, five in number, to give instruction in mathematics and the natural sciences in a new building, the first which the university had possessed. Slowly but steadily the university expanded its teaching departments by the addition of professors of civil and electrical engineering (1907, 1909), architecture and modern languages (1913), until in 1914 for the first time it offered the full work for the bachelor's degree in arts and science. It was in 1914 that Manitoba College restricted itself to theology and its students and staff in arts transferred to the university.

Expansion inevitably brought a change in administration. The acquisition of students, staff and building involved income and expenditure, the latter much greater than the former. The province, which since 1877 had needed to contribute little financial support, now began to be asked for increasing annual grants. An endowment of 150,000 acres of land obtained from the Dominion Government in 1898 added gradually but substantially to the university's revenue as sales were realized. The University Act of 1917 established a board of governors, appointed by the provincial government, as the plenary authority in the university. In 1934 graduates obtained the right to elect three members to this board. The university council continued to have general charge of academic work until it was replaced by the Senate set up under a new University Act of 1936. The university has had a chancellor, a vice chancellor and a registrar since 1877.

Subsequent to the granting of the charter, other denominational colleges became affiliated with the university and now prepare candidates for the university's degrees in arts and science. The earliest of these to join was Wesley College (1888), now united with Manitoba College as United College. Later came St. Paul's College (R.C., 1931) and Brandon College (1938), which severed its conection with the Baptist Church when it sought support from public funds.

In the first half of the century, the university's rapid growth was marked by the adhesion of a number of professional schools and the establishment of others as faculties and schools of the university. These included medicine 1882, pharmacy 1902, agriculture 1907, home economics 1911, law 1914, engineering 1920, architecture 1924, education 1935, commerce 1937, interior design 1938, nursing education 1943, social work 1943, music 1944, fine and applied arts 1950. In 1949 the Committee on Graduate Studies was reconstituted as a Faculty of Graduate Studies and Research.

In 1913 the agricultural college occupied a new group of buildings five miles south of Winnipeg in the municipality of Fort Garry. To this beautiful site of 1,100 acres in a bend of the Red River the university was moved gradually as other buildings were erected. In 1950 the move was complete. The law school and the faculty of medicine remained in Winnipeg. In 1950 the total enrollment of students was 5,50(in regular courses leading to degrees and de plomas, and 2,800 in summer school and othe courses. The staff numbered 296 full time and 257 part time instructors.

W. M. Hugill,
Professor of Latin and Greek.

MANITOU, măn'ĭ-tōō, a name given, among the American Indian tribes, to any spirit or supernatural being, good or evil; also applied to any object of religious awe and reverence. "The Illinois," wrote the Jesuit Father Marest, "adore a sort of genius, which they call manitou; to them it is the master of life, the spirit that rules all things. A bird, a buffalo, a bear, a feather, a skin—that is their manitou." "If the Indian word manitou," says John G. Palfrey, "appeared to denote something above or beside the common aspects and agencies of nature, it might be natural, but it would be rash and misleading to confound its import with the Christian, Mohammedan, Jewish, Egyptian, or Greek conception of Deity, or with any compound of a selection from some or all of those ideas." The word was applied to any object used as a fetish or an amulét.

MANITOU SPRINGS, Colo., town and resort in El Paso County; altitude 6,336 feet; 3 miles northwest of Colorado Springs, and 9 miles from the summit of Pike's Peak; on the Denver and Rio Grande Western; Midland Terminal; and Manitou and Pike's Peak railroads. The town has been known as Manitou and Manitou Iron Springs. The Manitou and Pike's Peak cog railway, more than eight miles long, goes to the summit of the Peak, and there is an inclined railway to the top of Mt. Manitou (9,455 feet). Its healthgiving, highly radioactive mineral springs of soda and iron, saturated with carbonic acid gas, flowing a quarter of a million gallons daily, were known to the Indians and were a neutral ground, their sacred character being marked by the name Manitou meaning Great Spirit. John Charles Frémont (q.v.), explored this region in 1843 and analyzed the waters, which for a while were called Frémont Soda Springs. West of the town is Pike National Forest, part of the Pike's Peak State Game Refuge, and one of the largest forest preserves in the state. Near by are many scenic attractions, such as the Garden of the Gods, with unusual shapes and colors due to erosion, the Cave of the Winds, Rainbow Falls, and Ute Pass. Like Colorado Springs, Manitou was developed largely by General William Palmer, who, with Dr. William A. Bell, founded it in about 1872. Pop. (1940) 1,462; (1950) 2,580.

MANITOULIN (măn-ĭ-tōō'lĭn) **ISLANDS,** Canada, a group of islands in the northern part of Lake Huron, partially separating the waters of the lake from Georgian Bay, and east of the famous "Soo" Canal. The name is a corruption of the Indian word Manitouin, which means divinity. Except Drummond Isle, about 24 miles long and 9 miles

wide, which belongs to the State of Michigan, the group is a part of the Province of Ontario. The largest island of the group is Grand Manitoulin, or Sacred Isle; about 80 miles long and 30 miles at the widest. The coast is very irregular. Cockburn, or Little Manitoulin, is nearly circular, and about eight miles in diameter. All the islands are well wooded; Grand Manitoulin and Cockburn have large pine forests. The shore waters abound in fish. About one fifth of the inhabitants are Indians of the Algonquin tribe. The cool climate in summer and the striking natural features add to the attractions of the islands and make them a favorite summer resort. Pop. (1941) 10,841.

MANITOWOC, măn'ĭ-tō-wŏk, city, Wisconsin, seat of Manitowoc County and a port of entry, altitude 595 feet, is located on Lake Michigan, at the mouth of the Manitowoc River, 25 miles north of Sheboygan, on the Ann Arbor; Chesapeake and Ohio; Chicago and North Western; and Soo Line railroads. It has a municipal airport. It has a good harbor, shipbuilding and repair yards, grain elevators, fisheries, and an extensive coal trade. Its manufactured products include aluminum ware and castings, flour and malt products, furniture, canned vegetables, cheese, and condensed milk.

The British North West Company had a fur trading post here in 1795, and permanent settlement began with the land boom of 1835. Many Germans settled here in 1848, followed soon by Norwegians and Irish; Bohemians came in 1854, and Poles after 1865. The city was chartered in 1870. The name is an Indian word meaning "home of the Great Spirit." Pop. (1940) 24,404; (1950) 27,598.

MANIWAKI, măn-ĭ-wô'kĭ, village, Canada, Quebec Province, capital of Gatineau County, is located at the confluence of the Gatineau and Desert rivers, 82 miles northwest of Ottawa, and is the terminus of a branch of the Canadian Pacific Railway. In a lumber region, it has pulp mills and sawmills. The region is also famous for winter sports, hunting and fishing. There is a Roman Catholic college and hospital here, and a weekly newspaper. The village was incorporated in 1930. Pop. (1951) 3,835.

MANIZALES, măn-ĭ-zä'lĕs; -zăl'ĕs (Span. mä-nê-sä'lâs), city, Colombia, capital of Caldas Department, is located 110 miles northwest of Bogotá, at an altitude of 7,064 feet, on a ridge of the Cordillera Central range of the Andes Mountains. An aerial tramway 45 miles long connects it with Mariquita. It is an important coffee center, and there are gold, silver, and mercury mines nearby. It has a pleasant climate, though the rainfall is heavy, and is a modern city with fine parks, schools, cathedral, library, theaters, and a stadium.

Manizales was founded in 1847 by prospectors for gold, who named it for a kind of stone they found there and called maní. It was the scene of conflict during the civil wars of the mid-19th century, was destroyed by earthquake in 1878, and by fire in 1925. Since then it has been rebuilt largely of concrete. Pop. (1938) 51,025.

MANKATO, măn-kā'tō, city, Minnesota, seat of Blue Earth County, on the Minnesota River at the mouth of the Blue Earth River, 85 miles southwest of St. Paul, on the Chicago, Milwaukee, Saint Paul and Pacific; the Chicago Great Western; the Chicago and North Western; and the Chicago, Saint Paul, Minneapolis and Omaha railroads. It is situated in an agricultural region and in the vicinity are valuable stone quarries. Nine miles south is the Rapidan Dam, furnishing hydroelectric power for numerous southern Minnesota cities and villages. Mankato is the leading metropolis of southwestern Minnesota, and the trade center for that section. Its factories produce brick, cement, clothing, leather goods, flour, foods, boxes, brooms, and numerous other items. The Mankato hog market is one of the largest in the state, and the poultry industry and the creamery business are important factors in the city's commerce.

Mankato is the Sioux name for the blue earth found in the vicinity, specimens of which Pierre Le Sueur shipped to France in 1701 believing them to be copper-bearing. The city was laid out in 1852. During its early days Indians caused much trouble. Following the uprising of 1862, over 400 Sioux Indians were tried for murdering white settlers, and 303 condemned to death were brought to Mankato and held at Camp Lincoln, now Sibley Park. President Abraham Lincoln commuted the sentences of all but 38 and these were hanged simultaneously from a single gallows on Dec. 26, 1862. Mankato was incorporated as a village in 1865, and chartered as a city in 1868. It is the seat of a state teachers college and of Bethany Lutheran College. Pop. (1950) 18,809.

MANLEY, măn'lĭ, **John,** American naval commander: b. 1734; d. Boston, Feb. 12, 1793. At the outbreak of the Revolutionary War he was given command of the armed schooner *Lee,* with which he cruised along the coast of Massachusetts Bay, making captures of great value to the American army then at Cambridge. In July 1777 his ship, the *Hancock,* was captured by a British frigate and after a rigorous confinement on a prison ship in New York harbor, he was exchanged in March 1778. In 1782 he was put in command of the *Hague* frigate, which, after lying in a perilous position off the West Indies for three days, exposed to the fire of four British ships, contrived to effect her escape, and in January 1783 captured the *Baille.* This exploit closed the regular maritime operations of the United States during the Revolutionary War.

MANLEY, Joseph Homan, American journalist and politician: b. Bangor, Me., Oct. 13, 1842; d. Augusta, Me., Feb. 7, 1905. He was graduated from the Abbott Family School for Boys at Farmington, Me., in 1858 and in 1863 from the Albany Law School in Albany, N. Y. He was admitted to the bar in 1865. In 1866 he was president of the city council of Augusta and in 1881 was appointed postmaster of Augusta, an office he held for seven years. Acquiring a half interest in the *Maine Farmer* in 1878, he joined with James G. Blaine in local and national politics, dictating the editorial policy of that paper for three years. He was a delegate to the Republican National conventions of 1880, 1888, 1892, and 1900; member of the state Senate in 1903–1904; was for many years chairman of the Maine Republican State Committee; a member of the Republican National Committee, and chairman in 1896–1904; and was a notable figure in

the executive committees of 1896 and 1900, which aided in the election of McKinley.

MANLEY, Mary de la Rivière, English author: b. in the Island of Guernsey about 1663; d. London, July 11, 1724. She succeeded Swift as editor of the *Examiner* in 1711. She is known for her *Secret Memoirs and Manners of Several Persons of Quality of Both Sexes: from the New Atlantis* (1709), a licentious satire reflecting on politicians of the day, that caused the arrest of both the author and the publisher though they were subsequently discharged. This work was continued in the *Memoirs of Europe* (1710). She also published *Letters Written by Mrs. Manley* (1696); *The Secret History of Queen Zarah and the Zarazians* (1705); *The Adventures of Revella* (1714); *The Power of Love: in Seven Novels* (1720), and other unimportant books.

MANLIUS, măn'lĭ-ŭs, **Marcus,** Roman legendary hero, of the 4th century B.C., called Capitolinus because of his successful defense of the Capitoline Hill. Tradition says he was aroused to action by the cackling of Juno's sacred geese just in time to prevent the surprise of the citadel by the Gauls (390 B.C.). Two years before he defeated the Aequi; and in six years after (384 B.C.) was thrown from the Tarpeian rock, having been declared guilty of plotting to become king or dictator. This judgment, almost certainly unjust, was due to the envy of the patricians, who distrusted Manlius' philanthropic endeavors to free plebeians sold for debt.

MANLY, Basil, American clergyman and educator: b. Pittsborough, Chatham County, N.C., Jan. 28, 1798; d. Charleston, S.C., Jan. 25, 1865. He was graduated at South Carolina College in 1821, and, after filling several charges, in 1837 he became president of the University of Alabama, remaining there nearly 20 years.

MANLY, John Matthews, American educator and author: b. Sumter County, Ala., Sept. 2, 1865; d. April 2, 1940. He was graduated from Furman University in 1883 and from Harvard in 1889, and took his D.Ph. at Harvard in 1890. From 1891 to 1898 he was associate professor and professor of English at Brown University and from 1898 to 1933 was professor and head of the department of English at the University of Chicago. In 1909 he was Chicago exchange professor at the University of Göttingen. He was a member of the Modern Language Association. He contributed to the *Cambridge History of English Literature* and to the *Encyclopaedia Britannica* and to various periodicals. He edited *Macbeth* (1896); *Specimens of the Pre-Shakespearean Drama* (1897); *English Poetry* (1907); *English Prose* (1909); *A Manual for Writers,* with J. A. Powell (1914); *English Prose and Poetry* (1916); *Contemporary American Literature* (1922); *Some New Light on Chaucer* (1926).

MANN, Sir Donald D., Canadian contractor and financier: b. Acton, Ontario, March 23, 1853. In the later 70's he went West, became manager for a firm of contractors who had a sub-contract on the Canadian Pacific line and thereafter worked continuously as a contractor until the completion of the main railway. Between 1881 and 1883 he completed various contracts for railroads and in the two following years began railroad-building in the mountains. He also undertook contracts for construction and tunnels in Columbia Cañon and in the Selkirk Range of the Rocky Mountains. Together with Sir William Mackenzie (q.v.) he constructed the Canadian Northern Railway (q.v.). In 1887 and a part of 1888 they constructed the Canadian Pacific short line through Maine. In December 1888 Mr. Mann visited Panama, Ecuador, Peru and Chile with a view of building railways for the Chilean government, but was not satisfied with the prospects there and declined the contract offered. Later he visited China. He was associated with the building of the Qu'Apelle, Long Lake and Saskatchewan Railway, and was one of the original syndicate which built the Winnipeg Electric Street Railway. He was also interested in many other enterprises. He was knighted in 1911. He died Nov. 11, 1934.

MANN, Heinrich, German novelist, brother of Thomas Mann (q.v.): b. Lübeck, March 27, 1871. He attended the Katharineum School in his native city and then entered business. In 1893 he moved to Munich, later changing his abode to Berlin, with frequent sojourns in Italy, particularly Florence. His permanent home he finally fixed at Munich. Like his brother Thomas, Heinrich is a reserved, unsociable character, who has developed a feeling almost of hostility for the types of German life with which he is surrounded. His mother was partly of creole origin, and this circumstance is taken by some German critics (e.g., Kurt Martens in his essay in *Literatur in Deutschland,* 1910) as explaining Heinrich's predilection for the life and literature of the Romance countries as opposed to those of the Germanic countries. His first works were volumes of short stories: *Das Wunderbare* (1897); *Ein Verbrechen und andere Geschichten* (1898). Next came novels: *In einer Familie* (1898); *Im Schlaraffenland* (1901); *Die Göttinnen, oder die drei Romane der Herzogin von Assy* (3 vols., 1902–03); *Die Jagd nach Liebe* (1904). *Die Göttinnen* represents an ideal of womanhood in three different phases (Diana, Minerva, Venus) and is a brilliantly constructed hymn of joy in the Romance style. Again he turns to the short story: *Flöten und Dolche* (1905); *Professor Unrat* (1905); *Eine Freundschaft* (1906). *Zwischen den Rassen* (*Between the Races,* 1908) is a novel dealing with the affection of a young girl, Lola Gabriel, for a German and an Italian, who are supposed to incorporate the virtues of their respective races. It has met with great popularity, but the attempt to capitalize racial characteristics in this way is too great a task for all but the greatest men. Heinrich Mann has also tried his hand at the drama, in *Die Schauspielerin* (1911), but with no particular success.

JACOB WITTMER HARTMANN.

MANN, Horace, American educationist: b. Franklin, Mass., May 4, 1796; d. Yellow Springs, Ohio, Aug. 2, 1859. He was graduated from Brown University in 1819, studied law at the Litchfield (Conn.) Law School and in offices at Dedham, Mass., in 1823 was admitted to the bar, and practised at Dedham from 1827 to 1833, when he removed to Boston. In 1827–33 he was a representative in the state legislature, in 1833–37 state senator and in 1836–37 presi-

dent of the senate. From the first he identified himself with philanthropic interests. His first speech in the assembly was on religious liberty; and one of his enterprises was the establishment of the State lunatic hospital at Worcester (1833), in connection with which he was chairman of the board of commissioners and later of the board of trustees. In 1837, upon the appointment by the State of a board of education to revise and reorganize the Massachusetts common-school system, Mann became secretary to the board (19 June). He withdrew from politics and from a lucrative practice at the bar, and devoted himself entirely to a work which proved of the greatest significance not for Massachusetts only but for the entire United States. This work he accomplished largely in spite of opposition often pronounced. For the reform of State education he founded and edited the monthly *Common-School Journal*, held teachers' conventions, published 12 most valuable annual reports and established normal schools. In 1843 at his own expense he visited Europe for the study of Continental methods. He was successful in arousing throughout the country an unprecedented interest in educational affairs. In 1848 he was elected to Congress to succeed John Quincy Adams, deceased; and he served until March 1853. He was strongly opposed to slavery, and fearlessly attacked Webster's course. On 15 Sept. 1852, he declined the nomination for the governorship of Massachusetts, and on the same day accepted the presidency of Antioch College, Yellow Springs, Ohio, in which post he served until his death, greatly influencing the educational development of Ohio. He was a Fellow of the American Academy of Arts and Sciences. In addition to his annual reports he published 'Reply to 31 Boston Schoolmasters' (1844); 'Report of Educational Tour' (1846); 'A Few Thoughts for a Young Man' (1850); 'Slavery: Letters and Speeches' (1852); 'Lectures on Intemperance' (1852); 'Powers and Duties of Woman' (1853); and 'Sermons' (1861). Consult the 'Life' by Mary P. Mann (1865); and Boone, 'Education in the United States' (1890); 'Report' (United States Commission of Education, 1895–96); Hubbell, G. A., 'Life of Horace Mann' (1910).

MANN, James Robert, American congressman: b. near Bloomington, Ill., 20 Oct. 1856. He was graduated at the University of Illinois in 1876 and at the Union College of Law, Chicago, in 1881. He was admitted to the bar in 1881 and thereafter practised law at Chicago. He was attorney for the village of Hyde Park in 1888 and upon its annexation to Chicago he became alderman of the 32d ward, serving in 1893–96. He was temporary chairman of the Republican State Convention in 1894. He was master in chancery of the Superior Court in Cook County in 1892–96, and general attorney of the South Park Board, Chicago, in 1895. He was elected to Congress in 1896 and served continuously until his death, 30 Nov. 1922. He was leader of the Republican minority in the House during the Wilson Administration.

MANN, Matthew Derbyshire, American gynecologist: b. Utica, N. Y., 12 July 1845; d. Buffalo, N. Y., 3 March 1921. Graduated at Yale 1867, at College of Physicians and Surgeons, Columbia, 1871, he later studied in Europe. He practised medicine in New York in 1873–79; was established as a specialist in obstetrics at Hartford, Conn., in 1879–82; and in 1880–82 he was clinical lecturer on gynecology at Yale. He was professor of obstetrics and gynecology at the University of Buffalo in 1882–1910, and later was consulting gynecologist and obstetrician at the Buffalo General Hospital. He was president of the American Gynecological Society in 1894. He edited 'American System of Gynecology' (1888). Author of 'Manual of Prescription Writing' (1879).

MANN, Thomas, German writer of novels and short stories: b. Lübeck, 6 June 1875, of a wealthy family of merchants, whose traditions of solidity and solvency surrounded him in his youth and gave him the material for his treatment of the family life of the Hanseatic patricians in 'Buddenbrooks' and other works. After his father's death (1893) the family settled in Munich, where Mann joined them later (1894), and where he became an apprentice in the offices of the South German Fire Assurance Bank, a position of which he soon wearied. He attended lectures on æsthetics and literature at the University of Munich, later lived at Rome, returning to Munich in order to join (1899) the staff of *Simplicissimus* (q.v.), to which he remained attached for a number of years. Mann has a delicacy and refinement of style and observation that are unparalleled in German literature. In his first long novel, 'Buddenbrooks' (1901), which established his literary reputation, as well as in his short stories, he captivates by a psychologic naturalism which is enhanced by the fact that the feelings depicted are those of well-to-do middle class persons in comfortable, if not luxuriant, surroundings. Henry James, whose attention is usually devoted to a higher social class, is the English novelist whom Mann's delicate and insinuating treatment most resembles, and the two men are also similar in their scrupulous precision and artistry of language. 'Der Tod in Venedig' ('A Death in Venice,' 1913), which has the proportions of a German *novelle* (about 100 pages), describes the last hours of an elderly German writer. 'Der Zauberberg' (The Magic Mountain), published in 1926, is generally conceded to be his greatest novel. It contributed much toward making him the Nobel Prize Winner in Literature in 1929. He has written many short stories, some essays, and a play. Later works are 'Joseph and His Brethren' (1937); 'Joseph in Egypt' (1938); 'The Coming Victory of Democracy' (1938). The Nazi régime forced him into exile. In 1938 he came to the United States and the same year was made lecturer at Princeton University.

MANN, Tom, English Socialist: b. Foleshill, Warwickshire, 15 April 1856. His boyhood was spent in farming and mining and from the age of 14 he served an apprenticeship of seven years at engineering in Birmingham; in 1877 he went to London, where he was prominent in connection with various trade-union affairs, and in 1885 he became a Socialist. Among his works are 'The International Socialistic Movement'; 'Russia in 1921'; 'Tom Mann's Memoirs.' D. England, 13 March 1941.

MANN, William Julius, American Lutheran clergyman, educator and author: b.

Stuttgart, Germany, May 29, 1819; d. Boston, Mass., June 20, 1892. He was educated at Stuttgart and Tubingen and was ordained in the Lutheran ministry in 1841. He came to the United States in 1845 with Dr. Philip Schaff. He was assistant pastor at Saint Michael's and Zion's congregation, Philadelphia, in 1850–63, pastor in 1863–84 and thereafter pastor emeritus. He was professor of Hebrew ethics and symbolics at the Lutheran Theological Seminary at Philadelphia from the time of its establishment. Author of *Plea for the Augsberg Confession* (1856); *The Lutheran Church and its Confessions* (1880); *Life and Times of Henry Melchoir Mühlenberg* (1887), etc.

MANNA, a name for several substances, especially a saccharine matter which exudes naturally or from incisions made in the trunk and branches of a species of ash (*Fraxinus ornus*). It first appears as a whitish juice, thickens on being exposed to the air and when dried forms a whitish or reddish granular substance, which is the manna of commerce. The tree is a native of Italy and is cultivated extensively in Sicily. June and July are the two months in which the manna is collected. It is detached from the trees with wooden knives and is afterward exposed to the sun for drying. A little rain, or even a thick fog, will often occasion the loss of the collections of a whole day. The taste is sweet and slightly nauseous. It is a mild purgative and is principally administered to children. The finest kind of manna is called *flake manna;* it is white or yellowish-white in color, light, porous and friable. *Sicilian manna* is generally found in small, soft, round fragments; its color is yellowish-brown and it is generally mixed with more or less impurities. The principal constituent is mannite, chemically separable as a white crystalline substance of a sweetish taste, which also appears as a whitish efflorescence on certain edible seaweeds and fungi. To this and the saccharine elements, the nutritiousness of manna is due.

Many other sweet tree-juices go by the name of manna, or false manna, since they contain no mannite, but depend for their peculiar qualities upon the possession of melitose or meletzitose. In many cases the exudation of the sap is due to the irritation produced by insects or is the product of the insects themselves. Thus edible exudations are obtained from the Oriental teatree, sandal-wood and an Australian grass (*Andropogon*); in Europe from the larch and an oak, and in Persia from the camel's thorn. American manna is derived in California from the sugar pine and from a rush (*Phragmites*); while in India a species of bamboo secretes it so copiously as to form an important food-resource for the people in periods of famine.

The tamarisk manna, derived from the tamarisk trees about the eastern end of the Mediterranean, is not a direct product of the tree, but of a scale-insect, the manna-insect (*Jossyfraria mannifera*), which abounds upon the tamarisk and secretes the substance, which some persons have regarded as the manna of the Bible. In Australia the waxen larval cases of several species of flea-lice (*Psyllidae*) that feed upon the gum-trees (*Eucalyptus*) are gathered and eaten by the natives under the name of "lerp."

The Scriptural manna (Heb. Man-hu, what is it?) is described in Exodus (xvi, 15) as covering the ground in such quantities as to supply food for the vast multitude of the Israelites. It was small and round like coriander seed, white and tasting like honey and wafer. It was of the color of bdellium (Num. vi, 7). According to the Biblical narrative it was the food of the Children of Israel for 40 years. They complained of the diet (Num. xi, 6). In Rabbinical literature there are a vast number of stories about the manna hard to accept except as myths. It cannot be identified with any of the substances known nowadays as manna; but is called in the Bible "bread from heaven," while the Jewish doctors taught that it became to each person who ate it that meat of whatever kind he liked best.

MANNAIA. See GUILLOTINE.

MANNHEIM, män'hīm, Germany, a large town of Baden on the Rhine, at the confluence of the Neckar, 45 miles south of Frankfort. It lies in the administrative district of Mannheim, of 1,386 square miles area and 707,303 population. Dikes protect it from inundation and there are extensive harbors and modern docks. A bridge across the Rhine, here 1,200 feet wide, connects with Ludwigshafen, Bavaria, and there is also a bridge across the Neckar. Mannheim is the first commercial town in the Free State and on the upper Rhine. This it owes to its admirable position on two important navigable rivers and its railway communications. During World War I it was important as a distributing point for the German army. It was several times bombed by French and British aircraft, but without serious damage. The principal articles of trade are corn, flour, wood, petroleum, coal, tobacco, cattle, sugar, iron goods, etc. The manufactures consist chiefly of iron-castings, machinery, chemicals, cigars, carpets, woolen goods, paper, tiles, celluloid and rubber wares, mirrors, carriages, trinkets, sugar, liqueurs, starch, glue, etc. Mannheim was once strongly fortified and lying not far from the French frontier and near the center of military operations, suffered severely during the wars between France and Germany. In a siege by the Austrians in 1795 only 14 houses remained uninjured. Hence, notwithstanding the antiquity of its foundation, it has become an entirely modern town with regular, straight streets, known, as in America, by numbers, and with fine public squares. The principal buildings are the former Palatine palace, with a museum and picture gallery in one of its wings, a public library of 75,000 volumes and good gardens behind it; the Jesuits' church, an imposing edifice, with a profusely decorated interior; the former observatory building; the theater, one of the best in Germany; several gymnasia and schools, conservatory of music, hospitals and orphanage, town-house, railway station, etc. In 1899 the suburb of Neckaran was incorporated with it. Pop. (1939) 283,801.

MANNING, măn'ĭng, **Daniel,** American journalist and financier: b. Albany, N.Y., May 16, 1831; d. there Dec. 24, 1887. At 10 he entered the printing office of the Albany *Atlas* which shortly after was merged in the *Argus,* upon which paper he became a reporter and in time an authority in state politics. He was as-

sociate editor and part owner in 1865. In his hands the paper became a strong political power and an instrument in breaking the Tweed ring. For many years he was a strong leader in the Democratic Party and a close friend of Samuel J. Tilden. Upon Grover Cleveland's inauguration as president in 1885, Manning was appointed secretary of the treasury, the affairs of which office he conducted with great ability. He resigned in 1887 as a result of ill health, though he was connected with several commercial and banking enterprises until his death in the same year.

MANNING, Henry Edward, English cardinal: b. Totteridge, Hertfordshire, July 15, 1808; d. London, Jan. 14, 1892. The youngest son of a West India merchant and director of the Bank of England, Manning studied at Harrow and in 1827 matriculated at Balliol College, Oxford, where he was an outstanding debater. When he left the university in 1830, W. E. Gladstone succeeded him as president of the Union. He held a clerkship in the Colonial Office for two years, then (1832), having determined to enter the church, returned to Oxford, was elected fellow of Merton College, and ordained. The following year he was presented with the rectory of Lavington-with-Graffham in Sussex, and married the granddaughter of the donor of this living. When in 1837 his beautiful wife died of consumption, the tragedy made a permanent mark on the young cleric. Adopting the austere tenets of the Tractarians, he moved ever closer to High Church views, a year later for the first time visiting Rome. He had already achieved a reputation for devotion and eloquence when, in 1841, he was made archdeacon of Chichester. Newman's secession from the Church of England occurred in 1845; in 1848 Manning had public and private audiences with the pope, and his private papers indicate that he was already considering the possibility of taking the same step. However, it was not until the autumn of 1850 that the popular outcry against reestablishment of the Roman Catholic hierarchy in England determined him to resign his rectorship and archdeaconry. He was received into the Roman Catholic Church in April 1851 and within ten weeks was ordained priest by Cardinal Wiseman. He now proceeded to Rome for theological studies and was warmly received by the pope who personally conferred on him the degree of D.D. in 1854, and in 1857 appointed him provost (head) of the chapter of Westminster. For eight years he lived at Bayswater as superior of the Oblates of St. Charles, secular priests, and became Cardinal Wiseman's indispensable assistant. Among English Roman Catholics he was regarded as head of the Ultramontane party. On Wiseman's death in 1865 he succeeded him as archbishop of Westminster. His powerful advocacy of papal infallibility, especially at the Vatican Council of 1869–1870, gained him wide fame. On March 15, 1875 he was created cardinal by Pope Pius IX. A zealous prelate, he was a strict teetotaler from 1872. His devotion to the cause of the working man led to accusations that he was a Socialist.

Consult Hutton, A. W., *Cardinal Manning* (1892); Purcell, E. S., *Life of Cardinal Manning,* 2 vols. (1895); Taylor, I., *The Cardinal Democrat* (1908).

MANNING, James, American Baptist clergyman and first president of Brown University: b. Piscataway, N. J., Oct. 22, 1738; d. Providence, R. I., July 29, 1791. Graduated from the College of New Jersey (Princeton) in 1762, he settled in Warren, R. I., in 1764 where he became pastor of a Baptist church and also opened a Latin school which seems to have been the germ of Rhode Island College. The latter was granted a charter in 1764, and the next year Manning was appointed president of the institution which was later to move to Providence and become known as Brown University (q.v.). He resigned the presidency in 1790.

Consult Guild, R. A., *Early History of Brown University, Including the Life, Times, and Correspondence o President Manning* (1897).

MANNING, Robert, American pomologist: b. Salem, Mass., July 18, 1784; d. there, Oct. 10, 1842. He established a pomological garden at Salem in 1823 with the purpose of establishing the identity and classifying the various varieties of fruit. His efforts accomplished a great public benefit in introducing to general use the best varieties of fruit and in standardizing the nomenclature. At the time of his death his fruit garden contained more than 1,000 varieties of pears and many hundreds of apples, peaches, plums, and cherries. Largely through his efforts the Massachusetts Horticultural Society was established and he was a generous contributor to its support. He was an uncle of Nathaniel Hawthorne. Author of *Book of Fruits* (1838).

MANNING, William Thomas, American Protestant Episcopal bishop: b. Northampton, England, May 12, 1866; d. New York City, Nov. 18, 1949. Educated at the University of the South, Sewanee, Tenn., he was ordained deacon in 1889 and priest in 1891. After serving as rector of Trinity Church, Redlands, Calif., he returned to his alma mater where he taught dogmatic theology (1893–1895). The latter year he married Florence Van Antwerp of Cincinnati, Ohio. Subsequently he held rectorships in Landsdowne, Pa., and Nashville, Tenn. Appointed vicar of St. Agnes' Chapel of Trinity Parish in 1903, he became rector of Trinity Church in 1908. Charged with the direction of the wealthiest, most influential, and one of the oldest parishes in the United States, he displayed an exceptional capacity for administration, and several times declined offers of bishoprics in the West. On the death of the bishop of New York, he was prominent among several candidates for the post. The violent campaign against his election, led by yellow journals in New York which alleged his unfitness for the exalted office because of his English birth, failed; he was elected by overwhelming vote and consecrated on May 11, 1921. An uncompromising enemy of divorce, he was often involved in controversies. He declared Judge Ben B. Lindsey's advocacy of companionate marriage was propaganda for "unrestrained sexual gratification," assailed King Edward VIII for abdicating the throne to marry a divorcee, and barred a twice-divorced son of President Franklin D. Roosevelt from serving as vestryman of the church at Hyde Park, N. Y. In 1940 he was chiefly instrumental in voiding the appointment of the English philosopher Bertrand Russell to the faculty of the City College of New York, branding him a "defender of adultery and disbeliever in God." Yet the stern moralist was, in the opinion of many parishioners, far too much of a liberal. He accepted evolution and other

scientific tenets, opened the pulpit of the Cathedral of St. John the Divine to clergymen of other denominations, and supported many of President Roosevelt's social and economic reforms. In both world wars he roundly condemned "sentimental pacifism" and urged the adoption of selective service in 1940. At the age of 80 he retired, Dec. 31, 1946. A short, slender man with ascetic features and penetrating glance, he was a militant churchman of the old tradition. He made many enemies but was loved by the large circle who admired his courage, nobility of character, and kindliness.

MANNING, town, South Carolina, seat of Clarendon County, altitude 90 feet; 17 miles southeast of Sumter, on the Atlantic Coast Line. Agricultural products include tobacco, cotton, and sweet potatoes. Government is by mayor and council. Pop. (1940) 2,381; (1950) 2,775.

MANNINGTON, city, West Virginia, in Marion County; altitude 974 feet; 55 miles southeast of Wheeling, on the Baltimore and Ohio Railroad. The region produces a variety of farm crops and has rich deposits of coal, building clay, oil and gas. Manufactures include pottery, glassware, and tools. The city was incorporated in 1871. Pop. (1950) 3,241.

MANNITOL, a white crystalline compound, also known as mannite, having the formula $C_6H_8(OH)_6$. It is a hexatomic alcohol obtained from manna ash (see MANNA), and from many other plants. It has a sweet taste and resembles sugar. It is used as a mild laxative, as a chemical reagent, and as an ingredient of explosive caps.

MANNLICHER, män'lĭ-kĕr, **Ferdinand,** Austrian engineer and inventor: b. Mainz, Germany, Jan. 30, 1848; d. Vienna, Jan. 20, 1904. He was chief engineer of the Northern Railroad for many years. After the success of the needle gun at the Battle of Sadowa (Königgrätz) in 1866, he began experiments that ultimately produced a breech-loading repeater rifle which was adopted by the Austrian Army in 1885. He became famous for his numerous inventions in small arms and was elected to the upper house of the Austrian Parliament in 1899 in recognition of his distinguished services.

MANNY, măn'ĭ, or **MAUNY,** mō'nĭ, **Sir Walter de** (BARON DE MANNY), English military commander: b. medieval county of Hainaut; d. London, 1372. His memory is perpetuated as the founder of Charterhouse (q.v.), London, and by his military exploits as recorded by his friend Jean Froissart in his *Chronicles.* Scion of a noble family of Hainaut, it is believed that he arrived in England in 1327 in the train of Queen Philippa. He rose to high rank in the Scottish wars of Edward III, became a commander of the English fleet and of the army in France, and both in military commands and in diplomatic negotiations received the commendation of the king. He was created a baron and Knight of the Order of the Garter, and in 1335 married Margaret, the countess (later the duchess) of Norfolk.

MANNYNG, măn'ĭng, **Robert** (ROBERT OF BRUNNE, brōōn'nĕ), English chronicler and poet: flourished 1288–1338. He was born in Brunne (now Bourne), Lincolnshire, and entered the Gilbertine monastery of Sempringham in 1288. His chief work is his *Handlyng Synne* (1303), a free and amplified translation into English verse of William of Wadington's *Manuel des Pechiez,* with such judicious omissions and excellent additions as made his verse much more entertaining than the original. The purpose of the book was to convey religious instruction to the people in the agreeable form of moral anecdotes. It is of great importance from the linguistic point of view as one of our best landmarks in the transition from the Early to the Middle English. He also wrote *The Story of Inglande,* a new version in octosyllabic rhyme of Wace's *Brut d'Angleterre,* and added to it a popular translation of the French rhyming chronicle by Peter of Langtoft of Bridlington. Mannyng deliberately wrote in English instead of French, in order to reach the common people, to give them the means "for to haf solace and gamen, in felauschip when tha sit samen [together]."

MANOMETER, mă-nŏm'ē-tĕr, an instrument for measuring the pressure exerted by gas or liquid. It may have many forms of which the mercurial barometer (q.v.) is one. One of the commonest designs for the measurement of pressures not greatly different from that of the atmosphere consists of a U-tube, one of whose legs is open to the air, while the other is in communication with the gas or liquid whose pressure is to be measured. The lower part of the U is filled with some nonvolatile liquid of known density, and the difference between the pressure of the fluid under examination and that of the atmosphere is found by observing the difference between the levels of the manometric fluid in the two branches of the U-tube. If the absolute pressure of the fluid is desired, it is necessary to add the atmospheric pressure to the differential pressure as read from the manometer. In rough work it may be sufficient to assume the atmospheric pressure to be 14.7 pounds per square inch; but in more refined observations the atmospheric pressure must be determined by reading the barometer simultaneously with the manometer. Mercury is commonly the liquid that is used in the U-tube, but when the differences in pressure that are to be read are very small, some less dense liquid may be used with advantage. Sulphuric acid is often employed in such cases; and where (as in the measurement of chimney draft) a slight amount of evaporation from the manometric fluid is unimportant, water may be employed. When the pressure to be measured materially exceeds one atmosphere, the siphon manometer, as just described, is modified by sealing one of the ends of the U-tube instead of leaving it open to the air. In this case the pressure is determined by observing the amount of compression that it produces in the air that is confined in the sealed arm of the siphon, by the manometric fluid; for it is known by Boyle's law, that the volume of the air in this arm is sensibly proportional to the reciprocal of the absolute pressure, so long as the temperature remains constant. Boyle's law is not rigorously exact, however, and when a high degree of precision is required from the compression manometer, it is necessary to make allowances for its error. Data for this purpose have been given by Amagat, up to 85 atmospheres, when the temperature of the manometer is maintained at 16°C. (60.8°F.). Consult

Amagat, 'Comptes Rendus,' Vol. XCIX, p. 1153; Preston, 'Theory of Heat,' p. 403). In steam engineering the commonest form of manometer is the "Bourdon gauge," which depends for its action upon the elastic deformation of a flattened metallic tube when exposed to an internal pressure. In practice the flattened tube is bent into a circular form, one end of it being fixed while the other communicates, by means of a multiplying gear, with an index hand which travels over the face of a graduated dial. A tube so constructed straightens out slightly when subjected to an internal pressure, returning again to its original form when the pressure is removed. The deformation is approximately proportional to the magnitude of the pressure (so long as the tube is not strained beyond its elastic limit), and hence the dial may be graduated, without difficulty, so as to indicate true pressures, at least to a degree of precision quite sufficient for the purposes of steam engineering. All such gauges should be carefully compared with a standard mercury column, however, before great reliance is placed upon them; for it is found that they are sometimes seriously in error in some parts of the scale, even when sensibly correct in other parts. In using them in connection with steam boilers, care should also be taken to prevent steam or highly heated water from coming into direct contact with the curved tube, since the elastic properties of the tube are injured by overheating. To ensure the proper protection of the gauge, a siphon, or a complete circular bend, should be placed in the pipe between the gauge and the boiler. The trap so formed will fill with water of condensation the first time the boiler is fired up, and thereafter it will be impossible for steam to enter the gauge directly.

MANON LESCAUT, a short novel of 200 pages, the seventh volume of a larger work, "Memoirs of a Nobleman," has sufficed to assure the reputation of its author, Prévost d'Exiles (1697–1763), better known as L'Abbé Prévost. After a life of adventure in France, England, Holland and Germany when he was in turn soldier, monk, journalist, teacher and later chaplain of the Prince of Conti, Prévost became a professional writer and composed more than 100 volumes. He also translated many English works, and among those, his adaptations rather than translations of 'Pantela,' 'Clarissa Harlowe' and 'Grandison' gave to Richardson a great popularity in France during the second half of the 18th century, to the detriment of Prévost's own works. Of all Prévost's novels, critical articles in the periodical *Pro and Con* and pseudo-scientific travel stories, Manon Lescaut alone survives. Published in Holland in 1731, it "took like wild fire" according to contemporary testimony and more than 30 editions were printed before the end of the century, that of 1753 revised and corrected by the author being considered as the best. This novel is the story of the passionate love of the young Chevalier des Grieux for the courtesan Manon. It is told in a simple narrative style and with a sincerity which leads us to believe that Prévost relates at least in part some episodes of his stormy life. The novel presents a realistic and painful picture of the sufferings which uncontrolled passion brings upon those who lack the will power to resist it, and while Prévost does not attempt to excuse or justify the faults of his heroes, he shows passion as a terrible force whose victims are to be pitied rather than blamed. Prévost had many imitators even in his own time, and the theme of Manon, dealing with rehabilitation through love and sufferings, is found later in 'Marion Delorme' (Hugo), 'La Dame aux Camélias' (Dumas), 'Sapho' (Daudet) and in the works of several Russian novelists.

Louis A. Loiseaux.

MANOR (old French *manoir, maneir,* from L. *manere,* to remain, being the residence of the owner), a piece of territory held by a lord or great personage, who occupied a part of it, as much as was necessary for the use of his own household, and granted or leased the remainder to tenants for stipulated rents or services. No manors, with all their incidents and franchises, have been granted in England since the reign of Edward III. One of the most important incidents to these ancient manors was the right to hold a court, called a *court-baron,* which was held within the manor, and had jurisdiction of misdemeanors and nuisances within the manor, and disputes about property between the tenants. The manor system was in vogue in the United States only during the British occupation, but many old manor names like Briarcliffe manor, Pelham manor, etc., are still retained by the present owners of large estates. See also Tenure.

MANOURY, General. See Maunoury.

MANRIQUE, mạn-rē-kā, **Angel,** Spanish poet and ecclesiastic: b. Burgos, 1577; d. Badajos, 1649. He rose to high rank in monastic life, becoming finally head of the Cistercienses throughout Spain, and finally bishop of Burgos (1645). He wrote a history of the Cister order which had considerable reputation throughout Europe. He also wrote many devotional and other works of a religious or religio-historical nature.

MANRIQUE, Gómez, Spanish poet and dramatist: b. about 1415; d. 1491. He was son of Pedro Lord of Amusco, and a younger brother of Rodrigo Manrique, master of Santiago and one of the troubadours of the court of John II. He became a soldier of some note and took part in wars against the Moors. He sided with the Infante, Don Enrique, against Alvaro de Luna and the royal court. He was very active and seems to have taken part in almost every political disturbance and warlike expedition of Spain in his day. He was very much mixed up in the political move which forced the marriage of Ferdinand of Aragon and Isabel of Castile, which was of great significance since it ultimately led to the expulsion of the Moors from the country and the political and national unity of all Spain. He attained to numerous high offices under the king of Aragon and later under the united crowns of Castile and Aragon, becoming finally a member of the royal council and the confidant of the joint sovereigns. Gómez Manrique, notwithstanding his tempestuous and warlike life, was one of the greatest orators of his age and a talented poet. He was one of the set of writers who sang the glories of the Virgin Mary and their love for and devotion to her. He was a satirist with a keen sense of humor, and he attempted nearly every class of literature known in his day in Spain.

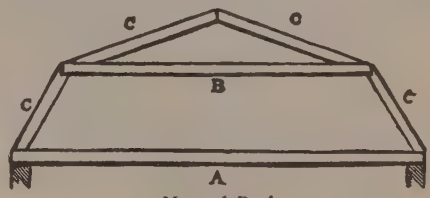
He played his part in helping to introduce into Spanish poetry the poetical forms of Italian literature. He also wrote religious dramas in the form in which they appeared in his age. For this reason and for the fact that he introduced more than customary life into these dramatic pieces, his work had considerable influence on the development of the drama, both religious and, subsequently, profane, in Spain. The best of his religious dramas, all of which are of a liturgical caste, is 'Representacion del nacinùento de Nuestro Señor.' He also wrote on political and philosophical subjects and on matters of ethics and vices such as gluttony, envy, laziness, and of virtues, such as reason (in human actions), faith, prudence and honesty of purpose in government. His poem on the death of the Marques de Santillana became immensely popular and Gómez Manrique rose to be the most quoted writer and most recited lyrical poet of his day. His 'Cancionero' has been published several times and poems of Gómez Manrique have appeared in various other cancioneros. Consult Menéndez y Pelayo, Marcelino, 'Antologia de poetas liricos castellanos' (Vol. VI, Madrid 1886); Pas y Melia, A., 'Cancionero de Gómez Manrique' (Madrid 1885); Ríos, Amador de los, 'Historia critica de la leteratura española.'

MANRIQUE, Jorge, Spanish poet: b. about 1440; d. 1479. He was son of Rodrigo Manrique, grand master of Santiago. He early took a prominent part in the troubles of the reign of Henry IV, taking sides with Don Alfonso. Notwithstanding the fact that most his life was passed in active military duty and that he died in battle in the attack on the fortress of Garci-Muñoz, he yet attained such an eminence as a poet that he is still classed among the great writers of Spain, and a worthy nephew of Gómez Manrique (q.v.) and heir of his father, Rodrigo Manrique, who was one of the successful troubadours at the court of John II, one of the foremost patrons of lyrical poetry. Jorge Manrique has written satires, love songs and poems of a like nature common to the age in which he lived; but his most noted poem and the one to which he owes his lasting fame is 'Coplas de Jorge Manrique por la muerte de su padri.' This is one of the finest lyrics in the Spanish language, instinct with true poetic form and thought and sympathy. This poem has been imitated and praised by some of the greatest writers of Spain and it has found universal favor in the eyes of the critics. Longfellow has made a worthy translation of it into English; and it was set to music as far back as the 16th century by Venegas de Henestrosa. (See COPLAS DE MANRIQUE; ROMANCERO DEL CID). Consult Longfellow's translation and Fitzmaurice-Kelly, James, 'A History of Spanish Literature' (New York 1898); Menéndez y Pelayo, Marcelino, 'Antología de poetas líricos castellanos' (Vol. VI, Madrid 1896); *Biblioteca de autores españoles* (Rivadeneira, Vols. XXXII and XXXV) contains his works and notices thereof.

MANS, mäñ, **Le,** France, the capital of the department of Sarthe, on a height above the Sarthe, here crossed by three bridges, 115 miles southwest of Paris. It consists of a lower and an upper town. The principal edifice is a fine Gothic cathedral of the 11th century. It has a seminary, excellent schools, a public library of 60,000 volumes and several museums. The chief manufactures are metal works, railway cars, tobacco, canned goods, chemicals, cordage, leather and woolen and linen goods; being a railway centre it is a distributing point for farm produce, canned goods, wines, etc. Le Mans existed in the time of the Romans under the name of Cenomani, a tribe who inhabited the district. Numerous vestiges of Roman structures (subterranean aqueducts, walls, etc.) still remain. It was long in the possession of the English, and Henry II, the first Plantagenet, was born here. During the Franco-German War (1870–71) General Chanzy was defeated here by Prince Frederick Charles and the Grand-duke of Mecklenburg. A monument commemorates the battle. Pop. about 73,000.

MANSARD, mäñ-särˊ, or **MANSART, François,** fräñ-swä, French architect: b. Paris, 23 Jan. 1598; d. there, 23 Sept. 1666. He designed many important buildings in Paris, as well as provincial chateaux and country seats. The chateaux at Blois are partly his work, and he built the church of Val de Grâce and the Hotel Carnavalet. The mansard roof is called after him.

MANSARD ROOF, *in architecture* (so called from François Mansard, or Mansart (q.v.), a French architect to whom the invention is attributed), a roof formed of two sets of rafters, of which the upper set are more inclined to the horizon than the lower set, and



Mansard Roof.

form an obtuse angle at the ridge. The transverse beams connecting the lower ends of the under set of rafters are called as in ordinary roofs tie-beams; the corresponding beams at the union of the upper and under rafters are called collar-beams.

MANSART, Jules Hardouin, zhül ärˊ-dooˊäñ mäñ-särˊ, French architect: b. Paris, 16 April 1645; d. Versailles, 11 May 1708. He was a nephew of François Mansart, or Mansard (q.v.). He directed all the great building operations of Louis XIV, who heaped favor and wealth upon him. His works include the palace at Versailles; the Maison de Saint-Cyr; the Grand Trianon; the triple dome of the Invalides, and the Chateau de Clagny, the residence of Madame de Montespan. He also designed the Place Vendôme and the Place des Victoires.

MANSE, *in Scotch law,* a name given the dwelling-house of the minister of the Established Church. In popular use the term is often applied generally to the dwelling-house of any minister of a dissenting congregation. In the Established Church every first minister of a rural parish is entitled to a manse, which the heritors or landed proprietors in the parish are bound to build and uphold. When a manse has

been built or repaired by the heritors it becomes a free manse, and all ordinary repairs have to be done at the charges of the minister.

MANSEL, Henry Longueville, English logician and theologian: b. Cosgrove, Northamptonshire, Oct. 6, 1820; d. London, July 31, 1871. He was educated at Saint John's College, Oxford, and took orders in the Anglican Church in 1845. He became Wayneflete professor of philosophy at Oxford in 1859; regius professor of ecclesiastical history, 1867, and dean of Saint Paul's, London, 1868. He was made a canon of Christ Church, Oxford, in 1867.

MANSFELD, mäns'fĕlt, **Peter Ernst I,** COUNT, Austrian general and statesman: b. July 15, 1517; d. Luxemburg, May 22, 1604. He became governor of the Low Countries after the death of the Duke of Parma.

MANSFELD, Peter Ernst II, COUNT, German Protestant military leader: b. Luxemburg, 1580; d. Racowitza, Bosnia, Nov. 29, 1626. He was a natural son of the preceding, but, disappointed in regard to the inheritance of his father's lands, joined the Protestant princes and became the bitter enemy of Austria. He gained a victory over Tilly at Wiesloch in 1622, but was defeated by Wallenstein at Dessau in 1626, and died soon after.

MANSFIELD, mănz'fēld, **Edward Deering,** American author: b. New Haven, Conn., Aug. 17, 1801; d. Morrow, Ohio, Oct. 27, 1880. He was graduated at West Point in 1819 and at Princeton in 1822 when he took up the study of law and was admitted to the bar in 1825. He went to Cincinnati to engage in practice until 1835 when he accepted the chair of constitutional law and history in Cincinnati College. He resigned to enter journalism and was editor of the *Cincinnati Chronicle,* the *Atlas* and the *Railroad Record.* For many years he was a contributor to New York newspapers under the title "Veteran Observer."

MANSFIELD, Joseph King Fenno, American soldier: b. New Haven, Conn., Dec. 22, 1803; d. near Sharpsburg, Md., Sept. 18, 1862. He was graduated from West Point in 1822 and in the Mexican War became chief engineer under General Taylor. He took an active part in the engagements at Fort Brown, Monterey and Buena Vista. In 1853 he was appointed inspector general of the United States Army and served in that capacity until 1861 when he was made brigadier-general and given command of the Department of Washington. He was in command of a corps of the Army of the Potomac at Antietam and was killed there.

MANSFIELD, Katherine (pseudonym of KATHLEEN, nee BEAUCHAMP, bē'chăm, MURRY), British writer: b. Wellington, New Zealand, Oct. 14, 1888; d. Fontainebleau, France, Jan. 9, 1923. She lived most of her early childhood in the small township of Karori near Wellington. At 14, she went to London to school and, except for a two-year visit in New Zealand, spent the remainder of her life in Europe. Her first short stories were published in small literary magazines. Upon the publication of her volumes of short stories, *Bliss* in 1921 and *The Garden Party* in 1922, it was immediately recognized that hers was one of the rare talents of 20th century literature. She was married twice, to George Bowden in 1909, whom she divorced, and in 1918 to John Middleton Murry, the English critic. Because of poor health she spent considerable time in the south of France and died at thirty-five from tuberculosis.

In her stories, Katherine Mansfield disregarded plot to relate simple, meaningful incidents with a sensitivity and a masterful sense of character delineation that have seldom been equalled. The stories are admired and loved for their warm, sympathetic quality and an undertone of heartbreak. In *The Doll's House* she uses a plaything to show the natural cruelty of children and the domineering social attitudes of adults. In *The Garden Party* she tells of an adolescent's first experience with death, at the close of what had been an idyllic summer's day. *A Cup of Tea* is a study of the mixed emotions of a vain young wife who would like to be charitable. In *Bliss* she shows that a blooming pear tree can overpower a woman with its beauty and then in an instant become a symbol of silent mockery.

Her best known stories can be found in innumerable anthologies; her husband, J. Middleton Murry, has edited biographical material, including: *The Journal of Katherine Mansfield* (1927); *The Letters of Katherine Mansfield* (1928); and *The Scrapbook of Katherine Mansfield* (1939). See also NEW ZEALAND LITERATURE AND ART; ENGLISH LITERATURE, TWENTIETH CENTURY—*Fiction.*

MANSFIELD, Richard, American actor: b. Heligoland, May 24, 1857; d. New London, Conn., Aug. 30, 1907. He first studied art, opening a studio in Boston, but later returned to England and entered the theatrical profession. He played small parts in comic opera, and first appeared in America as Dromez in *Les Manteaux Noires* at the Standard Theatre, New York. He afterward was very successful in a wide variety of plays and became the head of his own company. He created such parts as Beau Brummel, Baron Chevrial, Dr. Jekyll and Mr. Hyde, and Monsieur Beaucaire; among his other most successful rôles were Cyrano de Bergerac, Shylock, Henry V, Brutus, and Peer Gynt.

MANSFIELD, William Murray, EARL OF, British jurist: b. Scone, Scotland, March 2, 1705; d. London, March 20, 1793. One of the youngest sons of 5th Viscount Stormont, he was educated at Christ Church, Oxford; studied law; was called to the bar in 1730; won a large Scottish practice and many literary friends, the foremost being Alexander Pope. In 1742 he was made solicitor general and entered Parliament. Though of Jacobite descent he upheld the Hanoverian interest in 1745, did special service in 1748 by his defense of the Treaty of Aix-la-Chapelle, and was admitted leader of the House. An attempt to prove him guilty of treason or disloyalty to the Crown was unsuccessful, although often repeated. He was made attorney-general in 1754 and chief justice and Baron Mansfield in 1756. He became Earl of Mansfield in 1776; proposed the coalition of 1779, and in 1780 suffered at the hands of the Gordon rioters because of his sympathy with Catholic emancipation. In 1788 he retired from the bench. Although unpopular and constitutionally a believer

in royal prerogative, Mansfield was a great judge, whose work was not too conservative, and an able, calm, logical debater. Possibly his greatest labor was his revision of the mercantile law.

MANSFIELD, town, Connecticut, is located on the Willimantic River about 20 miles east of Hartford in Tolland County. Settled in about 1692, it was incorporated in 1703 and is now important as an agricultural and manufacturing center, its chief industrial products being fiberboard and silk. The village of Storrs, a subdivision of the town, is the location of the coeducational University of Connecticut established in 1881. Pop. (1940) 4,559; (1950) 10,008.

MANSFIELD, market town and municipal borough, England, is located on the site of a Roman camp in Nottinghamshire, 15 miles north of Nottingham, in the midst of a rich coal district, surrounded by the vestiges of Sherwood Forest. Iron, shoes, hosiery, textiles, metal products, and chemicals are produced here. A grammar school founded in 1561 still stands. Pop. (1951) 51,343.

MANSFIELD, town, Louisiana, seat of De Soto Parish, is located 34 miles south of Shreveport at an altitude of 330 feet. Served by the Kansas City Southern Railroad, it is an agricultural and shipping center. Its industries include lumber mills, cotton ginning, a trailer factory, and a steel foundry. The site of the Battle of Sabine Crossroads (April 8, 1864) is now a nearby park. Incorporated in 1847, the town is governed by a mayor and council. Pop. (1950) 4,440.

MANSFIELD, town, Massachusetts, is an agricultural and industrial center located in Bristol County 24 miles southwest of Boston on the New York, New Haven and Hartford Railroad, at an altitude of 180 feet. Long an industrial town, its products include chemicals, jewelry, machine parts, metal products, and chocolate. It was settled about 1659 and incorporated about 1775. Pop. (1950) 7,184.

MANSFIELD, city, Ohio, seat of Richland County, is an industrial center located in the midst of a rich agricultural region about 55 miles southwest of Akron at an altitude of 1,155 feet. Served by the Baltimore and Ohio, Erie, and Pennsylvania railroads, its industrial products include aircraft parts, electrical appliances, brass, sheet steel, tin plate, machinery, rubber goods, plumbing fixtures, heating apparatus, and farming implements. The Ohio State Reformatory is located in Mansfield. The city was named in honor of Jared Mansfield, surveyor general of the United States, under whose direction it was laid out in 1808. It was incorporated as a village in 1828 and as a city in 1857. It has a mayor-council type of government. Pop. (1940) 37,154; (1950) 43,564.

MANSFIELD, borough, Pennsylvania, in Tioga County, is situated 24 miles southwest of Elmira, N. Y. on the Tioga River at an altitude of 1,120 feet. It is in a farming and dairying, bituminous coal, and natural gas area and is noted for its manufacture of novelties. The coeducational Mansfield State Teachers College is located here. The site, cleared as a field by Asa Mann in 1804 and known as "Mann's Field," later became a village and was incorporated in 1857 Pop. (1950) 2,657.

MANSFIELD, Mount, is located in north central Vermont about 20 miles northeast of Burlington in the midst of a winter sports and summer resort recreational area. At 4,393 feet, it is the highest peak of the Green Mountains (q.v.) of Vermont. A scenic feature is Smugglers Notch, a gorge at the base. At the summit is a hotel, built about 1860.

MANSFIELD PARK. This quietly charming novel of manners, published in 1814, is perhaps less popular than some of the other works of Jane Austen, but it is regarded by more than one critic as even superior to them in richness and maturity. As the title implies, the story is built around English country-house life. Fanny Price, an indigent niece, is taken into the family of Sir Thomas Bertram. Overlooked for the most part by Sir Thomas and his wife, subjected to the carping control of the odious Mrs. Norris, Lady Bertram's sister, and neglected or patronized by three of her cousins, Fanny finds her chief consolation in the casual kindness of her remaining cousin, Edmund, whom she grows to love. But Edmund is attracted by the dashing and sophisticated Mary Crawford, who with her brother, Henry, is visiting at the neighboring rectory. Henry, in turn, after various flirtations with the Bertram sisters, pays suit to Fanny. The unfolding of these several relationships by means of seemingly insignificant incidents—dances, excursions, amateur theatricals—constitutes some of Miss Austen's most skillful work and affords her opportunity for those delicately humorous, mildly ironical accounts of the life she knew best, that have made her immortal. In the end, of course, Henry and Mary Crawford are eliminated, and Edmund loves and marries his Cinderella-like cousin. No single character in this novel is as well known as Mr. Collins of *Pride and Prejudice* or Miss Bates of *Emma;* yet the various personages are excellent examples of the author's nice discrimination and marvelous insight. Each character is clearly portrayed though not unduly simplified; each exhibits in varying proportions that mixture of good and evil common to all mankind. In a word, the characters are not types or Elizabethan "humors," but are richly human. *Mansfield Park* appeals to many classes of readers. It is the best kind of historical novel, for it records vividly the manners and customs of ordinary folk in the Napoleonic era. It is a superb example of a serene, balanced realism, avoiding alike the rose-pink and the dirty drab that Meredith later reprehended.

Consult Howells, W. D., *Heroines of Fiction;* Cornish, Francis Ware, *Life of Jane Austen;* Smith, Goldwin, *Life of Jane Austen.*

George B. Dutton.

MANSHIP, Paul, American sculptor: b. St. Paul, Minn., Dec. 25, 1885. He received his early education at the St. Paul Institute of Arts, where he evinced marked talent for sculpture, and later studied at the American Academy in Rome. His first achievement was the winning of the Helen Barnett prize, in the National Academy of Design in 1913, and he won this again in 1917. He was also awarded a gold medal at the San Francisco World's Ex-

position in 1915. His statues are to be seen in the Metropolitan Museum in New York, Pratt Institute, Brooklyn, Art Institute, Chicago, and other leading institutions.

MANSILLA DE GARCIA, Eduarda, ā-doo-är'dä män-sēl'yä dā gär-sē'ä, Argentine novelist: b. Buenos Aires, 1838. Her maiden name was Mansilla; at 16 she married Manuel R. García, a diplomat, and at 19 published 'El Médico de San Luis,' possibly her best novel. It was followed by 'Lucia Miranda,' a historical novel on the discovery of La Plata, and by 'Pablo, ó la Vida en las Pampas,' which with its fresh description of Argentine life made a great impression in Paris and was praised by Hugo. She was a musician of much talent and wrote, besides novels, several plays.

MANSION HOUSE, in London, England, the official residence of the lord mayor, built on the site of the Old Stock Market in 1739 from designs by George Dance, at a cost of $213,190. It is an oblong building and contains an Egyptian banquet hall accommodating 400 guests.

MANSLAUGHTER, the killing of a human being; in criminal law the second degree of felonious homicide. Murder and manslaughter are distinguished from each other by the intent which causes or accompanies the act. If a homicide be not justifiable nor excusable, and yet be not committed with malice aforethought, it is manslaughter and not murder. It is quite certain that the intent need not be to kill; for while there must be a criminal intent to make a person amenable to law as a criminal, yet if one crime be intended, and in the act of committing it another of a higher character be also committed without intent, the criminal is responsible for this higher crime. The general principle laid down in respect to manslaughter is, that not only a positive intention to commit some crime, but mere negligence, may make one guilty. If any one take upon himself an office or duty requiring care or skill, he is liable for the want of either; and if death be the consequence of his ignorance or carelessness, he is guilty of manslaughter. So if one driving furiously run over and kill a person whom he did not see, or if one in command of a steamer or sailing-vessel by reason of gross negligence run down a boat and some one in it be drowned, this would be manslaughter. So, if any one, whether medical by profession or not, deal with another as a physician, and through gross want of care or skill kill him, or if any one charged with building a house of any kind construct it so badly that it falls and kills persons within or near it; or if in building he drop a stone upon some one passing below and kill him; in all these cases he would be guilty of manslaughter, provided he were grossly negligent in the act causing the death. This is the essential question.

Blackstone defines manslaughter thus: "Manslaughter is the unlawful killing of another without malice either express or implied; which may be either voluntarily, upon a sudden heat, or involuntarily, but in the commission of some unlawful act."

The judicial treatment of this crime, being regulated by statute, varies in the several States. The element of premeditation is not essential to conviction of this crime. There are cases which the law regards as only manslaughter, without evidence of momentary excitement; partly because the law infers that from such a provocation there must be excitement; and partly, perhaps, because the party killed brought his death upon himself by his outrageous wrong. Thus, if a husband detects his wife in adultery, and instantly and purposely takes either her life or the adulterer's, it is only manslaughter. Not so, however, if he waits for a subsequent opportunity, for then the first reason wholly fails, and the killing becomes murder.

In New York State four degrees of manslaughter are defined. The first carries a penalty of not over 20 years' imprisonment, the second degree not over 15 years. The first degree, briefly stated, consists of killing without the purpose of death, when the deceased was engaged in perpetrating or attempting a crime less than felony, and where such killing would be, at common law, murder. Assisting in self-murder is manslaughter in the first degree, as also wilfully killing an unborn quick child by injury to the mother if it would be murder in case the mother died from the injury. The second degree consists in procuring abortion otherwise; killing in the heat of passion without the intent of death, but in a cruel and unusual manner; or killing unnecessarily one attempting to commit felony. The third degree is killing in heat of passion, without intent of death, but with a dangerous weapon; involuntary killing, by procurement or negligence of another, while the person killed is engaged in committing a trespass on property; suffering an animal known to be mischievous to go abroad without care, or keeping it without care, and thereby causing death; receiving wilfully or negligently so many persons in a boat or vessel as to cause death; racing while in command of a steamboat carrying passengers, bursting the boiler, and so killing; killing by a physician while in a state of intoxication. The fourth degree may be said to include all other modes or forms of manslaughter, known as such at common law, and of a milder kind than the preceding. There is much difference between the States in the penalties prescribed. Some States, as Louisiana, Maine and Maryland, assign "not over 20 years" to both first and second degree manslaughter, thus practically leaving the penalty to the judge's discretion; other States, as New Hampshire and South Carolina, call for "not over 30 years," while Texas, West Virginia and Delaware place five years as the greatest punishment. Several States make second degree manslaughter "not over one year" in prison. See HOMICIDE.

MANSURA, MANSURAH, or MANSOURAH, män-soo'rä, Egypt, a town on the Damietta branch of the Nile, 34 miles southwest of Damietta. It has railway connection with Zagazig and Cairo and is the chief depot of the bread-stuffs, cotton, indigo, hemp and flax which this part of the Delta produces. There are also linen and cotton manufactories, etc. Mansurah was founded in 1221 and here in 1250, during the Crusades, Louis IX of France was captured and imprisoned. Pop. about 64,000.

MANTA, män'tä, Ecuador, city, port of entry on the Pacific Coast, about 155 miles southwest of Quito. It has an excellent harbor and steamer connection with nearly all the Pacific

Coast towns of South America. It was founded as early as 1534–35, and for many years its importance has been in being the port of Monticristi, which is about 10 miles inland. The chief exports are coffee and rubber. Pop. 8,000.

MANTALINI, măn-tą-lē'nē, a low and affected character in Dickens' 'Nicholas Nickleby' who lives on the labors of his wife, mantuamaker.

MANTARO, män-tä'rō, a river in Peru which has its rise in the mountains in the western part of the province of Junin. Its source is about 13,000 feet above the sea. It flows south and east to Huanta, near which it breaks through the mountains and turns northwest which course is continued for about 60 miles, when again it changes and flows northeast to Pisquitini, where it joins the Apurimac River and forms the Ené. The Mantaro is nearly 300 miles long and navigable only a short distance above the junction with the Apurimac. It has extensive water power which is not used except in a few cities.

MANTEGAZZA, Paolo, pä'ō-lō män-tägät'sä, Italian author and physiologist: b. Monza, Italy, 1831; d. 1910. He was educated at the universities of Pisa and Milan, spent several years in traveling, visiting almost every portion of the globe, after which he returned to Milan and practised medicine there. He was appointed professor of physiology at Pavia in 1860 and in 1870 became professor of anthropology at Florence, where he founded the Museum of Anthropology, also a society and a review of anthropology. He was a member of the Italian Parliament 1865–76 and then became senator. He is the author of many medical and philosophical books; among them are 'Elementi d'igiene' (1875); 'Fisiologia del piacere' (1881); 'Le istasi umane' (1887); 'L'anno 3000' (1897); 'L'amore' (1898), etc. He has also written books of travel and has devoted a share of his attention to political affairs.

MANTEGNA, Andrea, Italian painter: b. Vicenza 1431; d. Mantua, 13 Sept. 1506. His master, Squarcione, was induced by the talents which he displayed to adopt him as a son. The youth employed himself principally in drawing from antiques, and at the age of 16 painted a picture for the grand altar in the church of Saint Sophia at Padua. About 1468 Mantegna entered the service of Ludovico Gonzaga, at Mantua, where he opened a school. Here he painted his great picture, the 'Triumph of Julius Cæsar,' for the tapestry of a palace erected in Mantua. It consists of several cartoons, which have since been transferred to Hampton Court. Gonzaga conferred on him the honor of knighthood in reward for his merit. Innocent VIII invited the artist to Rome to paint in the Belvidere. One of the best of this artist's works is the 'Madonna della Vittoria,' now in the Louvre at Paris, in which Giovanni Francesco Gonzaga is seen returning thanks for the victory gained by him in 1496 over the forces of Charles VIII. The genuineness of this picture is, however, sometimes doubted. There are several others of his works in the Louvre, and an 'Annunciation' in the Dresden Gallery. The New York Historical Society has his 'Crucifixion,' the Metropolitan Museum 'Holy Family,' the Johnson Gallery in Philadelphia his 'Adoration of the Magi.' He was also noted as a line engraver, and left many notable copper plates of both religious and historical subjects. Consult Bell, N. R. E., 'Mantegna' (New York 1911).

MANTELL, Gideon Algernon, English geologist: b. Lewis, Sussex, 1790; d. London, 10 Nov. 1852. For many years he practised as a medical man, and employed his leisure time in studying the strata and fossil remains of the weald district, by which he was surrounded. Through his investigations the fossilized skeletons of the Iguanodon and Hylæosaurus were discovered, the fresh-water origin of the wealden beds demonstrated and many other important facts established in regard to the geology of that district. He published 'The Fossils of the South Downs' (1822); 'Illustrations of the Geology of Sussex' (1822), and the very popular 'Wonders of Geology' (1838); and 'Medals of Creation' (1844). His magnificent collection of fossils was purchased in 1839 for the British Museum.

MANTELL, Robert Bruce, American actor: b. Irvine, Scotland, 7 Feb. 1854; d. 27 June 1928. He made his début at Rochdale, England, in 1876, and in 1878 played in juvenile rôles with Modjeska in the United States. He then spent three years in England as leading man, returning to New York to play with Fanny Davenport. He became a star and played at the head of his own company, presenting the leading classical and romantic rôles, including Hamlet, Macbeth, Romeo, Richelieu, etc.

MANTES, mänt, France, a town in the department of Seine-et-Oise, on the left bank of the Seine, opposite Limay, with which it communicates by two handsome bridges connecting the banks with an island in the river, 29 miles west-northwest of Paris. It contains a fine Gothic church, with two lofty towers; a beautiful Gothic tower, the only remains of the church of Saint Maclou; and has manufactures of tiles and baskets, famous breweries, numerous mills and a trade in leather, corn and wine. William the Conqueror received his death-wound at Mantes. Pop. 9,700.

MANTEUFFEL, măn'toif-fĕl, **Edwin Hans Karl,** BARON VON, German field-marshal: b. Dresden, 24 Feb. 1809; d. Karlsbad, 17 June 1885. He entered the army in 1827 and advanced rapidly, becoming lieutenant-general of cavalry 1861. He took part in the Danish War of 1864, and next year was appointed governor of Schleswig. During the war between Prussia and Austria he commanded the army of the Main, and fought at Hemstadt, Vettingen, Rossbrunn and Würzburg. He served with distinction in the Franco-German War, especially in several actions around Metz, at Amiens, and from June 1871 to July 1873 he commanded the army of occupation in France, and was made field-marshal. In 1879 he was appointed governor-general of Alsace-Lorraine, and in this capacity showed singular want of skill and tact in ruling a conquered people.

MANTI, măn'tī, Utah, city, Sanpete County seat, alt. 5,548 feet, on the Denver and Rio Grande Western Railroad, 126m. S. of Salt Lake City. It is situated in a sheep-raising region. Poultry and dairy products are handled. The city has a Carnegie library, a hospital, a

National Guard armory, and a county-city jail. There is a Mormon temple here; also, three Mormon churches and a Presbyterian church. The name Manti is taken from the *Book of Mormon.* Manti has a mayor and council; the city was founded by Mormons in 1849. Pop. (1950) 2,051.

MANTINEA, măn-t'n-ē'à, or **MANTINEIA,** ancient city, Arcadia, Greece; on the Argolis district border of the eastern Peloponnesus, on the Ophis River. Mantinea was known for its wealth, and famous for the battles fought near it; in 418 B.C., when the Argives, Athenians, and Mantineans were defeated by the Spartans; in 385 B.C., when the city was taken and destroyed by the Spartans; and in 362 B.C., when the Thebans under Epaminondas defeated the Spartans, although the victory of the Thebans was purchased with the life of their commander. Mantinea was, in 226 B.C., surprised by Aratus of Sicyon; and in 222 B.C. taken by Antigonus III Doson; on this occasion the town was sacked, and the inhabitants were sold as slaves. Another battle was fought near Mantinea 207 B.C., between Machanidas, tyrant of Lacedaemon, and Philopoemen, general of the Achaean League. The latter was victorious, and slew the tyrant with his own hand.

The French school at Athens financed an archaeologist, G. Fougères, in uncovering a large area here in 1888. The ancient city was walled, with towers about 80 feet apart. A large mound-shaped theater was disclosed, a square market hall, and paved roads of different eras.

Consult Fougères, G., *Mantinée et l'Arcadie Orientale* (Paris 1898).

MANTIQUEIRA, mann-tê-kā'ê-rà, **Serra da,** mountain range, Brazil, which is in the southeastern part of the republic and is about 75 miles from the Atlantic Ocean and extends nearly parallel with the coast for about 200 miles. The eastern end is near Rio de Janeiro. Ranges connected with the Mantiqueira are often included with this range and the name Mitiqueira applied to the whole. Mount Itatiaía, the highest peak, is 9,145 feet above the sea. Several large rivers have their sources in this range.

MANTIS, an orthopterous insect of the family Mantidae. These curious insects, allied to grasshoppers, abound in many parts of the world, and have always excited popular notice, and have been endowed with many supernatural qualities by the ignorant and superstitious of all countries. They are slender, with long, locust-like legs, oval wings, and a long necklike prothorax, terminating in an angular head with large protruding eyes. The front legs are stout, spiny, fitted for grasping their prey, and are held up in front of them in an attitude that to some suggest prayer. Hence the names praying insect, prophet, and the like often given to the more familiar species; to others they suggest other ideas, as of a horse pawing the air, whence our common species of the southern states (*Stagomantis carolina*) is known as the rearhorse, and in Europe these insects are called camel crickets. Why it should also be called mule killer is harder to explain; probably it is by confusion with a scorpion also so called.

These insects in tropical countries have come to assume various forms and hues similar to the flowers near which they lurk to catch the insects visiting the blossoms—a protective measure which comes under the head of mimicry. A large proportion of the insects upon which they feed are injurious to crops, hence the mantis may be regarded as beneficial to man. Among the Japanese and Chinese they are made to minister to human amusement also, being kept in cages and made to engage in combats upon which the spectators bet money. The eggs of the mantis are laid in an oval mass upon the stem of a plant and covered with a tough case of hardened mucus which shows a curiously braided pattern of surface and is easily recognized.

MANTIS SHRIMP, a large crustacean (*Squilla empusa*) of the order Stomatopoda, which dwells in burrows between tidemarks along the Eastern coast of the United States, and seizes marine worms, and the like, that come within its reach. Its general shape is shrimplike, but it has strong claws on the second pair of legs, which much resemble the forelegs of a mantis (q.v.), are provided with sharp spines, and are so joined that they can be folded back upon themselves like the blade of a clasp knife, and so take a firm grip upon the struggling captives. It is quite blind, although the eyes appear to be well formed. A well-known European species is gathered for food by the coast people.

MANTLE (1) a kind of cloak or loose garment to be worn over other garments. (2) *In heraldry* see MANTLING. (3) A fabric-like covering of salts easily rendered incandescent, for placing over a gas flame to increase the light diffused. See also GAS ILLUMINATION, HISTORY OF.

MANTLE-ROCK (also called Regolith), the loose unconsolidated debris that results from rock weathering. It includes all soils except those of strictly organic origin. If they have resulted from weathering in place, without removal, the soils are called residual; if they have been carried from their place of origin by wind, glaciers, or running water, they are said to be transported. The mantle-rock varies greatly in thickness. In some places it is entirely absent, in others it is hundreds of feet deep. See also SOIL.

MANTLING, *in heraldry,* an ornament depicted as hanging down from the helmet, and behind the escutcheon. It is considered to represent either the cointise, an ornamental scarf which passed around the body, and over the shoulder; or the military mantle, or robe of estate. When intended for the cointise, it is cut into irregular strips and curls of the most capricious forms, whose contortions are supposed to indicate that it has been torn into that ragged condition in the field of battle. When the mantling is treated as a robe of estate, the bearings of the shield are sometimes embroidered on it. A mantling adjusted so as to form a background for the shield and its accessories constitutes an "achievement of arms."

MANTRAPS, metal traps formerly used on the grounds of large estates in England to catch poachers and trespassers. The grounds were often posted with the warning notice, "Man-traps and spring-guns set here." Designed with sharp teeth to clutch and hold the leg of anyone caught in them, in appearance they resembled gigantic rat-

traps several feet long. They may be seen in museums; it has long been illegal to set them (save indoors between sunset and sunrise), as a defense against burglars.

MANTUA, măn'tū-ą, Italy, a fortified northern town, capital of the former duchy, and now of the department of Mantua, 80 miles by rail southeast of Milan, on an almost insular site on the Mincio, which here divides into several arms ending in a marshy and insalubrious lake. Communication is maintained between the islands and mainland by several bridges, the chief of which is Ponte di San Giorgio, 800 yards long. Mantua is written Mantova by the Italians; it is the see of a bishop, the seat of a civil, criminal and mercantile court, and the residence both of a military governor and of a provincial delegate. The most remarkable edifices are the cathedral, after an elegant design by Giulio Romano; the church of Saint Andrea, conspicuous from a distance by its majestic cupola and Gothic tower; the church of Santa Barbara, containing the mausoleum of Carlo Gonzaga; the church of San Sebastian; the Corte Reale, formerly the ducal palace of the Gonzagas, a huge irregular pile, now partly used as barracks; the Castello di Corte or old castle of the Gonzagas; the Torre della Gabbia, the Torre del Orologio, and the Torre dello Zuccaro; the Beccheria and Peschiera, or shambles and fish market, both built by Giulio Romano; the house of Giulio Romano, the Palazzo Colloredo, with enormous caryatides supporting its façade; the Palazzo del Té, outside the walls of the town, also built by Giulio Romano, and adorned with some of that master's largest frescoes; the Accademia Virgiliana di Scienze e Belle Arti; the Liceo, the military arsenal, two theatres, one called the Teatro Virgiliano, employed for open-air performances in summer, situated in a fine piazza also named after Virgil, and containing a marble pillar surmounted by a bronze bust of the poet; the library, containing 80,000 volumes; the civic and two foundling hospitals; the Monte di Pietà, the principal house of correction for the whole of Lombardy. The manufactures are increasing. The trade is chiefly in the hands of the Jews, who live in a separate quarter. The principal article of trade is silk. There are machine works, oil and flour mills, tanneries and breweries; there is also a considerable trade in timber, which is floated down the Mincio. Mantua was an ancient Etruscan settlement, and in the time of Virgil, a native of the region, was a Roman town. Charlemagne built its first fortifications. Soon after 1115 Mantua succeeded in making itself independent, and continued so till 1276, when it fell under the iron rule of Buonacolsi or Bonacossi. In 1328 it found better masters in the Gonzagas, who, first as captains, then (from 1432), as marquises, and finally (from 1530) as dukes of Mantua, governed it with great ability, and distinguished themselves by the splendor of their court and their patronage of literature and art. The last of the Gonzaga family who reigned in Mantua was Ferdinando Carlo, or Carlo IV, who, having taken part with the French in the War of Succession, was declared to have incurred a forfeiture by withdrawing his allegiance from his liege lord the emperor of Germany. The Mantuan territory was accordingly annexed to the Austrian possessions in Lombardy, and the remaining part of Montferrat was assigned to Savoy (1708). The fortifications of the town, previously formidable, were completed and put into their modern form by the Austrians and have been kept up to date by the Italian government. In 1796 Napoleon, apparently hopeless of reducing it by any other means, contented himself with keeping it under strict blockade, till famine compelled the garrison to capitulate. After the cession of the western part of Lombardy to Sardinia in 1859, Mantua, with what else of Lombardy remained to Austria, was united to Venetia, and with it was given up to Italy in 1866. The area of the department is 903 square miles, and the population (1921) 376,901. The communal population is 40,467.

MANU, mā'noo, the reputed author of the most renowned law-book of the ancient Hindus, and likewise of an ancient Kalpa work on Vedic rites. It is matter, however, of considerable doubt whether both works belong to the same individual, and whether the name Manu, especially in the case of the author of the law-book, was intended to designate a historical personage; for, in several passages of the Vedas (q.v.), as well as the Mahâbhârata (q.v.), Manu is mentioned as the progenitor of the human race; and, in the first chapter of the law-book ascribed to him, he declares himself to have been produced by Virâj, an offspring of the Supreme Being, and to have created all this universe. Hindu mythology knows, moreover, a succession of Manus, each of whom created, in his own period, the world anew after it had perished at the end of a mundane age.

According to theosophy, the Manu is a great Being (though once a man) who governs the earth planet; other Manus govern other planets, while the Logos (q.v.) created the universe. The word Manu is chiefly used with reference to the author of an ancient renowned Hindu lawbook. This work is not merely a law-book in the European sense of the word, it is likewise a system of cosmogony; it propounds metaphysical doctrines, teaches the art of government, and, among other things, treats of the state of the soul after death. The chief topics of its 12 books are the following: (1) creation, (2) education and the duties of a pupil, or the first order; (3) marriage and the duties of a householder, or the second order; (4) means of subsistence and private morals; (5) diet, purification and the duties of women; (6) the duties of an anchorite and an ascetic, or the duties of the third and fourth orders; (7) government and the duties of a king and the military caste; (8) judicature and law, private and criminal; (9) continuation of the former and the duties of the commercial and servile castes; (10) mixed castes and the duties of the castes in time of distress; (11) penance and expiation; (12) transmigration and final beatitude.

Bühler has proved that Max Müller was right in regarding the extant work as a versified recast of an ancient law-book, the manual of a particular Vedic school, the Mânavas; and holds that the work, the date of which used to be given at 1200 B.C., was certainly extant in the 2d century A.D., and seems to have been composed between that date and the 2d century B.C. There are many remarkable correspondences between this work and the Mahâbhârata, suggesting the use in both of common materials.

MANUAL ACTS, in ecclesiastical and Church hitsory, acts performed by the hands of the celebrant in the mass, chiefly the fraction of the host, and making the sign of the Cross over it before consecration. Both were objected to at the Reformation.

MANUAL ALPHABET, the deaf and dumb alphabet; the letters made by deaf and dumb persons with their fingers.

MANUAL BLOCKING. See BLOCK SIGNAL SYSTEM.

MANUAL TRAINING. As an educational term, manual training includes all handwork used as a means in general education. It differs from trade education through the apprenticeship system in that it emphasizes the educational element rather than the commercial or industrial element. This "hand-training," however, differs from education in its broader meaning, in that it emphasizes manual skill, and makes such by-products as judgment, accuracy, habits of observation, language, etc., more or less important incidents in the results to be attained. The more recent development of vocational training has tended to cast doubt upon the validity of manual training as a part of education, while the advocates of the traditional features of education — literature, history, mathematics, science, philosophy,— have never admitted it to a place in their educational scheme. The term has therefore become restricted to those forms of handwork which are used as agencies in general education as distinct from vocational, trade and industrial education. The manual training advocates continue to hold that habits of accuracy, judgment and observation and sincerity, formed through manual activities, will contribute to these same mental habits as permanent life characteristics. In this they return under peculiar circumstances to the doctrine of formal discipline, approaching the matter in reverse order from the early devotees to this doctrine. Nevertheless it is on this theory that manual training is now holding its place in American public education. When it surrenders this position it must become prevocational or vocational training.

History of Manual Training.— Finland holds the honor of the earliest use of handwork as an agency in education. Between 1858 and 1866 a plan was developed for teaching handwork in the primary schools, and for training handwork teachers for the public schools.

Sweden established handwork as a part of its educational system in 1872. This included carpentry, wood-turning, wood-carving, coopers' work, book-binding, etc., activities selected from the Hus Slöjd occupations from which we have the well-known "Sloyd Work." Sweden was concerned with the physical health of its people as well as the passing of the old system of house industries. It was hoped that this manual work would invigorate the physical and moral health of the people who lived under artificial city conditions; and that industry would be stimulated by a wide diffusion of manual skill. The Swedish nation has now made handwork an integral part of its public school program and has thus laid a broad and sure foundation for the excellent technical and trade schools above.

France adopted handwork in 1873 in the École Salicis, and in 1882 made such work compulsory in all elementary schools. From its very beginning drawing has been emphasized and mathematics has been a closely related subject. Because of this academic work the French have drawn the regular teacher into this handwork movement side by side with a trade teacher who gives the practical work. This relationship between the academic teacher and the trade-teacher has been adopted by other countries and has apparently proved its usefulness.

England opened its first handwork classes in 1886 and to-day all the large centres of population require such work in their schools. The government awards special financial grants to municipalities who give manual training to boys and girls of 11 years and older.

Germany has long emphasized manual instruction for the artisan classes in her population but her emphasis has been on trade or vocational features. Skill of hand has been the purpose, rather than such moral qualities as were sought, for example, by the Swedish system. As a consequence Germany developed trade and occupation schools, rather than manual training courses in the "*real-schulen.*" The Gymnasia of course give no training in handwork. In fact, there has been no general scheme adopted by any considerable portion of Germany. This is probably due to the fact that trade and occupational training were efficiently carried on. Recently, since 1887, some schools have adopted typical manual training courses, and the Manual Training Seminary at Leipzig is the principal source of manual training teachers within the Empire.

Manual training in the United States has depended on private and local initiative. There had been no national movement prior to 1917. The Ethical Culture Society of New York City made the first step by opening handwork classes for small children in 1878 in connection with its workingmen's school. This was followed in 1880 by Washington University, Saint Louis, Mo., under the direction of Calvin A. Woodward. This experiment consisted of a fully equipped manual training high school with a variety of shopwork in wood and metal, mechanical drawing, and in such appropriate academic work as science and mathematics. It was a pioneer school and its success was noticed by many of the large American cities. By 1900 a majority of American municipalities had adopted some form of manual training. Work for girls as well as boys was included in the program. The courses for girls included sewing, dressmaking, millinery, burnt wood, leather and art jewelry; for boys it included joinery, wood-turning, pattern-making, forging, machine-shop, foundry, sheet-metal, printing, electric wiring, etc. In the elementary school handwork has likewise found a large place on the program, beginning in the kindergarten and continuing through the elementary grades. The activities include paper folding and paper cutting, basketry, clay-modeling, wood-carving, raffia work, etc. Correlation with drawing is more and more the rule. The best practice in the public schools now relates drawing to the experiences of the child. Design is the basis of the work and the design of the drawing-class frequently becomes the project of the handwork-class in the upper grades. Manual training in the American high school early developed into a distinctive institution. Its handwork or shop-work program is only remotely

related to industry. The projects are often impractical because they are chosen, not because of their utility or industrial significance but because they illustrate fundamental processes of industry. Type constructions are used as analytical studies of various manufacturing processes. A complete product is not sought nor are such elements as time, commercial value and shop atmosphere made a part of the instruction. The purpose of this typical Manual Training High School is vaguely educational, remotely industrial. As such, it fails to meet the needs of many industrial communities.

The Vocational Motive.—A change of sentiment became apparent immediately after the Saint Louis Exposition of 1904. Educators who had investigated the subject in Europe and America, who saw the display of the nations' handwork, seemed to feel the need of training that related more closely to life motives. Manufacturers demanded industrial efficiency and appeared to have no confidence in the vague results of the typical Manual Training High School which was a traditional school with shop facilities. A demand arose for "shops with schools attached" or with school facilities. Manual training was soon modified so as to add the vocational appeal to boys and girls of 14 years of age and upward. The handwork of the seventh and eighth grades has come to be known as "prevocational" in the sense that the processes of many vocations are taught with the purpose of giving the child an opportunity to choose wisely with the aid of vocational advisers among teachers, parents and industrial or vocational experts. The logical step to follow this "prevocational" work is the trade school so that the advance of the vocational and industrial motives makes the old manual training ideal recede.

Industrial Education and Manual Training.— Industrial education is a more comprehensive term than manual training. It includes all that was at first expected from manual training as a stimulus to efficient workmanship; all that vocational and "prevocational" training propose; all that trade education seeks to secure. The emphasis is now on training and the specialized education pertaining to special industries, while the vague educational results of manual training which it was claimed would come by transfer of faculties, drop below the horizon.

Appreciation of the value of vocational education from the national standpoint was shown by the passage by Congress in 1914 of the Smith-Lever Bill, and in 1917 of the Smith-Hughes Bill. The former provided Federal co-operation with the States, chiefly along agricultural lines, while the former created a Federal Board of Vocational Education, and also provided for co-operation with the States in all branches of vocational training. After the World War the Federal Government provided, on a gigantic scale, facilities for vocational training for all honorably discharged soldiers who wished to take it. Up to 1 Nov. 1926, 179,674 veterans had taken this training, and of this number 127,348 had completed the courses. See EDUCATION, INDUSTRIAL; EDUCATION, TECHNICAL; VOCATIONAL EDUCATION.

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MANUCODIA, măn-u-cō-dĭ-ą, in ornithology, a group of birds either belonging or closely allied to the *Paradiseidæ,* and peculiar to the Papuan sub-region. The plumage is glossy steel-blue; the outer and middle toes are united for some distance, and there is an extraordinary convolution of the trachea in the males, to which the loud and clear voice of the birds is owing. Mr. Sharpe divides the Manucodia into two genera: Phonygama and Manucodia proper, of which four species are admitted — *Manucodia chalybeata* (*chalybea*), from the northwest, and *M. comriei,* from the southwest, of New Guinea; *M. atra,* widely distributed over the Papuan sub-region, and *M. jobiensis,* peculiar to the island whence it derives its specific name.

MANUEL I, Comnenus, man'ū-ĕl kŏmnē'nŭs, a Byzantine emperor: b. about 1120; succeeded his father, Joannes II, in 1143, died in 1180. The valor which he had displayed against the Turks induced his father to bequeath the crown to him rather than to his elder brother Isaac, who was immediately imprisoned by Axuch, the minister of the deceased emperor. Returning from his campaign in Cilicia, Manuel was received with enthusiasm at Constantinople, but was at once involved in wars both in the East and the West, which lasted with brief intermissions through his reign. In 1144 he subjected Raymond, the rebellious Latin prince of Antioch. In 1145 he defeated the sultan of Iconium in successive pitched battles. In 1147 he promised his aid to the new crusade headed by Louis VII of France and Conrad III of Germany, and though he allowed them a passage through his dominions he gave secret information to the Turks.

In 1148 he began the most important war of his reign with Roger, the Norman king of Sicily, who had taken Corfu and prepared to invade Greece. He formed an alliance with the Venetians, who within a year joined him before the fortress of Corfu, which was surrendered after an obstinate siege. He was prevented from invading Sicily by hostilities of the Serbians and Hungarians, instigated by Roger, the former of whom were vanquished in two campaigns, but the latter protracted the war till 1152. In that year he suffered a reverse from the Turks in Cilicia, but his general, John Ducas, gained so great successes in southern Italy that Manuel conceived the project of reuniting the eastern and western empires.

The defeat of Alexis, the successor of John Ducas, by William, the successor of Roger, soon followed; the Sicilian admiral Maius routed the Greek fleet off Negropont, and advanced toward Constantinople; and Manuel therefore accepted an honorable peace in 1155. Those Greek prisoners who were silk-weavers were retained in Italy, and gave origin to the flourishing Italian silk manufactures. In the following years he waged successful wars with Raymond, Prince of Antioch, and Az-ed-din, the Turkish sultan. A new war soon broke out with Gejza, king of Hungary, which was terminated by a disastrous defeat of the Hungarians near the present Semlin. In 1176 he experienced a terrible defeat from Az-ed-din in the mountains of Pisidia, and was obliged to sign a disadvantageous peace. By breaking the treaty and renewing the war he

obtained honorable terms. His many military campaigns weakened the empire financially and contributed to its ultimate collapse. He was succeeded by Alexius II Comnenus.

MANUEL II Palaeologus, Byzantine emperor: b. 1350; d. 1425. He was the son of John V, and coregent with John VII. In 1391 he was a hostage at the court of Bajazet (Bayazid) I, sultan of the Ottoman Empire, at Brusa. Having effected his escape, he was attacked by Bajazet but was assisted by an army of Hungarians, Germans, and French. However, the allies, under command of Sigismund, king of Hungary, were badly defeated at Nicopolis (Nikopol) by Bajazet in 1396, and Manuel was shortly besieged in Constantinople (now Istanbul). During 1399–1403 Manuel II visited Italy, France, and Germany, seeking to establish a union of the Latin and Greek churches and to obtain help against the Turks. The defeat of the latter at Angora (Ankara) by Tamerlane (Timur) in 1402 saved the threat to Constantinople, but Manuel failed to take further action against Bajazet, who died the next year. In 1422 the emperor was once more besieged in Constantinople, on this occasion by Murad II, and a few months before the end of his life Manuel was compelled to agree to the payment of tribute to the Ottoman Empire. He was a prolific writer, composing poetry and producing works on rhetoric and theology. His successor was John VIII Palaeologus (r. 1425–1448).

MANUEL II, king of Portugal: b. Lisbon, Nov. 15, 1889; d. Twickenham, England, July 2, 1932. He was the second son of Carlos I, and in boyhood, when he was known as the Duke of Beja, he was trained for a naval career. On Feb 1, 1908, his father and his elder brother, Louis, were assassinated in the streets of Lisbon and Manuel, then 18 years of age, was called to the throne. He inherited a burden of unpopularity with which his training had not fitted him to cope, and republican victories at elections in Lisbon and Oporto were followed in October 1910 by a naval revolt which forced the young king to flee the country. By way of Gibraltar he made his way to England after a reign of only 32 months, and the remainder of his life was spent in exile. While he never officially abdicated, he took no action to regain his throne. A man of great wealth, he led the life of a cultured country gentleman, among his books, his artistic pictures, and his sporting interests. He possessed a collection of early Portuguese books said to have no rival outside of the British Museum. In 1913 he married Augusta Victoria, daughter of Prince William of Hohenzollern; there was no issue. His body was returned to Portugal in August 1932 for burial in Lisbon's Pantheon, where funeral services were attended by the president of the Portuguese republic; he bequeathed his entire Portuguese estate to the government.

MANUEL, Don Juan, Spanish prince and writer: b. Escalona, May 5, 1282; d. 1349. He was a nephew of Alfonso X and cousin of Sancho IV. During the minority (1320–1325) of Alfonso XI he served as a coregent, and he also commanded a Spanish army fighting the Moors. His chief claim to remembrance, however, is as a writer of prose works notable for singular simplicity and charm. The finest of these was *Libro de Patronio,* more commonly known as *El Co Lucanor,* a collection of tales written in a hi moral tone.

MANUL, mă'nōōl, the common wildcat Siberia and Tibet. It is smaller than the E ropean wildcat and is stockily built; it has moderately long tail and a coat of long ha The general color is yellowish white, with blackish mark on the chest and upper part the forelegs, and some dark lines across haunches and ringing the tail. Two black li on the cheeks and a black spot behind the sh ear are other distinguishing marks. There a curious similitude of appearance between t animal and the pampas cat of Patagonia.

MANUMISSION, in Roman law, solemn ceremony by which a slave was em cipated. Constantine the Great allowed Christian masters to emancipate their slaves fore the altar on festival days, and especially Easter, by placing the deed of emancipation the head of the freedman in the presence of congregation. See EMANCIPATION.

MANURES AND MANURING. AGRICULTURAL CHEMISTRY; FERTILIZERS.

MANUS, mă'nŭs, largest of the Admira Islands, a group comprised within the Australi administered Territory of New Guinea. It situated 160 miles west of Lavongai, in the B marck Archipelago; it is 52 miles long by miles broad, and has an area of 650 square mi The island is densely wooded and mountaino the highest elevations approximating 3,000 fe Lorengau, at the northeastern end of the isla is the chief port and administrative headquarte Manus contains numerous coconut plantatio and off the coasts lie valuable trochus and pe shell fisheries. During World War II the Uni States constructed an extensive naval base Manus, harnessing the Lorengau River to sec hydroelectric power and building a bridge acr Loniu Passage to the neighboring island of N Negros. Manus was discovered in 1616 by W lem Cornelis Schouten (q.v.), visited by Phi Carteret and the Chevalier d'Entrecastea (qq.v.) in 1767 and 1791 respectively, and s veyed by the *Challenger* Expedition (q.v.) 1875. It was agreed between the governments Australia and United States after World War that the naval forces of both powers would ha the use of the Manus base.

MANUSCRIPTS (Latin, *manuscript* written by the hand), are literally writing any kind, whether on paper or any other m terial, in contradistinction to printed matt Previous to the introduction of printing all lite ture was contained in manuscripts. All the exi ing ancient manuscripts are written on parc ment or on paper. The paper is sometim Egyptian (prepared from the real papy shrub) sometimes cotton or silk paper (*cha bombycina*), which was invented in the E about the year 706 A.D., and used till the int duction of linen paper, and in common w this till the middle of the 14th century; so times linen paper, the date of the invention which, though ascribed to the first half of 13th century, on the authority of a docum of the year 1243, written on such paper,

nevertheless exceedingly doubtful. The earliest mention of quill pens is in the 7th century. The most common ink is the black, which is very old. The oldest, however, was not mixed with vitriol, like ours, but generally consisted of soot, lamp-black, burned ivory, pulverized charcoal, etc. Red ink of a dazzling beauty is also found in ancient times in manuscripts. With it were written the initial letters, the first lines, and the titles, which were thence called *rubrics,* and the writer *rubricator.* More rarely, but still quite frequently, blue ink is found in ancient manuscripts; yet more rarely green and yellow. Gold and silver were also used for writing either whole manuscripts (which, from their costliness, are great rarities), or for adorning the initial letters of books. With respect to external form, manuscripts are divided into rolls (*volumina,* the most ancient way, in which the troubadours in France wrote their poems at a much later period) and into stitched books or volumes (properly *codices*). Among the ancients the writers of manuscripts were mainly freedmen or slaves (*scribæ librarii*). Some of the professional copyists in Rome were women. When Origen undertook the revision of the Old Testament (231 A.D.), Saint Ambrose sent to his assistance a number of deacons and virgins skilful in caligraphy. Subsequently the monks, among them the Benedictines in particular, were bound to this employment by the rules of their Order. In all the principal monasteries was a *scriptorium,* in which the *scriptor* or scribe could pursue his work in quiet, generally assisted by a *dictator,* who read aloud the text to be copied; the manuscript was then revised by a *corrector,* and afterward handed to the *miniator,* who added the ornamental capitals and artistic designs.

It is more difficult to form a correct judgment respecting the age of Greek manuscripts from the character of the writing than it is respecting that of Latin manuscripts. In general it is to be remarked that in a Greek manuscript the strokes are lighter, easier and more flowing the older it is, and that they become stiffer in the progress of time. The absence or presence of the Greek accents is in no respect decisive. Some Greek papyri are earlier than the Christian era, but most are not earlier than about the 6th century. The characters in Latin manuscripts have been classified partly according to their size (*majuscula, minuscula*), partly according to the various shapes and characters which they assumed among different nations or in various periods (*scriptura Romana antiqua, Merovingica, Longobardica, Carolingica,* etc., to which has been added since the 12th century the *Gothic,* so called, which is an artificially pointed and angular character); and for all of those species of writing particular rules have been established, affording the means of estimating the age of a manuscript. Before the 8th century punctuation marks rarely occur: even after the introduction of punctuation, manuscripts may be met with destitute of points, but with the words separate. Manuscripts which have no capital or other divisions are always old. The *catch-word,* as it is termed, or the repetition of the first word of the following page at the end of the preceding, belongs to the 12th or subsequent centuries. The fewer and easier the abbreviations of a manuscript are the older it is. Finally, in the oldest manuscripts the words commonly join each other without break or separation. The division of words first became general in the 9th century. The form of the Arabic ciphers, which are seldom found in manuscripts earlier than the first half of the 13th century, also assists in deciding the age of a manuscript. Some manuscripts have at the end a statement when, and commonly also by whom, they were written (*dated codices*). But this signature often denotes merely the time when the book was composed, or refers merely to a part of the manuscript, or is entirely spurious. The most ancient manuscripts still preserved are those written on papyrus which have been found in Egyptian tombs. Next to them in point of age are the Latin manuscripts found at Herculaneum, of which there is a rich collection in the Naples Museum. Then there are the manuscripts of the imperial era, among which are the Vatican Terence and Septuagint and the Biblical codices in the British Museum. Since the middle of the 19th century many manuscripts of Greek writings have been found in Egypt, among the chief being that containing the orations of Hyperides, several containing parts of the works of Homer, Plato, Demosthenes, etc., that in which occurs a portion of the Antiope of Euripides, and the almost complete text of Aristotle's work on the constitution of Athens. It was the custom in the Middle Ages to obliterate and erase writings on parchment for the purpose of writing on the materials anew, and these manuscripts, many of them of great value, are known as "palimpsests." This custom ceased in the 14th century, probably because paper came then more into use. See LIBRARIES; MANUSCRIPTS ILLUMINATED; MANUSCRIPTS OF THE BIBLE; PALEOGRAPHY; PAPYRUS.

ANUSCRIPTS, Illuminated, are those whose text is heightened and brightened by vignettes and other decorations in colors, gold and silver. The verb to *illuminate* first occurs in the beginning of the 18th century; and means to decorate an initial letter, a word, or a text of a manuscript with gold, silver or brilliant colors, or with elaborate tracery, miniature illustrations and designs. The older verb was to *enlumine* (Old French *enluminer;* late Latin, *inluminare;* classic Latin, *illuminare*). It occurs, A.D. c. 1366, in Chaucer, A. B. C., 73, "Kalendeeres enlumyned ben"; A.D. c. 1400, 'Roman de la Rose,' 1695, "For it so welle was enlomyned"; A.D. 1430, Lydgate, 'Chron. Troy,' Prol., "For he enlumineth by craft and cadence this noble storye with many freshe coloure of Rhetorik." Illumination differs from painting, according to Ruskin, 'Modern Painters' (1856, Vol. III, iv, viii, sec. 9), in that "illumination admits no shadows, but only gradations of pure colour." The earliest writing of many peoples was by means of pictures. Witness the pictographs of Sumeria, that later evolved into Babylonian cuneiform script; the hieroglyphic writing of Egypt; the crude scrawls of our American Indians; and

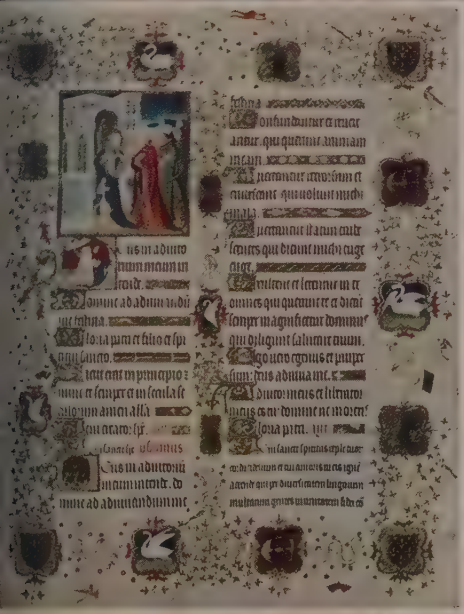
the Aztec picture-writing, which still defies epigraphists. It was but natural that an art arose of embellishing these pictographs. Fifteen centuries before Christ the papyrus rolls that contain the ritualistic 'Book of the Dead' were illuminated with brilliantly colored scenes. In due time the art of illumination passed over to peoples whose script was alphabetic; it always remained an art of beautiful writing. There is truth, though characteristically narrow and dogmatic in expression, in the saying of Ruskin, 'Lectures on Art' (1870, v. 138): «Perfect illumination is only writing made lovely; the moment it passes into picture making it has lost its dignity and function.»

I. Illumination in the East. 1. In Egypt. — The earliest specimens of illumination are on Egyptian papyrus rolls. Ritual directions are in red; hence the mediæval *rubric*. Profile portraits are inserted into the text. Agricultural and household scenes are interspersed between hieroglyphic signs. From the Egyptians the art of illumination reached the Hellenic folk of Alexandria. A 4th century B.C. papyrus manuscript of the poems of Timotheus, found at Abûsir, has a bird as a punctuation mark. Not until the Christian era do miniatures adorn the text. A 1st century A.D. Greek papyrus (Bibliothèque Nationale de Paris) shows a text that is adorned with miniatures in bold relief. A Berlin papyrus, Kaiser Friedrich Museum, illustrates the cure of a demoniac by Jesus. While in Hellenic Egypt the art of illumination thus progressed, the Coptic artists carried on a separate tradition from their ancient Egyptian forebears. A Coptic chronicle, dated 392 A.D. (Goleniscey collection) has a wealth of miniatures illustrative of the months, the provinces of Asia, the rulers of Rome, Lydia and Macedonia, together with the destruction of the Serapeum under the direction of the patriarch, Theophilus. The Morgan collection of Sahidic manuscripts, of the 9th and 10th centuries, contains a dozen manuscripts with miniatures of the Virgin and her Son, angels, martyrs, saints, hermits; and almost all of the 58 manuscript volumes of this remarkable Coptic library are illuminated with marginal decorative schemes of animals and plants.

2. In Syria. — The monks of Syria show the traditions of the Semitic orient in the illumination of manuscripts. Saint Augustine, 'Adv. Faustum' (xiii, 6, 18), refers to the miniature illustration of Persian parchments. From the 5th century, there were monastic schools for illumination in Mesopotamia and Syria. The Syriac Evangeliary, 586 A.D., the work of Rabbula at Zagba in Mesopotamia, now in the Laurentian Library, Florence, is an exquisite work of art; the miniatures represent the Crucifixion, etc.; the marginal schemes are geometrical, and contain flowers, birds, etc. Some Hellenistic influence is noticeable; but Semitic traditions dominate in the Syriac school of illuminating. To this school belong also the extant Armenian illuminated manuscripts. Three evangeliaries, books of pericopic readings from the Epistles and Gospels, show the most beautiful work of Armenian miniaturists: that of Etschmiadzin, 10th century, copied from a 6th century model; that of Queen Mlke, 902 A.D., Monastery of the Mechtarists, Venice; and the Tübingen Evangeliary, 1113 A.D. Mohammedan illumination copied Syriac in many Arabic, Turkish and Persian manuscripts, chiefly of the Qûran. The decorative work is often rich in its red blue and gold cufic characters.

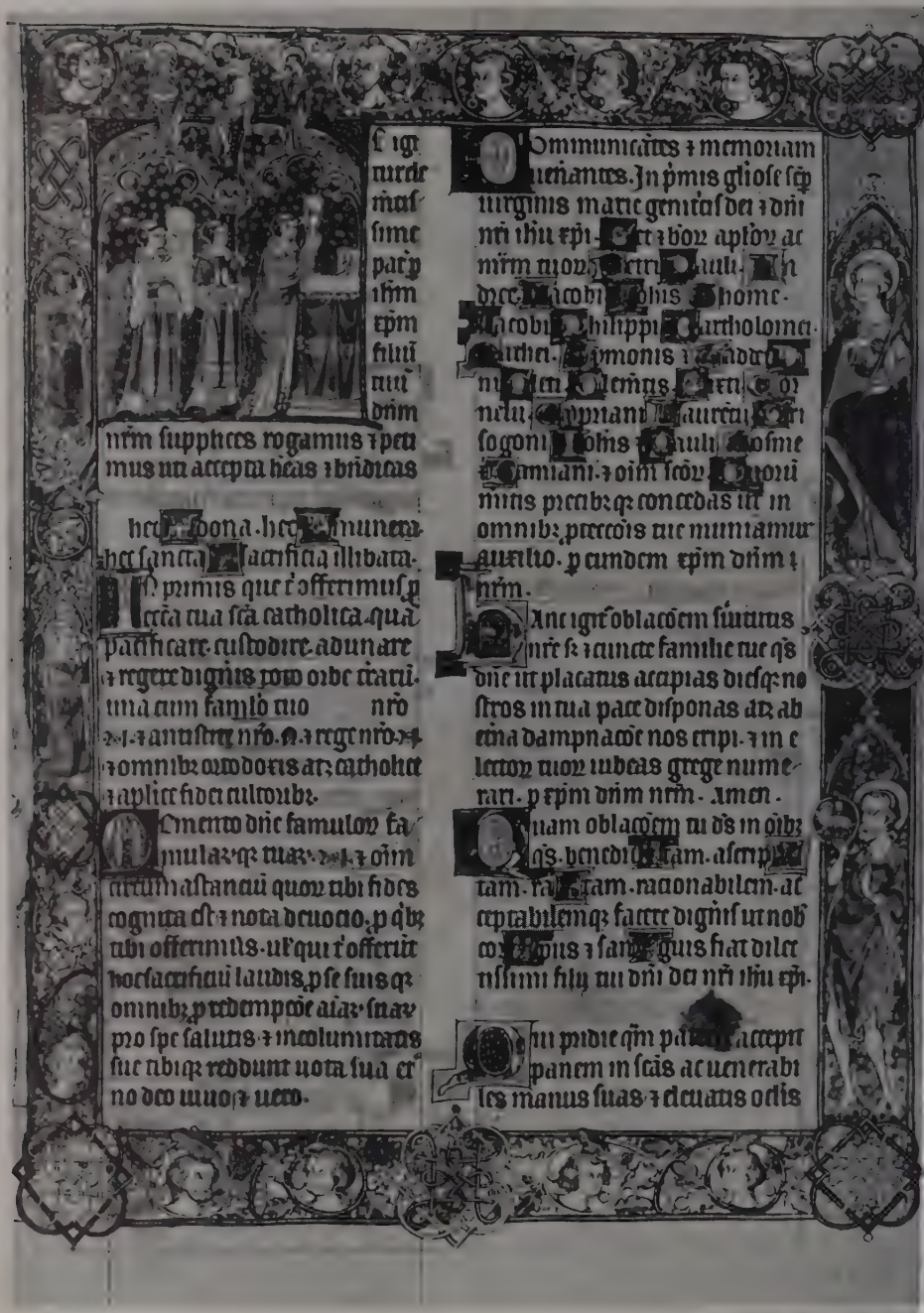
3. The Byzantine School. — In the Hel lenistic speaking parts of the Byzantine Em pire, the traditions of ancient Greece hel sway; although iconoclasm interfered for while with the progress of miniature painting and Syriac influences were strong. Previous t the destructive vandalism of the iconoclasts Byzantine miniaturists beautified the great 6t century purple parchment, Biblical codices L, *Vienna Genesis,* silver letters; N, *Cod. Pur pureus,* silver letters, Gospels, most of manu script at Petrograd; Σ, *Cod. Rossanensis,* si ver letters, Matthew and Mark, at Rossano, i Calabria; Σb, *Cod. Sinopensis,* gold letter Matthew, in the Bibliothèque Nationale d Paris; Φ, *Cod. Beratinus,* Matthew and Mark at Berat, Albania. These illuminated manu scripts contain Biblical scenes, the bearded fac of the Christ, etc., — all in miniature. To thi period of Byzantine illumination belongs th 'Roll of Joshua,' 11 yards long, at the Vatica which pictures the story of the great leader and the manuscript of Dioscorides, at Vienna 472 A.D., containing portraits of physicians tha were copied from originals. All this early By zantine illumination was along broad lines, fre from stereotyped forms, — save the hieratic an fixed faces, — classic in artistic merit, brilliar in coloring, and profusely decorated with gold.

Iconoclasm during the 8th and 9th centurie wrought havoc to the art of illumination in th Byzantine Empire. Precious manuscripts wer recklessly destroyed or ruthlessly mutilated The artists of the iconoclastic period substitute ornamentation for miniature; flora, fauna an geometric forms for figure-painting. An in stance of their work is the 'Evangeliary' a Bibliothèque Nationale de Paris, Gr. 631. Th triumph of image-worship, 842 A.D., brough about a return to the painting of figures. Th 10th to the 12th centuries were the most gloriou period of Byzantine miniaturists. About 4 years after the restoration of image-worshi the 'Sermons of Saint Gregory of Nazianzen (Bibliothèque Nationale de Paris, Gr. 510) 880 c. A.D., were executed, and embellished b a series of large, beautiful miniatures. Th 'Paris Psalter,' dating from the 10th centur (Bibliothèque Nationale de Paris, Gr. 139), ha scenes of the life of David, reproduced fro 3d or 4th century models, that vie with th frescoes of Pompeii in freshness and brilliancy The 'Homilies of Saint John Chrysostom,' Pari a manuscript which belonged to Nicephorus II (1078–81 A.D.) is likewise a good examp of Byzantine illumination at its maturity The Psalter and the Menologion, a brief sketc of the lives of the saints for each day, wer at this time most frequently decorated. Th 'Vatican Psalter' (1059 A.D.), in the Barberi Library; and the Menologion of Basil II (976 1025 A.D.) in the Vatican, are rich in minia tures of brilliant coloring. Here should b mentioned the Slavic school of illuminatio It was Byzantine at first; and gave us th 'Chloudov Psalter,' 9th century, at Moscow Between the 12th and 16th centuries, a nationa style appeared, which is characteristic of man of the numerous and richly illumined manu scripts of the libraries and museums of Petro grad and Moscow.



MANUSCRIPTS, ILLUMINATED: *Top:* "Lancelot of the Lake at the Tomb of Galahad," an illumination in two scenes by a French artist of the 14th century. *Center left:* A 15th-century Flemish illumination of the "Duc de Berry received by St. Peter." *Center right:* "The Bible of St. Louis," an illumination by a French 13th-century artist. *Bottom left:* "Tree of Jesse, Book of the Mass," done in Germany, 15th century. *Bottom right:* Italian 15th-century miniature of the "Stigmatization of St. Francis."

Courtesy The Pierpont Morgan Library, N. Y.; Bibliothèque Nationale, Paris; Bavarian State Library, Munich; National Gallery of Art, Washington, D.C.



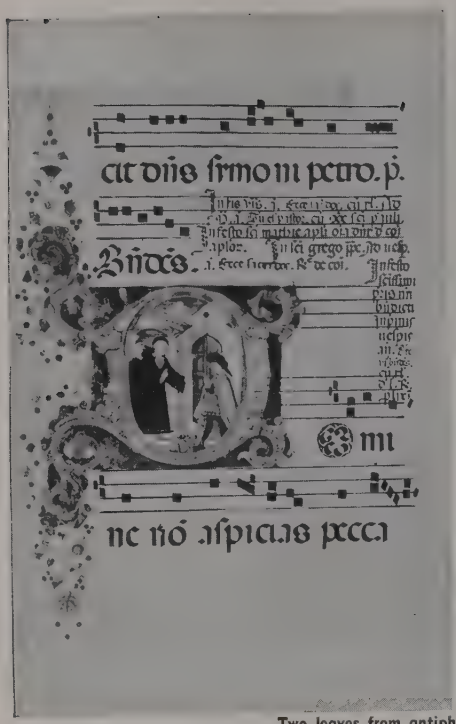
By permission of The Pierpont Morgan Libr

An English missal, of the early 14th century. This manuscript was known as the Tiptoft Missal, since it was writte and illuminated for Hawse de Tiptoft (d 1345) and John Clavering (1266–1332) to whom she was married. Folio 14 (*pictured here*) shows the standing figures of Saint John the Evangelist and Saint John the Baptist in the right borde In the left border, are the kneeling figures of John Clavering and Hawse de Tiptoft.

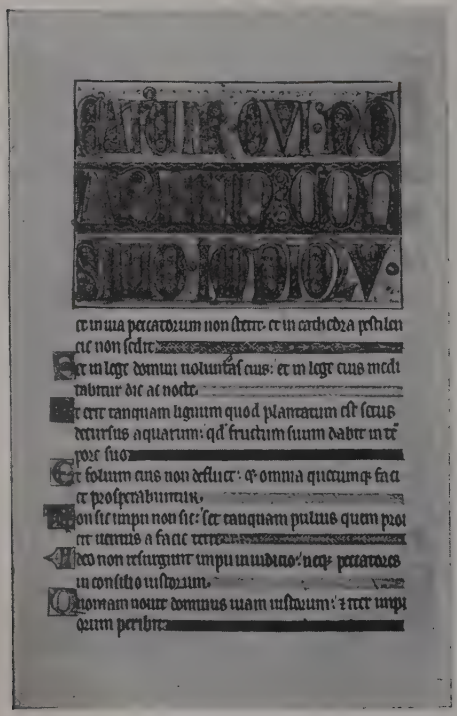
Letter S illuminated. Italian (Verona). Early 15th century.

Courtesy, The Metropolitan Museum of Art

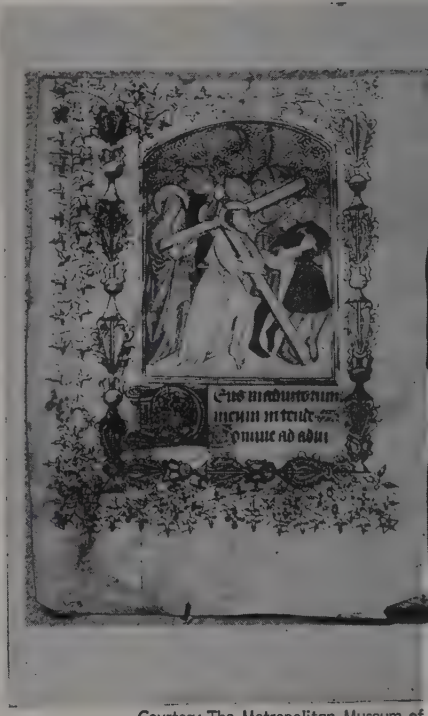
Letter M illuminated. Italian. 14th century.



Two leaves from antiphonary. Italian. 15th century.



First page of Psalter. French. 13th century.



Courtesy The Metropolitan Museum of
Letter D illuminated. French. 15th century.

II. **Illumination in the West.** **1. Early Italian.**— As manuscript writing, so illumination began in the East, and was thence taken over by the West. Pliny, 'Historia Naturalis' (xxv, 8) is witness to miniature-painting in Rome during the 1st century B.C. Martial (xiv, 1865) speaks of a parchment containing a portrait of Virgil. Varro had some 700 such miniature portraits. The most ancient illuminated manuscripts probably of western provenance are: the fragmentary 'Iliad,' 3d century, Ambrosian Library, Milan; the Vatican Virgil, the 'Schedæ Vaticanæ,' 4th century, Vat. Lat. 3225, with 50 miniatures; the 'Codex Romanus,' another Vatican Virgil. Here be it noted that Latin illuminators gave us the word *miniature,*— from the Latin *minium,* which means red lead or cinnabar,— the vivid-red lead oxide used as a pigment. Hence also is *minare,* to paint in miniature; together with *miniator,* the miniature-painter. Early Italian illumination is not very well known to the historian of art. Byzantine art reacted on Italian; and this reaction is marked in mosaics, early Italian painting, and the earliest illumination of manuscripts in southern and central Italy. Through Italy, the East influenced the illuminators of the Frankish Empire.

2. Celtic Illumination.— It was during this period of decline of illumination in the West that the Irish school, as early as the 7th century, broke completely away from the copying of ancient models and inaugurated its own style of book-ornamentation. The individuality of the artists, the civilization and character of their race, were expressed in an art that reached the very height of perfection and made its influence felt in continental Europe. The Celtic initials, margins, and full-page designs are easily recognized by their great intricacy of interlacing spirals, zigzags, and ribbons, that entangle animal and human shaped fancies, knots, and other designs,— all executed with a marvelous precision of mathematical accuracy, graceful delineation, delicate touch, brilliant coloring, and most fecund imagination. Irish illumination is decidedly oriental in conception and execution; and seems to point back to the ancient civilization of the race, before the Celtic migration from the steppes of Asia, across Asia Minor, by way of Austria, Switzerland, Spain and France. No trace is found of classic influences. Foliage is absent. Kinship with the sculpture on stone and jewels in barbaric Ireland is marked. The wonderful decorative schemes are more like to the Arabic than to any other; and the human form is depicted with a geometrical symmetry that is characteristic of Coptic workmanship. The finest example of Celtic illumination is in Q, 'Codex Kenanensis,' the Book of Kells, 8th century, Vulgate Gospels, in Trinity College, Dublin. Its pages are replete with brilliant, exquisite designs, testifying to a minuteness and delicacy of precision that are a marvel to art critics. The Celtic art of illumination reached Iona through Saint Columba's foundation there; and the monks of Iona (635 A.D.) brought their faith and their art to Lindisfarne, or Holy Isle, off the Northumbrian coast. Here was executed in Celtic style the 'Lindisfarne Gospels,' 8th century, now in the Cottonian collection of the British Museum. Other fine works of the Celtic school of illuminators are the 'Book of Deir'; Δ, *Codex Sangallensis,* 9th or 10th century, Gospels in Greek and Latin, at Saint Gall, Switzerland. In England, the Celtic school of illumination dominated, although manuscripts brought by Saint Augustine from Rome introduced a classic influence. The 'Utrecht Psalter' (800 A.D.) is representative of the Celtic style in transition. It shows crude attempts at drapery effects. In Anglo-Saxon miniatures, frames of foliage and fluttering draperies become characteristic. The 'Benedictionale' of the see of Devonshire is the most elaborate specimen of 10th century Anglo-Saxon miniatures. The Norman Conquest saved Anglo-Saxon illumination from the fantastic exaggerations into which it was sinking.

3. Carlovingian Illumination.— When Charlemagne became emperor of the West (800 A.D.) illumination was rapidly revived. The Celtic style provided to this new school its interlacements; Byzantine art was drawn upon for the painting of the human figure. Gold was used profusely in letters as well as illustrations. Large initials were almost the rule. Ornamentation was luxurious. Miniatures represented historical characters, symbolical themes, the arts, signs of the zodiac, virtues, vices, etc. Notwithstanding the gorgeous effect of purple vellum, a dazzling abundance of gold, and a brilliance of decoration, the Carlovingian illuminated manuscripts show a tendency to coarseness of workmanship and clumsiness of figure-painting. This tendency is in part offset by the purer style of the Celtic influence. The best examples of early Carlovingian illumination are: the 'Evangeliary,' said to have been illuminated by Godescalc for Charlemagne in 787 A.D., whose text is in gold letters on a purple ground, and whose every page is illustrated with a different decorative scheme; another 'Evangeliary' of Charlemagne, at Vienna; the 'Bible of Theodulf,' bishop of Orleans, at Paris and Le Puy; the 'Sacramentary,' written for Drogon, son of Charlemagne and bishop of Metz; the 'Evangeliary of Lothair,' Paris; and the 'Bible of Charles the Bald,' presented by Count Vivien, abbott of Saint Martin of Tours. It was about the time of Charles the Bald, second half of the 9th century, that Carlovingian illumination reached its greatest perfection.

4. Gothic Illumination.— The 10th to the 12th centuries show a decadence of Frankish illumination. After the 'Regensburg Gospels' (11th century) miniatures become more coarse and clumsy, colors are dull. Toward the end of the 12th century, a renascence of illumination is visible in both Germany and France. Gold is now laid on in leaf, and not in liquid; burnishing makes the illumination most brilliant. The old illuminators were monks; now laymen take up the art. The initials are smaller, but more artistic; they often contain miniatures of illustration or interpretation of the Biblical text. Hundreds of miniatures beautify the 'Picture Bibles' of the 13th century, or interpret the 'Sermon Bibles' of the period. Gothic features are introduced,— gables, pinnacles, rose and quatrefoil decorations. The human figure is painted with realism; 13th century costumes are preserved to us in an accuracy of coloring. During the 14th century, there is a departure

from conventional foliage, and a reproduction of garlands and flowers from nature. And with the flowers are intermingled peasants, birds, animals, butterflies, etc.,— all true to life. The 'Breviary of Belleville,' (Bibliothèque Nationale de Paris, Lat. 10483–4) the work of the famous Parisian illuminator, Jean Pucelle, together with Mahiet Ancelet and J. Chevrier; the 'Book of the Miracles of Our Lady,' Soissons; 'Queen Mary's Psalter' (British Museum), done for Mary Tudor, are all exquisite works of 14th century craft. The golden age of illumination continues during the early 15th century. Even at the outset of the Renaissance, the Gothic manner prevails. Books of Hours are the special feature. Such is the 'Très Riches Heures' of the Duke of Berry, Musée Condé, Chantilly, by Pol de Limbourg, containing miniatures of the various châteaux of the duke, and portraying marvelous aerial perspectives in landscape scenery,— the effects of snow, starlight, blazing sunlight and dull autumn shades. Other beautiful *Horæ* are the 'Grandes Heures,' by Jacquemart de Hesdin; 'Très Belles Heures,' and 'Heures de Turin,' of the same Flemish school; and the 'Hours of Anne of Brittany' (1508 A.D.). This last work marks the end of the art of illumination. The Renaissance, together with the invention of printing, were fatal to miniature painting of books, and to the illumination of their carefully written pages.

Bibliography.— Middleton, 'Illuminated Manuscripts in Classical and Mediæval Times' (1892); Bradley, 'A Dictionary of Miniaturists, Illumination, Calligraphers and Copyists' (1887); Lecoy de la Marche, 'Les manuscrits et la miniature' (Paris 1887); Labitte, 'Les manuscrits et l'art de les orner' (1893); Davenport, 'Beautiful Books' (1929); Saunders, 'English Illumination' (2 vols., 1929).

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MANUSCRIPTS OF THE BIBLE are written as opposed to printed copies of the whole Bible or a part thereof. All these manuscripts, whether of the original text or of an ancient version, so long as they were done before the invention of the art of printing, are important in the science of the textual criticism of Holy Writ. This article will contain a brief introduction on Bible manuscripts in general, followed by a summary account of the chief Hebrew, Greek, Latin, Syriac, Armenian and Coptic manuscripts of the Bible. Manuscripts of the Arabic, Ethiopic, Slavic and other early versions of Scripture do not witness to the earliest type of New Testament text; they are amply treated in technical dictionaries of the Bible.

I. Bible Manuscripts in General.— There are three classes of Bible manuscripts — papyrus, vellum and palimpsest — to which attention should be called.

1. *Papyrus Manuscripts.*— While Babylonian scribes were impressing upon endurable clay the cuneiform, or wedge-shaped, ideographic records of the style, Egyptian reed-writing with ink upon papyrus developed almost at the same pace. The name of this primitive paper is that of the plant which provided its raw material. The *papyrus,* πάπυρος, probably an Egyptian loan-word,— was a rush of thick triangular stalk.

Its main root, Theophrastus tells us, was about 15 feet long and as thick as a man's wrist. Likely the bullrush, *gómer,* the wicker out of which was plaited the ark that contained the infant Moses, was the Nile papyrus. The outer coat of this Egyptian water-plant was peeled off, the pith was cut into strips and these were glued together transversely to form the first known writing paper. Sheets of papyrus were very fragile, became brittle in air, crumbled with use, could not resist the disintegrating force of moisture and were quite impracticable for book-form. Hence all papyrus manuscripts have been lost to us, save such as were buried in the exceedingly dry soil of Upper and Middle Egypt. For many years, the ignorant *félläh'in* wantonly destroyed these precious records of the past. Now scientific excavators are preventing this ruthlessness, and constantly adding to the world's various collections of papyrus manuscripts. The most ancient papyrus document is a record of the reign of the Egyptian King Assa, B.C. 3580–3536; and the earliest literary papyrus work extant is the Prisse papyrus of Paris, written in the 5th dynasty, c. B.C. 2500. During the first three centuries of Christianity papyrus was the ordinary writing paper of the Roman Empire. It was used by the Arabs until the 8th century, when modern paper was invented. The sacred writers or their scribes most likely used ink and rolls of fragile papyrus for the *autographa* of the New Testament (2 Corinthians iii, 8; 2 John, xii). These precious documents seem to have perished during the early 2d century. No trace of them is found in the writings of either the Apostolic or Apologetic Fathers,— unless we except Tertullian's words, "the authentic letters of the Apostles themselves," which are now generally set aside as rhetorical.

Bibliography.— Deissmann, 'Bible Studies' (1901), 'Light from the Ancient East' (1910); Moulton, 'Grammar of New Testament Greek' (Vol. I, 3d ed., 1908); Milligan, 'The New Testament Documents' (1913); Moulton and Milligan, 'Vocabulary of the Greek New Testament illustrated from the papyri and other non-literary sources' (parts 1 and 2, 1914–15).

2. *Vellum Manuscripts.*— Pliny ('Historia Naturalis' xiii, 1) is witness to the use of vellum for documentary purpose before the time of Christ. Saint Paul (2 Timothy iv, 13) employed both papyrus-rolls, τὰ βιβλία, and parchment, μεμβράνας. In the 3d century, vellum began, outside of Egypt, to supersede papyrus; and in the early 4th century, the codex or parchment book-form gained complete victory over the papyrus-roll. To this century belong the earliest extant Bible manuscripts of any thing but fragmentary size.

3. *Palimpsests.*— Some of our most important vellum manuscripts are palimpsests (= Lat. *palimosestum,* παλιμψηστός "scraped again," i.e., manuscripts that were scraped a second time with pumice-stone and written upon anew). The reckless charge of wholesale destruction of Biblical manuscripts by the monastic scribes of palimpsest works has not been substantiated. Wattenbach ('*Das Schriftwesen im Mittelalter,*' 1896, pp. 299 ff), a leading authority on the subject, notes that a Greek synod, A.D. 691, forbade the use of any but u

terly unserviceable Biblical or Patristic manuscripts for palimpsest-writing. According to Wattenbach, "more precious manuscripts, in proportion to the existing supply, have been destroyed by the learned experimenters of our time than by the much abused monks of old." The deciphering of a palimpsest may at times be accomplished by merely soaking it in clear water. The "learned experimenters" use some chemical reagent, in order to bring back the original writing. Such chemical reagents are an infusion of nutgalls, Gioberti's tincture and hydrosulphuret of ammonia; all do harm to the manuscripts.

II. Hebrew Manuscripts.— Certain parts of the Hebrew Bible,— Daniel ii, 4b–vii, 28, and Ezra iv, 8–vi, 18, together with vii, 12–26,— are not in Hebrew, but in Aramaic. These Biblical Aramaic portions, in the language that the exiled Jews adopted during their Babylonian captivity (B.C. 586–536), are here treated conjointly with the Hebrew text into which they have been received. We shall briefly sum up the age, number and worth of the Hebrew manuscripts of the Bible.

1°. *Age.*— Textual criticism divides the Hebrew text of the Bible into the Masoretic and pre-Masoretic.

The Masoretic text is that of our complete Hebrew manuscripts. It represents the Masorah. This authoritative textual tradition was begun in the 1st century B.C.; was fixed in its consonantal readings during the Talmudic period (A.D. 300–500); and received the vowel points about the 8th century of our era. The pre-Masoretic text includes chiefly the readings that are not witnessed to by Masorah. The earliest manuscript of the Hebrew Bible, and probably the oldest extant Biblical manuscript, is the Nash papyrus. There are four fragments, which, when pieced together, give 24 lines of a pre-Masoretic text of the 10 commandments and of the *shemá* (Exod. xx, 2–17; Deut. v, 6–19, and vi, 4–5). The writing is without vowels, and seems paleographically to belong to not later than the 2d century. Another witness to the pre-Masoretic text is the Samaritan Pentateuch, which is probably pre-exilic in origin. The earliest Samaritan manuscript extant is that of Nablus, once rated very ancient and now assigned to the 12th or the 13th century. The newly-discovered Hebrew '*Ecclesiasticus*,' represented by fragmentary manuscripts of the 10th or 11th century, preserves parts of the pre-Masoretic text of a book until recently thought to have been written in Hellenistic.

All other Hebrew manuscripts of the Bible are Masoretic, and belong to the 10th century or later. At most 9 or 10 are earlier than the 12th century. The earliest are *Codex Petropolitanus*, dated A.D. 916; the *Saint Petersburg Bible*, dated A.D. 1009; and *Codex Oriental*, 4445, British Museum, which Ginsburg assigns to A.D. 820–850.

2°. *Number.*— Kennicott ('Dissertatio Generalis in Vetus Testamentum Hebraicum,' 1780), collated 16 Samaritan and 638 Masoretic manuscripts. De Ross; ('Variæ Lectiones,' 1784), brought the number of Masoretic manuscripts up to 1,375. No one has since surpassed this critical work of De Rossi on the Masoretic text. Some 2,000 Masoretic manuscripts gathered in the Crimea by Firkowitsch, await critical study in the Imperial Library of Petrograd. Consult Strack, 'Die biblischen und massoretischen Handschriften zu Tschufut-Kale' (In *Zeits. für luth. Theol. und Kirche*, 1875).

3°. *Worth.*— This rich store of some 3,375 manuscripts promises no very important critical results. For they all depend on an archetype of the 2d century A.D.; and are singularly alike in accuracy of reproduction. The Masoretes were most detailed in their painstaking efforts to hand down the text of this archetype. The Scribes counted words and consonants of each book; noted the middle words and middle consonants; retained peculiarities of script,— such as broken letters, inversions, consonants that were too small or too large, dots out of place, etc. All these oddities were handed down as God intended, and received mystical interpretations. Here is an instance. In Genesis ii, 4, *behibbāre' ām*, "when they were created," the letter *h* is unduly small. The rabbis handed down this peculiarity as God inspired; translated the word, "In the letter *h* he created them"; and then disputed what that meant. Hence the importance of manuscripts of the early versions of the Old Testament, so as to reach a pre-Masoretic text.

Bibliography.— Kraft and Deutsch, 'Die handschriftl. hebräischen Werke der k. k. Hofbibliothek' (1857); Strack and Harkavy, 'Catalog der hebr. Bibelhandschriften der kaiserlichen Bibliothek' (1875); Schiller-Szinessy, 'Catalogue of the Hebrew Manuscripts' (preserved in the University Library, 1876) Assemani, 'Bibliothecæ Apostolicæ Vaticanæ Codices Orientales' (1756); Mai, 'Appendix to Assemani' (1831); Neubauer, 'Facsimiles of Hebrew Manuscripts' in the Bodleian Library (1886), and 'Catalogue of the Hebrew Manuscripts' in the Bodleian Library and in the College Libraries of Oxford (1886).

III. Greek Manuscripts.— Textual critics divide Greek manuscripts of the Bible into uncials and minuscules. Uncial manuscripts are written in large disconnected letters that vary in force so as to indicate the time and place of provenance. Words are not separated; accents and punctuation marks are not used; no great variety of script is admitted; ligatures are employed for the most ordinary words; paragraphs are marked off by small lacunas. The decadence of elegant uncial writing begins in the 6th century; twists and turns are given to certain letters. In the 7th century manuscripts still greater freedom of flourish is allowed the scribe; accents and breathings are introduced, and the script leans to the right. By the 10th century the writing in Biblical manuscripts begins to be more or less cursive; these manuscripts are called minuscules. The letters are now small, connected and written with a running hand. Cursive writing holds sway in Biblical manuscripts until the 16th century. In A.D. 1514, the Greek New Testament was for the first time printed.

1°. *Old Testament Greek Manuscripts.*— Traces of the version of Aquila (C. A.D. 130) are found in: (1) fragments of Origen's third columns, written as marginal notes to some manuscripts of the Septuagint; (2) the Milan palimpsest of the Hexapla, a 10th century copy found by Mercati in 1896, containing about 11 psalms; (3) the Cambridge fragment,

7th century, giving parts of Psalm xxi.— Cf. Taylor, 'Cairo Genizah Palimpsests' (1900); (4) the Cairo fragments of the 4th and 5th centuries: three palimpsests (containing 1 Kings xx, 7–17, 2 Kings xxviii, 11–27), published by Burkitt in 1897; also four portions of the Psalms (89:17 — 91:10, 95:7 — 96:12, 98:3, 101:16 — 102:13) published by Taylor (op. cit.); (5) the 4th century papyrus fragments of Genesis i, 1–5, published by Grenfell and Hunt in 1900. Our few manuscript traces of the versions, which Symmachus and Theodotion issued toward the end of the 2d century, may be found in the same Hexaplaric fragments that witness to the text of Aquila. Theodotion's Daniel is preserved in the Septuagint manuscripts.

The Septuagint version of the Old Testament is extant in many manuscripts. These represent three textual families,— the Hexaplaric, Hesychian and Lucianic. The Hexaplaric text takes its name from the Hexapla of Origen. This colossal critical work, completed c. A.D. 240, presented in six columns the Hebrew text, the Greek transliteration thereof, Aquila, Symmachus, the Septuagint and Theodotion; and, for certain books, two other Greek translations that are named *Quinta* and *Sexta*. Pamphilus, a disciple of Origen, preserved manuscripts of the Hexapla at Cæsarea. In the 4th century, Pamphilus and his disciple, Eusebius of Cæsarea, reproduced the fifth column,— i.e., Origen's Hexaplaric Septuagint text,— together with all its critical signs. By these critical signs, Origen had marked off passages, which he had found wanting in the Septuagint and had supplied from either Aquila or Theodotion. Unfortunately the scribes were not faithful in handing down the critical signs of Origen. In this wise the Cæsarean text of the Septuagint was evolved into a hopeless commingling of Origen's Septuagint together with his interpolations from Aquila and Theodotion. Meantime two other editions of the Septuagint got a vogue,— those of Hesychius at Alexandria and of Lucian at Antioch. From these three editions of the Septuagint text, all of our extant manuscripts are descended, but by ways that have not yet been accurately traced. The Hexaplaric, Hesychian and Lucianic texts acted and reacted upon each other. The result is that most of the extant manuscripts of the Septuagint contain readings from each of the three textual families. Criticism is at work to trace the respective influences of each text upon the manuscripts now to hand. Consult Field, 'Originis Hexaplorum quæ supersunt, sive veterum interpretum Græcorum in totum Vetus Testamentum fragmenta' (1875).

A. Papyrus Manuscripts.—About 40 papyrus manuscripts of parts of the Septuagint have been found in recent years. Of these the most important are (1) *Oxyrhyncus Pap. 656*, early 3d century, preserving parts of Gen. xiv–xxvii, wherein most of the great vellum manuscripts are defective; (2) *British Museum Pap. 73*, called U, 7th century, Psalms 10–33; (3) a *Leipzig Papyrus*, 4th century, Psalms 29–54; (4) a *Heidelberg Papyrus*, 7th century, Zachary iv, 6 — Malachy iv, 5; (5) a *Berlin Papyrus*, 4th or 5th century, containing some 30 chapters of Genesis.

B. Vellum Uncial Manuscripts.— Parsons 'Vetus Testamentum Græcum cum Variis Lectionibus,' 1798), designated uncial manuscripts of the Septuagint by Roman numerals, minuscule by Arabic. Lagarde inaugurated the now common usage of Roman and Greek capitals for uncials. Von Soden's system of manuscript symbols, though illuminating, has not been widely adopted. The important vellum uncials of the Septuagint text are here subjoined:

Aleph, *Cod. Sinaiticus* (c. 350), 43 leaves at Leipzig, 156 together with New Testament at Petrograd; contains fragments of Genesis and Numbers, I Paral. 9:27 — 19:17, Esdr. 9:9 to end, Esth., Tob., Judith, 1 and 4 Mach., Isa., Jer., Lam. (in part), Joel, Abd.-Mal., the Poetical Books, the entire New Testament, Epistle of Barnabas, and part of 'Shepherd of Hermas.' The text is mixed; in Tobit it widely differs from A and B. Two correctors are of the 7th century. The first writes, at the end of Esther, that he compared the manuscript with a copy of the Hexaplaric text, authenticated by Pamphilus.

A, *Cod. Alexandrinus*, 5th century, in British Museum, complete Bible (excepting Psalms 50:20 — 80:11 and smaller lacunæ); includes deuterocanonical books and fragments, apocryphal 3 and 4 Mach., also 1 and 2 Clement; of Egyptian provenance, and likely Hesychian in text; differs much from B, especially in Judges.

B, *Cod. Vaticanus*, c. 350, in Vatican Library, complete Bible; the Old Testament lacks Gen. i–xlvi, 28, 1 and 2 Mach., parts of 2 Kings ii, Psalms 105–137; the New Testament lacks Hebr. 9:14, 1 and 2 Timothy, Titus, Apoc. provenance, Lower Egypt; text deemed by Hort to be akin to the Hexaplaric.

C, *Cod. Ephræm*, 5th century palimpsest, in National Library, Paris; 64 leaves of Old Testament, 145 out of 238 leaves of New Testament.

D, *Cotton Genesis*, 5th century, British Museum; fragments of Genesis; almost destroyed by fire in 1731, but previously collated.

E, *Cod. Bodleianus*, 9th or 10th century, Bodleian Library, Oxford, Heptateuch, fragments.

Q, *Cod. Marchalianus*, 6th century, Vatican, Prophets complete; provenance, Egypt; text Hesychian; marginal notes from Hexapla contain Hexaplaric signs.

Theta, *Cod. Washington*, 5th or 6th century, Smithsonian Institution, Deuteronomy to Joshua.

Among uncial manuscripts of the Septuagint are also listed 17 codices, some of the 5th and 6th century; seven Psalters of the 9th or 10th century; and 18 fragments.

C. Vellum Minuscule Manuscripts.— More than 300 are known but not classified. Few bear witness to the entire Old Testament; the greater part are Psalters. The most critical use of the minuscules of the Septuagint is evidenced by Brooke and McLean, 'The Old Testament in Greek' (Vol. I, *The Octateuch*, 1906–17).

Bibliography.— Swete, 'Introduction to the Old Testament in Greek' (1900), and 'The Old Test. in Greek' (3d ed. of Vols. I and II, 1907; 4th ed. of Vol. III, 1912); Kenyon, 'Our Bible and the Ancient Manuscripts' (1898); Nestle, 'Septuagintastudien' (1886–1907).

2°. New Testament Greek Manuscripts.— According to Von Soden ('Die Schriften des Neuen Testaments in ihrer ältesten erreichbare

Textgestalt,' 1902), 2,328 Greek New Testament manuscripts are extant; only about 40 contain, either entire or in part, all the books; 1,716 are of the Gospels, 531 of Acts, 628 of the Pauline Epistles, 219 of Apocalypse.

A. Papyrus.—About 31 papyrus fragments, of which six belong to the 3d century, bear most important witness to parts of 12 books of the New Testament. Consult Milligan, 'Greek Papyri' (1912), and 'The New Testament Documents' (1913).

B. Vellum Uncials.— Besides Aleph, A. B. C, already described, there are some 160 vellum uncials of the New Testament; 110 contain the Gospels or a part thereof. The most important of these manuscripts are:

D, *Cod. Bezæ,* 5th or 6th century, Cambridge; Gospels and Acts in Greek and Latin, excepting Acts xxii, 29 to end; text, Western, i.e., that of Old Latin and Old Syriac.

D_s, *Cod. Claromontanus,* 6th century, Nat. Libr., Paris; Pauline Epistles in Greek and Latin, each independent of the other.

E, *Cod. Basileensis,* 8th century; Univ. Libr., Basle, Gospels.

E_s, *Cod. Laudianus,* 6th century, Oxford, in Bodleian Libr., Acts in Greek and Latin, same text as D.

E_s, *Cod. Sangermanensis,* 9th century, Imper. Libr., Petrograd, Pauline Epistles in Greek and Latin, same family as D_s.

F, *Cod. Boreeli,* 9th century, Utrecht, Gospels.

F_s, *Cod. Augiensis,* 9th century, Trinity Col., Cambridge, Pauline Epistles in Greek and Latin, same family as D_s, E_s, G_s.

G, *Cod. Wolfii,* 9th century, Cambridge and London, Gospels.

G_s, *Cod. Bœrnerianus,* 9th century, Dresden, Pauline Epistles in Greek and Latin.

Washington Manuscripts, called W and I by Gregory, giving a 5th or 6th century text of Gospels and Pauline Epistles, Smithsonian Institution.

C. Vellum Minuscules.— The vast number of minuscule witnesses to the New Testament text would seem to indicate a rich field of research for the critic. Such is not the case. Ninety-five per cent of these manuscripts are of little moment; they represent an inferior type of text,— that called the *textus receptus.* Only those minuscules attract attention which approach to one of the great uncials. Thus the "Ferrar Group" resemble the text of D.

Bibliography.— Kenyon, 'Textual Criticism of the New Testament' (1912), and 'Paleography of Greek Papyri' (1899); Warfield, 'Textual Criticism of the New Testament' (1886); Tischendorf, 'Novum Testamentum Græce' (1869), together with Gregory's *Prolegomena* thereto (1894); Gregory, 'Canon and Text of the New Testament' (1907); 'Textkritik des Neuen Testaments' (1909), and 'Die Griechieschen Handschriften des Neuen Testaments' (1908); Von Soden, 'Griechisches Neues Testament' (1913), and 'Die Schriften des New Testaments' (4 vols., 1911–13); Nestle, 'Textual Criticism of the Greek Testament' (1901); Hutton, 'Atlas of Textual Criticism' (1911).

IV. Latin Manuscripts.— Epigraphists find far greater variety of script in Latin than in Greek manuscripts. Hence the former are divided into uncials, semi-uncials, capitals, minuscules and cursives: and these divisions are subdivided. The time, place and even the monastery of the copyist may often be traced by the very distinct script of the text.

1°. *Old Latin Manuscripts.*— The origin of the Old Latin text is wrapped in obscurity. Three distinct types are recognized,— the African, European and Italian. The African text is that used by Tertullian (c. 150–220), and Saint Cyprian (c. 200–258); it is the crudest in style, and apparently the earliest to be made. The European text is less crude in style and vocabulary; and may be an independent translation. The Italian text, probably the *Itala* which Saint Augustine preferred to all others, is the version used by Saint Jerome in his revision. About 40 manuscripts preserve this pre-Hieronymian Latin text,— 27 manuscripts of Gospels, seven manuscripts of Acts, six manuscripts of Paul's Epistles, fragments of Catholic Epistles and Apocalypse. All show the influence of the Vulgate or of corrections made by scribes. The most important Old Latin manuscripts are the bilinguals already noted: D, D_s, E_s, E_s, F_s, G_s. Besides there are the codices *Vercellensis,* 4th century; *Veronensis,* 5th century; *Palatinus,* 5th century; *Brixianus,* 6th century; *Corbeiensis,* 5th century; *Gigas,* 13th century; *Palimpsest de Fleury,* 6th century; *Bobiensis,* 4th century. Cf. Burkitt, 'The Old Latin and the Itala' (1896); Wordsworth, Sanday and White, 'Old Latin Biblical Texts' (1883–97); Buchanan, 'Old Latin Biblical Texts' (1907–11) and 'Sacred Latin Texts' (1912–14).

2°. *Vulgate Manuscripts.*— More than 8,000 manuscripts of the Vulgate are extant, most of which are later than the 12th century and of little use in the reconstruction of the sacred text. Wordsworth and White, in their critical text (1889–1905), collate 40 of the most important Vulgate manuscripts. The Benedictine Commission for the Revision of the Vulgate, established by Pope Pius X, is at work on the collation of this vast store of manuscripts; its task is to reconstruct the various families of the Vulgate text,— the Spanish, Italian, Irish, French, etc.,— to sift out the Old Latin readings and other interpolations, and to reach back as nearly as possible to the text that was issued by Saint Jerome. Chiefest among the Vulgate codices are *Amiatinus,* 8th century: *Cavensis,* 9th century; *Fuldensis,* A.D. 541–546; *Kenanensis,* Book of Kells, 8th century; *Stonyhurstensis,* 7th century.

V. Other Versions.—Syriac manuscripts represent six distinctive Syriac versions of the New Testament. The *Old Syriac* version, made about the middle of the 2d century, is represented by two important manuscripts of the 5th century. The Curetonian Syriac manuscript was discovered in 1842 among manuscripts brought to the British Museum from the monastery of S. Maria Deipara, in the Nitrian Desert, Egypt; and was published by Curetor in 1858. The Sinaitic Syriac manuscript was found by Mrs. Lewis and Mrs. Gibson, in 1892, at the monastery of Saint Catherine, on Mount Sinai. Cf. Bensley, Harris and Burkitt, 'The Four Gospels in Syriac transcribed from the Sinaitic Palimpsest' (1894); Lewis, 'Light on the Four Gospels from the Sinai Palimpsest' (1913):

Burkitt, 'Evangelion da Mepharreshe' (1904).

The *Diatessaron* is a Syriac harmony of the Gospels, made about A.D. 170 by Tatian, an Assyrian and disciple of Saint Justin Martyr. The only manuscript records thereof are two Arabic versions, discovered one in Rome and the other in Egypt, which were published by Ciasca in 1888.

The *Peshitta,* or Syriac Vulgate, was made by Rabbula, A.D. 411–435. The Peshitta Pentateuch, dated A.D. 464, in British Museum, is the earliest dated Biblical manuscript. The Peshitta Gospels number 125, Acts 58, Paul's Epistles, 67; two of these New Testament MSS. are of the 5th century.

The *Philoxenian Syriac* version has reached us only in a manuscript of Apocalypse at Trinity College, Dublin, and in the four minor Catholic Epistles.

The *Harklean Syriac* version is witnessed to by 35 manuscripts dating from the 7th century and later; its text is like to that of D.

The *Palestinian Syriac* version is found in lectionaries and fragmentary manuscripts; these latter date from the 11th century and later.

2°. *Armenian Manuscripts* date from A.D. 887, are very numerous and have not yet been accurately collated.

3°. *Coptic Manuscripts.*— By the time Egypt became Christian, the 3d or 4th century, its ancient language had been evolved into the following dialects: Sahidic, or Theban, of Upper Egypt; Akhmîmic, a dialect that was later superseded by Sahidic; Fayûmic, the dialect of Fayûm; Middle Egyptian; Bohairic, or Memphitic, the dialect of Bohaireh,— i.e., of the northwestern province of the Delta. The chief Sahidic manuscripts of the Bible, that have been collated, are among the 58 volumes, discovered (1910) in the Fayûm and now called the Morgan Collection,— six books of the Old Testament and the entire New Testament except the Apocalpyse. The British Museum also has parts of the Old Testament, Acts and Apocalypse. Moreover, the bilingual T, *Cod. Borgianus,* 5th century, in the Vatican, preserves fragments of Mark, Luke and John in both Greek and Sahidic. Bohairic is well represented by manuscripts of the same character as Aleph-B. The *Curzon Catena,* dated A.D. 889, is the earliest extant Bohairic manuscript and is in the Parkham Library. Cf. Crum, 'Catalogue of Coptic Manuscripts in the British Museum' (1905); Wallis Budge, 'Coptic Biblical Texts of Upper Egypt' (1912).

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MANUTIUS, mą-nū'shĭ-ŭs, **Aldus** (Ital. Manuzio, Manuzzi and Manucci), Italian printer: b. Sermonetta, near Belletri, in the neighborhood of Rome (and hence sometimes known as Romanus), 1450; d. 6 Feb. 1515. He began his studies at Ferrara, and continued them at Rome where he was tutor to princely families. He learned Greek in Ferrara under Guarini and at the suggestion of the Prince di Carpi established a printing-press at Venice 1489. He gained the reputation of being learned in Greek, Hebrew and Latin and entertained in his house many scholars of the day, forming his "Neacademia" or New Academy, which later was styled "Academia della Fama." He was the author of 'Dictionarium Græcum' (1497); 'Institutiones Græco-Latinæ' (1501–08); 'Grammaticæ Institutiones Græcæ' (1514); 'De Metris Horatianis' (1509). His son PAULUS (b. 12 June 1512; d. 6 April 1574) continued (1533) to manage the printing-press at Venice, and subsequently (1561) presided over the papal press, Typographia Vaticana, at Rome. He wrote a commentary to Cicero's Letters, and 'Epistolæ Selectæ.' ALDUS, the younger son of Paulus (b. 13 Feb. 1547; d. Rome, 28 Oct. 1597), was a scholar and author from his earliest youth. He continued his father's work at Venice and Rome. Consult Renouard, 'Annales de l'Imprimerie des Aldes' (1834); Didot, 'Alde Manuce et l'Hennénisme à Venise' (1873); Goldschmid, 'A Biographical Sketch of the Aldine Press at Venice' (1887); Omont, 'Catalogues des Livres Grecs et Latins, imprimés par Alde Manuce à Venise' (1892). Consult De Vinne, T. L., 'Notable Printers of Italy During the Fifteenth Century' (1910). See ALDINE EDITIONS.

MANX CAT, a breed of house-cats, originating in the Isle of Man, which are characterized by very high hindquarters, and, as a rule, by a very short tail. See CAT.

MANX LITERATURE. The Celtic dialect of the Isle of Man, one of the three subdivisions of the Gaelic language, is closely related to the Irish and the Scottish Gaelic, and nearer to the latter than the former. (See CELTIC LANGUAGES; GAELIC LITERATURE). The literature of the language consisted mainly of ballads and carvels (or Christmas carols). The earliest monument of the vernacular is 'The Book of Common Prayer,' translated by Bishop Phillips in 1610 (reprinted in 1895). In later times the orthography closely followed English. In the middle of the 18th century English was a foreign tongue to about two-thirds of the common people, but since that time the decline in the use of Manx has been very rapid, and only two or three thousand of the islanders now speak it. The last edition of the Bible published in Manx was dated 1819, and the last edition of the New Testament was published in 1840. Consult Rhys, 'Outlines of the Phonology of Manx' (1895); Kelly, 'Practical Grammar of Manxs' (1803; reprinted 1859); Goodwin, 'First Lessons in Manx' (1866); Jenner, 'The Manx Language, Its Grammar, Literature and Present State' (Trans. London Philol. Soc. 1875); Moore, 'Surnames and Place Names of the Isle of Man' (1890); 'Folklore of the Isle of Man' (1891); 'Manx Carols' (1891); and History of the Isle of Man' (1900).

MANZANILLO, măn-thä-nēl'yō, Cuba, city, port of entry, in the western part of the province of Santiago de Cuba, on the Gulf of Guacanabo on the southern shore. It has a large harbor which is protected by a number of small islands. The city is the port for Bayamo, an inland city about 40 miles east by north from Manzanillo. The low land and the mangrove swamps around the place make it very unhealthy. It is well built and has a number of fine churches, hospitals and schools,— among the schools four are high schools. Urban pop. about 25,000.

MANZANILLO, män-sä-nē′yō, seaport, Mexico, on the Pacific coast in the State of Colima, 38 miles west of Colima, the capital of the state. Manzanillo is connected by road and railroad with Colima, and thence with other cities of Mexico. It has been a port of importance since the Spanish conquest. The chief exports are coffee and hides. Pop. (1940) 6,831.

MANZANITA, a popular name for various species of *Arctostaphylos* of the heath family (Ericaceae), especially *A. pungens* and *A. manzanita.* They are shrubs or small trees which sometimes exceed 20 feet in height, and often form impenetrable thickets in the region of the Pacific coast of North America, from Oregon southward. They have alternate, evergreen, entire leaves, usually white or pinkish flowers in panicled racemes, and generally smooth berry-like drupes. Another well-known species often called by this name is the bearberry (q.v.), a trailing evergreen shrub which extends from the Arctic region to the mountains of Mexico, whose red berries form one of the principal foods of ptarmigan and other related birds. The great-berried manzanita (*A. glauca*), a California species, bears fruit more than half an inch in diameter. Of the 30 species of the genus, probably a dozen are used for ornamental purposes: some Central American ones in greenhouses where the climate prevents outdoor use; the shrubby western kinds in mild climates; and only the trailing kinds in cold localities. The gnarled roots are a source of fuel in the untimbered parts of California.

MANZANO MOUNTAINS, a range on the east side of the Rio Grande Valley in Bernalillo, Torrance and Valencia counties southeast of Albuquerque, N. Mex. It extends from Tijeras Canyon on the north to Abo Pass on the south, a distance of 45 miles. The very steep western front of the mountain is granite and schist, capped by a thick sheet of limestone which dips east and constitutes the long sloping plateau of the summit and east side. The highest summits are Manzano Peak, 10,103 feet; Osha Peak, 10,023 feet, and Mosca Peak, 9,723 feet, which are about 5,000 feet above the Rio Grande. To the east is the Estancia Valley, long famous for its salt lakes. Near Bosque Peak is a large spring. The region is forested with yellow pine, piñon and juniper, and is included in the Manzano Forest Reserve. Deer, bear and wild turkeys and many minor wild animals remain in these mountains. Ores of gold, lead and silver are mined on the west slope. Most of the long canyons on the eastern slope contain streams from large springs. The water is utilized by many settlers, mostly Mexicans, who have occupied the region for several centuries. Their small plazas or settlements are Chilili, Tajique, Torreon, Escabosa, Punta del Agua and Manzano. The latter has given its name to the mountains, the plaza taking its name from a grove of apple trees (*manzano* in Spanish) of prehistoric origin. The old ruins of Abo and Quarai are near the south end of the range.

MANZANOS, a natural park in Lincoln, Bernalillo and Santa Fe counties in New Mexico, southeast of Albuquerque. The Manzano Mountains, with several lofty peaks, and numerous tablelands and valleys, with many springs and small streams, are the chief features of this park. The Rio Grande is on the west side; the base of the mountains is about 1,000 feet above the river and about 6,000 feet above the level of the sea. The almost perpendicular, stupendous red cliffs which rise above the plain and form the western face of the mountains are almost unscalable. South of the red-cliff region is the canyon of Las Moyas, and south of this canyon Bosque Peak, one of the high points of the range.

The view from the summit of the range at some points includes the green valley of the Rio Grande, mountains west of Albuquerque and north to the walls of Santa Fe, and intervening valleys and mountains. On the west of the park, or the western border, are the white Manzano salt lands, on the southeast the gypsum desert.

MANZONI, män-dzō′nē, **Alessandro (Francesco Tommaso Antonio),** Italian poet and novelist: b. Milan, March 7, 1785; d. there, May 22, 1873. He studied at Milan and Pavia, and published in 1806 his poem on the death of his friend Carlo Imbonati, which was followed in 1815 by his *Sacred Hymns* (*Inni Sacri*). In 1820 appeared his first tragedy, *Il Conte di Carmagnola,* the first drama in which an Italian defied the unities. This play was reviewed and praised by Goethe, who took a warm interest in every subsequent production of Manzoni. The death of Napoleon inspired one of the finest odes of the century, *Il Cinque Maggio* (*The Fifth of May*). In 1822 his second tragedy, *Adelchi,* appeared. This, as well as its predecessor, finds more favor in personal reading than on the stage. After this Manzoni divided his time between country pursuits at his residence in the neighborhood of Milan and the composition of his romance *I Promessi Sposi* (*The Betrothed*), a Milanese story of the 17th century, published 1825–1827, and which has been translated into most of the European languages (see BETROTHED, THE). Manzoni was devoted to the ideals of Italian independence and unification, participating, with his sons, in the Milanese revolt of 1848, and declining all honors from the Austrians; he became a senator of the Italian kingdom, however, in 1860. His *I Promessi Sposi* is regarded as a model of Italian prose, and its influence, when revised (1840) in the Tuscan dialect, had an important bearing on the establishment of Tuscan as the official form of the Italian language—a development which he warmly supported. Verdi's *Manzoni Requiem* (1874) is a magnificent musical tribute to his memory.

Consult Manzoni, A., *The Betrothed (I Pfomesi Sposi*), tr. by D. J. Connor (New York 1937); De Simone, J. F., *Alessandro Manzoni; Esthetics and Literary Criticism* (New York 1946).

MAO TSE-TUNG, mä′ō dzŭ′dŏŏng′, Chinese Communist leader: b. Shao Shan, Hunan Province, China, 1893. After attending primary and middle school at Changsha, he served in Sun Yat-sen's revolutionary army from 1911 until he resumed his education in 1912 at the Hunan Normal School, where he received his degree in 1918. He then took courses at the National University at Peking. Converted by his own studies of Marx and Engels, and stimulated by the advent of the Russian Revolution (1917), he devoted himself to helping organize the Chinese Communist Party, which came into active existence at Shanghai early in the next decade. In 1922 he became secretary of the branch of the Communist Party in the Province of Hunan, and in 1924 he and other Chinese Communist leaders

joined the Kuomintang headed by Chiang Kai-shek. In April 1927, however, the Communists were ousted by the Nationalists, and Mao fled execution to southern China, where in 1928 he and Chu Teh, later commander in chief of the Chinese Communist armies, organized the Chinese Red Fourth Army, of which Mao became political director. In 1934 Mao's forces broke through opposing Nationalist troops to stage its epic "Long March" from southern China to Yenan in Shensi Province, where Mao, as chairman of the Soviet Republic of China, set up headquarters and prepared the foundations of the Chinese Communist state.

During World War II, Mao and other Communist leaders entered an alliance with Chiang Kai-shek against the Japanese, but in 1945 after the Allied victory over Japan, they resumed their fight against the Nationalists for control of China. By late 1949 Mao and the Chinese Communist armies had succeeded in driving the Nationalists from the Chinese mainland to Formosa, and the Communists had established their capital at Peking. On Oct. 1, 1949, Mao became chairman of the Central People's Government of the People's Republic of China, and on Feb. 4, 1950, at Moscow, after having been present for the celebrations of Premier Joseph Stalin's 70th birthday, he signed a 30-year Sino-Soviet treaty of friendship and mutual defense which replaced the 1945 Soviet treaty with the Chinese Nationalists.

Mao is well known for his political writings, which include: *Red China* (1934), *China and the Second Imperialist World War* (1939), *China's New Democracy* (1944), and *On Coalition Government* (1945).

MAORIS, mä'ô-rĭz, mou'rĭz, or mä'rĭz, a Polynesian people inhabiting New Zealand. Their traditional clothing is a loose garment woven from *harakeke* (New Zealand flax, *Phormium tenax*). Tattooing is a highly developed art among them. They formerly tattooed the faces of a young warrior after his first successful combat, adding fresh designs for each new exploit. Their religion combined ancestral cult with deification of natural forces; they held that the soul was distinct from the body, and survived it. *Tapu* (taboo) was a strong force. Social organization, founded on kinship through common descent, is evidently a remnant of the waves of immigration, the most important of which was the "fleet" of about 1350 A.D. The largest unit is the *waka* (canoe), a loose affiliation of *iwi* (tribes), which are subdivided into *hapu* (clans), and these into *whanau* (family groups). The villages (*kainga*) are usually built around a central meeting place (*marae*), and were usually situated near a fort (*pa*) for defense. Before the coming of Europeans, they lived mainly on agricultural products (particularly the *kumara,* sweet potato), other roots and fish. See also NEW ZEALAND.

MAP, măp (Latinized as MAPES, mā'pēz), **Walter,** Welsh(?) poet and wit: b. probably in Herefordshire, about 1140; d. about 1209. He studied at the University of Paris and became a favorite at the court of Henry II. He attended the Lateran Council of 1179, and was appointed archdeacon of Oxford in 1197. Map is now generally believed to have been probably author, or in large part author, of *Lancelot* in the Arthurian cycle. It is extremely probable, at any rate, that Map did contribute to the bringing of the cycle into its present state, but it is uncertain to what extent his work has survived. He is undoubtedly the author of a curious book *De Nugis Curialium* (*Courtiers' Triflings*), a notebook of the events of the day and of court gossip. It was edited for the Camden Society in 1850 by Thomas Wright. To Map is attributed the famous drinking song beginning:

"Meum est propositum in taberna mori."

MAP. The word derives from the Latin *mappa* meaning napkin, cloth, sheet (just as we speak now of topographic "sheets"). A map is a symbolized picture of the Earth pattern drawn to scale on a horizontal projection, to which lettering usually is added for identification. Abstraction and symbolization often go far from the original conception of a picture, as for instance on a political map.

Scale.—Every map is on a definite size relationship with the part of the land it represents, which can be expressed in three different ways:

(1) Numerical scale, or representative fraction, as 1:1,000,000, meaning that one inch on a map represents 1,000,000 inches in nature, or nearly 16 miles.

(2) Inch to mile scale, as 1 inch to 8 miles (1:506,880), meaning that one inch on the map represents 8 miles in nature.

(3) Graphic scale, as 0 |_____|_____| 10 miles, which has the advantage that it remains true even if the map is photographed larger or smaller.

Enlarging and Reducing Maps.—Changing the scale of maps can be accomplished by:

(a) The quadrangle method, by drawing closely set nets of parallels and meridians both on the original map and for the new drawing on larger or smaller scale. All features are filled in by hand. This method is especially good if the projection system is also changed.

(b) Photostat or photograph, which, however, often shows some distortion.

(c) Pantograph, which instrument is based on a parallelogram with free moving angles and can enlarge or reduce drawings with great precision.

(d) By various arrangements of lenses, mirrors, or prisms an enlarged or reduced image can be projected upon the drawing paper.

Maps on a scale of 1:1,000,000 and smaller are called *small-scale* maps; *large-scale* maps are over 1:100,000; in between are *medium-scale* maps.

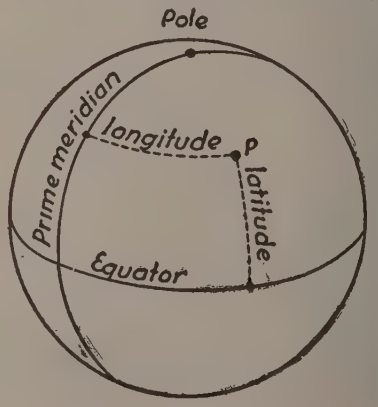

FIG. 1.—Latitude and longitude.

Parallels and Meridians.—The ancient Greeks established a co-ordinate system dividing the arc between the equator and the poles into 90° in parallel circles which get smaller nearer the equator. Similarly the equator is divided into 360 parts and through the division points and the two poles are 180 semicircles or meridians. Distance from the equator measured along a meridian and expressed in degrees (minutes and seconds) is called *latitude*. Distance in degrees reckoned from a chosen *prime meridian* measured along a parallel is called *longitude*. While all degrees of latitude are equally long (about 69 miles), degrees of latitude vary from 69.17 miles at the equator to 0 at the pole. For any degree

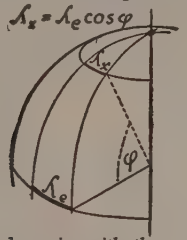

FIG. 2.—Longitude varies with the cosine of the latitude. λ_x=longitude on any parallel. λ_e=longitude on the equator. ϕ=latitude.

of longitude where ϕ is the latitude, for instance 1° of longitude at lat. 60° is one half of 1° long. at the equator, cos 60° being 0.5.

In all these considerations the Earth is regarded as a perfect sphere. As the exact form of the Earth is more nearly a rotational ellipsoid, the degrees of latitude are slightly smaller near the equator, 68.7 miles, and larger near the poles, 69.2 miles. Prime meridians changed a great deal during history from the Fortunate Islands of Ptolemy to Ferro (q.v.) in the Canary Islands. Even Washington, Philadelphia, Boston, and Hartford were used as prime meridians. By international agreement, at present the meridian at the Royal Observatory in Greenwich, England, is used for prime meridian.

Most maps are oriented with north on top, but this is conventional. Other orientations are often used at present to bring out hidden relationships.

Projections.—The spherical surface of a globe cannot be flattened into a map without stretching or tearing. If only a small part of the Earth's surface is shown, as on large-scale maps, distortion is negligible, but on medium-scale maps, and especially small-scale maps of the whole Earth, considerable distortion is necessary.

Several geometrical methods were tried. If the globe is enveloped into a cylinder and the surface is projected upon this surface and then the cylinder is cut open and laid out flat, we have a *cylindrical projection*. Similarly, if we cap the globe with a conical hat, project upon the cone, split open the cone along one of its elements and lay it out flat, we have a *conical projection*. Also, if the surface of the globe is projected upon a tangent board from some eye point at a selected distance, we have an *azimuthal projection*.

These projections are derived from actual perspective projection from a point or points upon a surface. Except for a few azimuthal projections, however, no perspective projections are in actual use. Most of them are simply some kind of network of parallels and meridians to suit the map maker's purpose. A map projection can be defined as *any orderly network of parallels and meridians upon which a map can be drawn.*

As the problem of flattening spherical surfaces is impossible, there can be no perfect projection. We can choose from dozens of imperfect solutions the one which is most suitable for our particular purpose. Some projections have special merits. *Equal-area* or *equivalent* projections are those in which every part of the map, and the map as a whole, has the same area as the corresponding part of the Earth's surface. To achieve this, shapes and angles have to be considerably distorted. *Conformal* or *orthomorphic* projections are those in which every small portion has the same shape as the corresponding part on the globe. Not only are the parallels and meridians right angles to each other, but they have also the correct proportions. To achieve this, the scale of the map has to vary a great deal. Some projections are not equal-area nor conformal but have small scale errors.

It is obvious from the foregoing that on any map only the parallels or only the meridians or certain other lines can be true to scale; all other distances are distorted. Which lines are selected to be *true to scale,* that is the same scale as on the corresponding globe, is the fundamental consideration in projections. Several hundred projections occur but only a few selected projections are presented here.

Rectangular Even-spaced Projection.—This is the simplest of projections, consisting of even-spaced horizontal parallels and vertical even-spaced meridians. Meridians are spaced on the central parallel of the map according to

$$\lambda_x = \lambda_e \cos\phi$$ (see Fig. 2).

Mercator Projection.—The equator is divided truly for vertical meridians. Parallels are horizontal, spaced conformally; that is, their relation

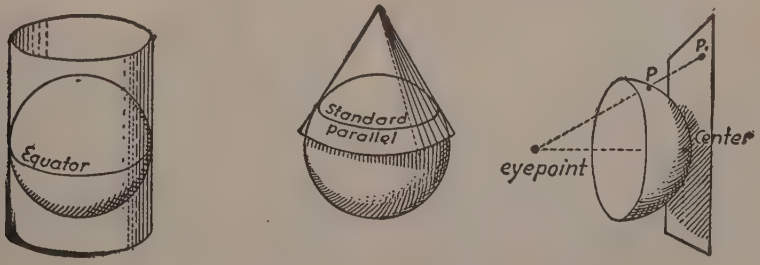

FIG. 3.—Cylindrical, conical and azimuthal projections.

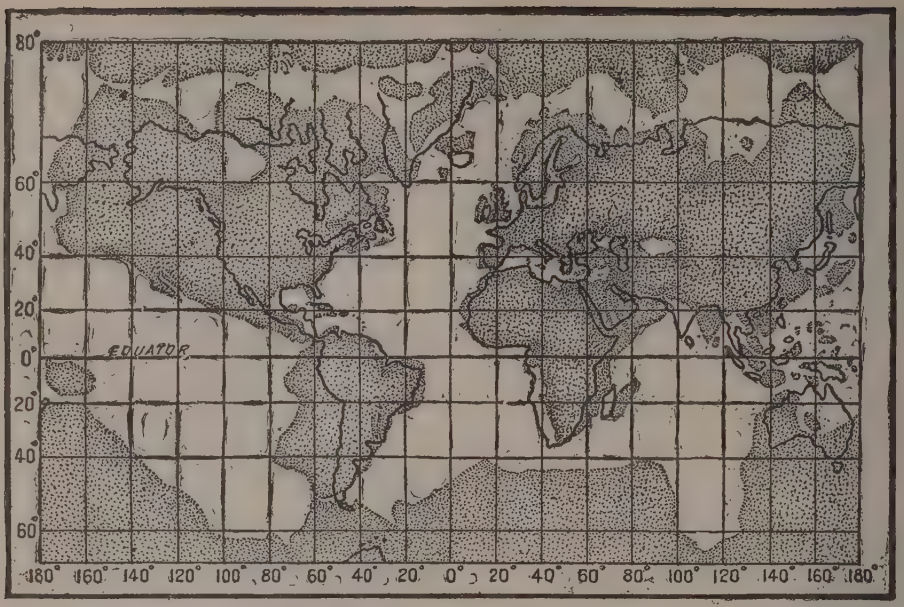

FIG. 4.—Mercator's projection from his World Map of 1569. Mercator's delineation of the land is dotted.

to the meridian is the same as on the globe. On the globe the meridians converge, but in this projection they are parallel. To get the correct proportion, the parallels are spaced at increasing distances toward the poles. The poles are at infinite distance.

The chief merit of the projection is that compass directions, or rhumb lines, appear as straight lines. (On the surface of the globe they spiral towards the poles.) For this reason the projection is ideal for navigation, in spite of the enormous variation of scale. It is less good for world maps for which it is frequently used. The projection was delineated by Gerardus Mercator, the great Belgian cartographer, in 1569 (see Fig. 4).

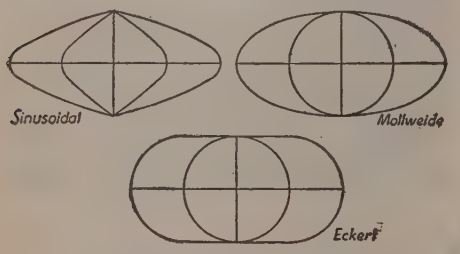

FIG. 5.—Outlines of the world and the hemisphere in various projections with horizontal parallels.

Other Projections.—Among other projections with horizontal parallels and vertical meridians, mention should be made of the Gall's projection and also of Miller's cylindrical projection, in which the parallels are spaced at increasing distances nearer the poles but not so much as in the Mercator projection.

The *sinusoidal* and the *Mollweide,* or *homolographic,* projections have both horizontal parallels but the meridians converge toward the poles. Both projections are equal-area. The *Eckert* projection is similar, but the poles are represented as lines half the length of the equator. All these projections are popular for world maps and continent maps.

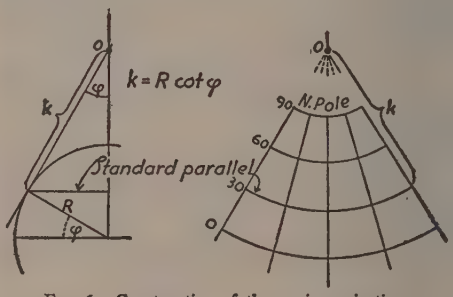

FIG. 6.—Construction of the conic projection.

In the *conic* projection, the globe is capped by a cone which touches it along a selected standard parallel. The radius of this standard parallel is $1=R \cot \phi$. The standard parallel is obviously divided truly; the meridians are radiating straight lines, placed truly on the standard parallel, and the parallels are concentric circles. For best results usually the central parallel of the map is taken as standard. The spacing of the parallels would be uneven in the actually projected network. In the practically used conic projection, the parallels are concentric circles placed at their true distances. The projection is used for country and continent maps in the tem-

perate zones on account of its small scale error. The scale error is further reduced in the *conic projection with two standard parallels*. On a map of the United States the maximum scale error would not exceed 1.25 per cent.

By different spacing of the parallels, this projection can be made equal-area. The *Albers conical equal-area* projection is adopted as the best projection for the country by the United States Geological Survey. By spacing the parallels differently, the projection can be made conformal. The *Lambert conformal conic* projection has relatively straight azimuths for which it is generally used for air navigation charts.

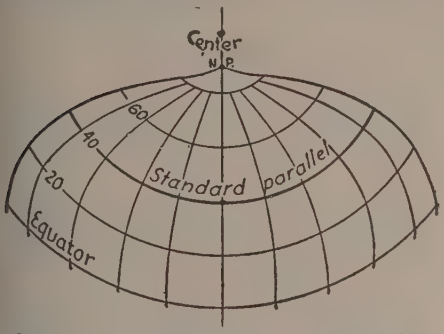

FIG. 7.—Bonne projection of the half-hemisphere centered on lat. 40° N.

The *Bonne* projection is similar to the simple conic, except that not only the standard parallel, but all parallels are divided truly, which makes the meridians curved and the projection equal-area. It is a popular all-around projection, used for all scales, from world maps to topographic sheets.

The *polyconic* projection has a truly divided vertical central meridian. The parallels are non-concentric circles, each with a radius $1=R \cot \phi$, as if each would derive from a tangent cone. Each parallel is divided truly, the connecting lines form the meridians. The United States Geological Survey topographic sheets are on this projection.

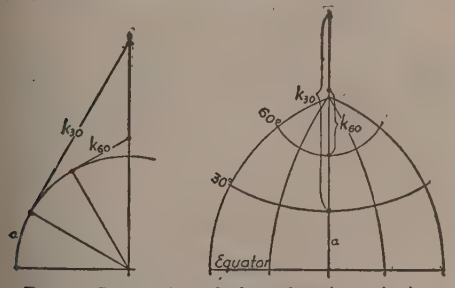

FIG. 8.—Construction of the polyconic projection.

The *azimuthal* projections derive from projecting a part of the earth's surface upon a plane surface from an eye point. The plane can be tangent at the pole, at the equator, or any other point, and all three views—polar, equatorial, and oblique—are often used.

In the *gnomonic* projection the eye point is in the center of the sphere. The projection has extreme distortions of size and shape, but it shows all great circles as straight lines, for which it is used for laying out transoceanic sailing and flying routes. The meridians are straight lines; the parallels are hyperbolas.

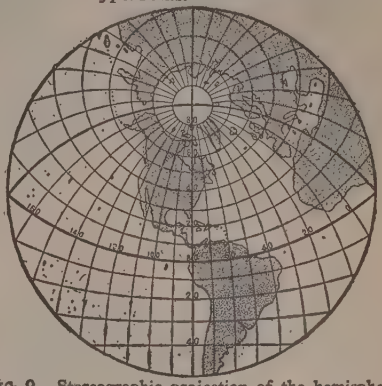

FIG. 9.—Stereographic projection of the hemisphere in oblique view.

In the *stereographic* projection the eye point is at the antipodal point of the center of the map. The projection has the interesting property that not only all parallels and meridians, but also all other circular lines of the globe appear as circles on the map too. It is a conformal projection, but it is not much used on account of its considerable distortion of scale.

The eye point of the *orthographic* projection is in the infinite; the rays are parallel. The parallels and the meridians are elipses, ranging from a straight line to a circle. The great merit of this projection is its visual quality—it looks like a globe. Although the distortion on the sides of the man is enormous, we see everything in correct proportion because we perceive not a map but a picture of a three-dimensional globe. For this reason it became very popular for so-called «global» maps.

Two azimuthal projections do not derive from direct perspective methods. The *azimuthal equidistant* projection is the only one in which every point is shown, not only the correct distance, but also in correct direction (azimuth) from the center point. All other distances and directions, however, are distorted. The *Lambert azimuthal equal-area* projection is very good for hemispheres and for continent maps.

Besides these, a number of interrupted, star-formed, and other projections are used. Among these the butterfly projection of B. T. S. Cahill is particularly attractive. Another interesting group of projections derives from the oblique, or transversal development of the cylindrical and related projections. The transverse Mercator projection is particularly interesting and used for the new maps of the British Ordnance Survey.

Symbols.—As all geographic information of the map is given with the help of symbols, a good symbol is one which can be recognized without a legend, yet is simple, distinct, and does not take up more space than its importance allows. Lines, patterns, and colors can all be used. Symbols are different on small-scale maps and on large-scale maps, and it makes a great deal of difference whether colors can be used or not.

Standardization of symbols is necessary by government agencies. Private cartographers, not hampered by such regulations, are in a position

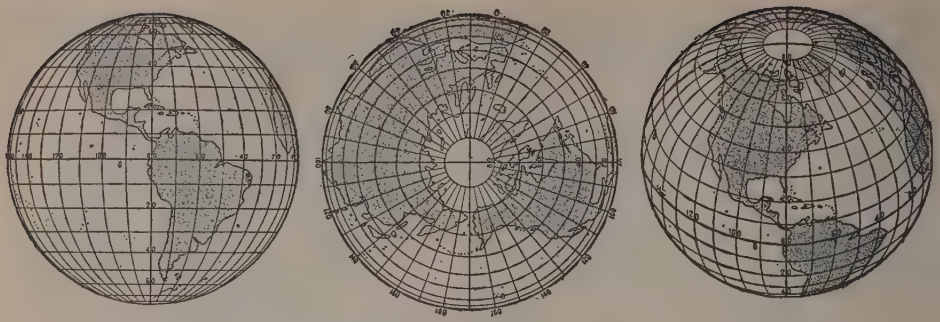

Fig. 10.—Orthographic projection of the hemisphere in equatorial, polar, and oblique views.

to design new and better symbols. Airplane photography presents a rich pattern of the earth's surface which our present symbols are not quite able to express, and a major change is expected in the appearance of maps in the future.

If colors can be used, the conventional color of *hydrography* (water features) is blue; for *hypsography* (relief features, such as hills and mountains) brown; and for *culture* or man-made features, black and red. Vegetation is usually shown with green symbols.

Relief Features.—The representation of mountains is a particularly difficult problem of cartography, essentially because we represent the mountains on maps as seen from above, while our familiar conception of mountains is as they look from below. Several methods are in use.

Hachuring.—This is the older type of representation of relief, and is usually applied to black-and-white maps. Slopes are shown by lines of variable thickness running along the «dip» of the slope, the way water would run upon that surface. The steeper the slope, the thicker the line. The method was systematized by F. G. Lehmann, a Saxonian officer in Napoleon's army.

Plastic Shading.—This method requires reproduction by half-tone method, which limits its use. Two methods are used. In «vertical illumination» the steeper the slope, the darker the tone (as in hachuring). This method is used by the topographic sheets of Norway. Much more common is «oblique illumination,» somewhat as a plaster model of the region would look lighted sideways but photographed from above. This method is often used in combination with contour lines.

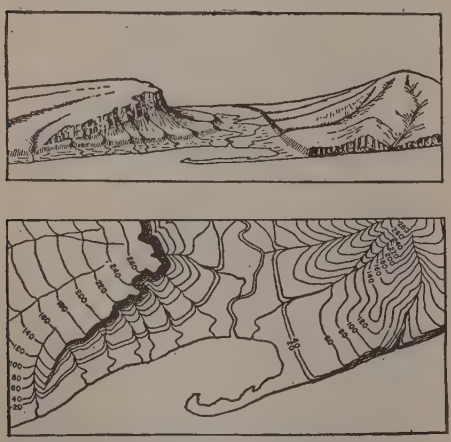

Fig. 11.—Topographical features expressed by contour lines. After the U.S. Geol. Survey.

Contour Lines.—These are continuous lines connecting places of the same altitude above a datum plane, drawn along selected regular intervals. All points between two contour lines have to be at intermediate elevation. Steep slopes produce close intervals; on gentle slopes the contour lines are far apart. The exact angle between contour lines can be expressed by «feet per mile,» or graphically by «profiles.» All contour lines are horizontal and perpendicular to hachure lines. The contour interval varies with the scale of the map and the ruggedness of the land. The 1:62,000 topographic sheets of the United States have 20-foot intervals in hilly country. The datum plane is mean sea level.

Lettering.—Letters obscure by their bulk much topographic detail on maps, and they are kept as small and fine as legibility will permit. If letters are applied to an area, they are spread so as to indicate the trend or extent of the area. Letters are sometimes hand-drawn, but stamped, pasted, or templeted letters are also common. Most United States maps have «slanted» letters for hydrography, «block» or «gothic» letters for relief features, and «Roman» letters for political units.

Composition.—Sectional maps—parts of a larger map—fill a quadrangle between two parallels and two meridians, and title, scale, key, name, authorities, glossary, and all other «marginal information» are set up outside the map. Maps of a unit region, however, have often all this pertinent information collected in a «cartouche» inside the frame of the map. Much empty space can be taken up by «insets.» These insets either show an important portion on a larger scale, or the location of the region on a smaller-scale map.

Reproduction.—Maps are drawn usually 1½ to 3 times the publication size to obtain finer detail. The most common method of reproduction is by offset planography. Only if the map has to be printed together with type is it reproduced by photoengraving (q.v.). Color maps are usually printed from separate color plates drawn on separate papers. Maps reproduced in four-color process are also common. (See Lithography.)

Charts.—Marine charts for navigation differ from land maps chiefly by their emphasis on the sea. They show submarine contours, usually ob-

tained by sounding. Almost all charts are on the Mercator projection. The datum plane is usually a low-water level for sounding, and a high-water level for land features. Charting has been greatly helped by the sonic depth finder instruments and from radar, which helps to locate exactly the point of the surveying vessel. The charts of coasts of the United States and territories are surveyed and prepared by the United States Coast and Geodetic Survey, while those of foreign waters are published by the United States Hydrographic Office (qq.v.). See also article on CHART.

Topographic Maps.—Every civilized country publishes detailed general maps of the land on 1:25,000–1:100,000 scale. In the majority of countries these maps are prepared by the army. Relief is usually shown by contours, but in reconnaissance maps plastic shading is common. The topographic sheets of the United States are prepared by the United States Geological Survey (q.v.) and also by the Corps of Engineers. The fine topographic sheets of England are prepared by the British Ordnance Survey.

Air Navigation Maps.—These are usually published on 1:500,000 to 1:1,000,000 scale, using contour lines with altitude tilts, and show all features which help airmen, especially radio beacons. The United States Army Map Service has prepared air navigation maps on 1:1,000,000 scale of the entire world.

Military Grids.—All new topographic maps have a grid system of even squares overprinted, for easier location of spots. These grid systems are drawn upon a standard map in a specified projection and grid distances and directions are not true on any map on another projection, but as long as the area involved is small, there is not much difference. In the United States Progressive Military Grid System, the country is divided into seven grid zones, and a 1,000-yard square grid is drawn upon a polyconic projection.

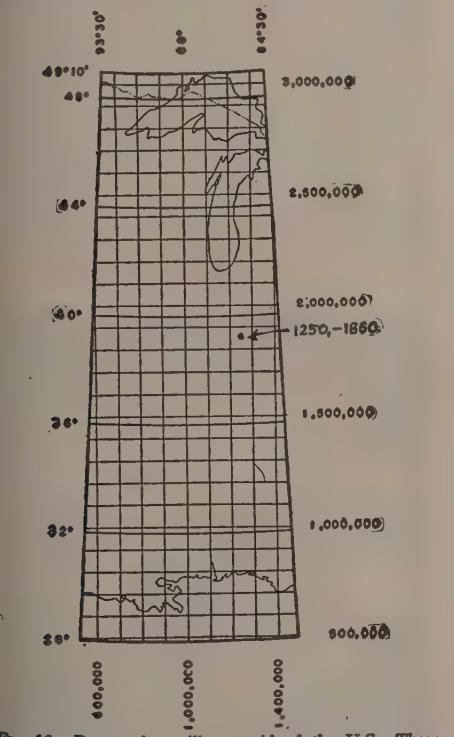

FIG. 12.—Progressive military grid of the U.S. There are seven grid zones. This is Grid Zone C.

Statistical Maps.—These maps show quantitatively the distribution of a certain variable, as, for instance, rainfall, acreage of wheat, religions of people. Three methods are used: (1) isopleths, which are lines connecting equal values; (2) dot system; and (3) superimposed diagrams. The last is recommended whenever the distribution is highly variable or has to be subdivided. «Density of population» maps are the most important in this group. Usually a combination of the dot system and superimposed circular graphs are used on them.

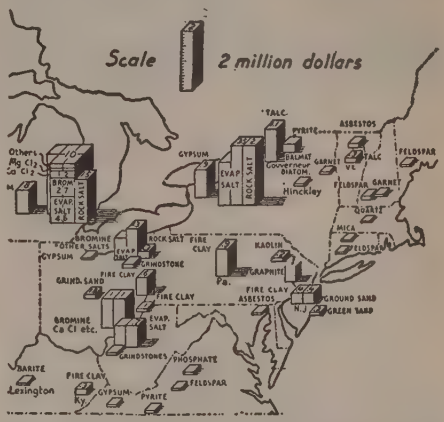

FIG. 13.—Statistical map with superimposed diagrams, showing the nonmetallic mineral production of the northeastern U.S.*

Cartograms.—Highly abstracted diagrammatic maps are called cartograms and are used much in statistical mapping and for showing the distribution or relations of distributions of certain variables over the earth.

Land Utilization Maps.—These indicate forest, meadow, various types of cultivation, etc., and form the most important type of maps in modern cartography. Various colors, patterns, index numbers and figures are used.

Scientific Maps.—This type of map is published in increasing numbers in atlases, books, and periodicals. Not only do the Earth sciences, such as geology, meteorology, climatology, oceanography, seismology, astronomy, plant geography, and zoogeography use maps as an essential part of their presentation, but also economics, history, sociology, etc., use maps in increasing numbers.

School maps, wall maps, city maps, railway, auto-road maps, maps of art and advertising, are just a few more items each of which has its own specialized cartography. See also GLOBE.

History.—The ability of making maps is an inherent quality of mankind. Primitive people are able to draw maps of large areas in vertical projection without any difficulty. The Eskimos, the Indians, the nomads of Asia and Africa, and

*From Raisz, E., "Geography of the Mineral Industry," *Mining and Metallurgy 1941.*

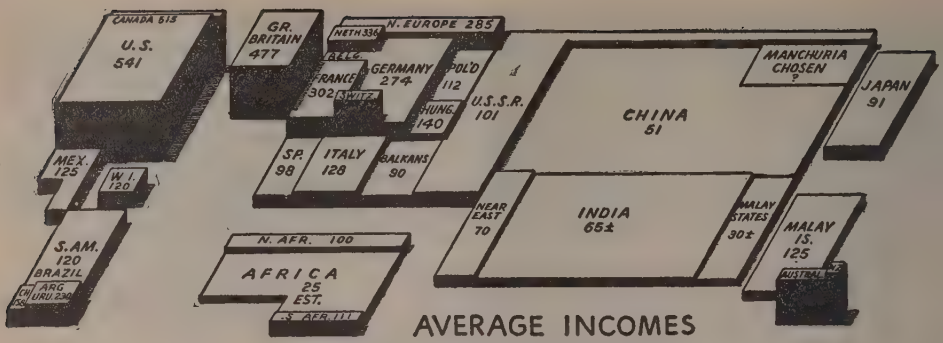

Fig. 14.—Statistical cartogram. The base of blocks is proportionate to population. From E. Raisz: *Atlas of Global Geography.*

the South Sea Islanders are excellent map makers.

The oldest maps which survived were made by the ancient Babylonians, but records indicate that the Egyptians, Persians, and Phoenicians also made maps, few of which survived, however.

Cartography as a science was established by the ancient Greeks. The Ionian geographers of the 5th and 6th centuries B.C. drew the earth in the form of a disk floating in the oceans. In the 4th century, an oblong earth was drawn from which our expressions latitude and longitude derive. At the same time arose the idea of a spherical earth, and it was a well-established fact in the time of Aristotle. The tilt of the ecliptic was accurately measured and the equator, poles, tropics, zones were defined. The size of the earth was measured by Eratosthenes of Alexandria in the 3d century (with an error of less than 14 per cent, 28,000 miles circumference), and later by Posidonius, who, however, figured it one-third too small. This latter measurement was accepted by Ptolemy and influenced Paolo dal Pozzo Toscanelli and Columbus (qq.v.). Eratosthenes prepared a map also showing certain principal parallels and meridians in which he was attacked by Hipparchus, who advocated an even system of parallels and meridians dividing the circle into 360°, as we still use it at the present time.

The only Greek map which survived was an atlas of Claudius Ptolemy of Alexandria about 150 A.D. Much of his material is based on the Phoenician, Marinus of Tyre. His atlas, a supplement of his 8-volume *Geography,* consists of 27 detailed maps and a map of the known world. His delineation had an immense influence upon the cartography of the Renaissance, and some of his mistakes did not disappear from maps until the 18th century.

Fig. 15.—Outline of Ptolemy's World Map.

Roman cartography did not continue the scientific attitude of the Greeks. They preferred a simple map to be used for administrative and military purposes. For this they returned to the disk-like earth of the early Greeks and the Roman *Orbis Terrarum* became the standard map of the world for 13 centuries. It has east on top and we still speak of «orientation.» Most of the map is an exaggerated representation of the Roman Empire with the rest of the world represented only as outlying provinces. A peculiar Roman product was the *Tabula Peutingeriana* (see PEUTINGER'S TABLE) from the 4th century A.D., made by Castorius in which Roman roads are delineated on an enormously elongated scroll 22 feet long and only 1 foot wide. A good medieval copy of this map survived.

The early Middle Ages added little to cartography. A great number of crude maps survived in various codices, but they were mostly copies of the *Orbis Terrarum.* Further diagrammatization of this map resulted in the T-in-O maps (*Orbis Terrarum*) with Jerusalem in the center. These maps, with their regularity, ap-

Fig. 16.—The Orbis Terrarum of the Romans. From E. Raisz: *General Cartography* (McGraw-Hill 1938).

pealed greatly to the medieval mind, not interested so much in reality but in divine harmony. A good map of England was prepared by Matthew Paris (q.v.) in St. Albans, c. 1250.

The Arabs are credited with the first school atlases dating back to the 10th century, showing highly diagrammatic maps. They measured the size of the earth with great accuracy. Their tables of latitudes and longitudes surpass anything prior. The most famous Arab map is the large world map of Idrisi (Edrisi) (1154) of rich detail. It shows, however, Christian influence as it was prepared in the court of King Roger II of Sicily.

FIG. 17.—T in ○ map from the 11th century.

Portolan Charts.—These charts appeared around 1300 and seem to be the copy of a remarkable early chart showing the Mediterranean and Black Seas with surprising accuracy. Indeed, this chart was used for actual navigation for three centuries. Over a hundred copies are known, with but few additions and improvements. The original portolan chart was based on an organized compass survey, probably under the Genoese Admiralty.

The Great Discoveries.—The introduction of the compass and improved sailing vessels made possible the voyages of Columbus, Magellan, and others. These great discoveries caused a revolution in map making, as America and its relation to Asia had to be explained to the public. The outlines of four maps below show the confusion which prevailed in the minds of cartographers in the early 16th century. Juan de la Cosa's map

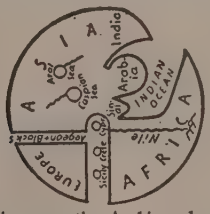

FIG. 18.—Diagrammatic Arabic schoolmap from the 10th century.

of 1500, if its date is correct (which is doubtful), is the earliest representation of the Americas. Martin Waldseemüller's (q.v.) map is the godfather of America, as it was the first to name the continent so. Diogo Ribero's map is a copy of the *padron real* or royal map of Spain. This is the first real world map showing the immensity of the Pacific Ocean, with China and India in their proper locations.

Engraving and Printing.—Hitherto all maps were manuscript and reproduced by hand. The invention of engraving and printing made maps very much cheaper and the flow of new information was facilitated. Woodcut maps were common at the end of the 15th century, but gradu-

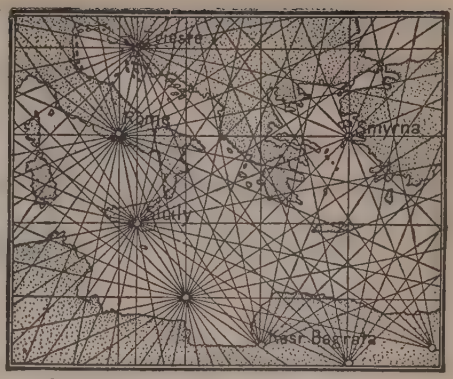

FIG. 19.—Portion of Portolan Chart, c. 1300.

ally copper engraving became the generally used method. Waldseemüller's map was engraved in copper.

Rediscovery of Ptolemy.—Ptolemy's map survived chiefly through the Arabic scholars. His work was translated into Latin around 1410 and since then it was republished perhaps a hundred times, mostly with the addition of new *Tabulae Modernae.* So great was the authority of Ptolemy that Waldseemüller replaced the good outline of the Mediterranean of the portolan charts with the far worse outline of Ptolemy.

The Dutch School.—The Low Countries, situated between England, France, and Germany, and subject to Spain, had good opportunity to obtain information from these countries. Dutch industry and talent supplied the rest, and in the 16th and 17th centuries the Low Countries were the leaders in the map making of Europe. Gerardus Mercator (q.v.) of Louvain is called the father of Dutch cartography. The projection bearing his name appeared in 1569 (see Fig. 4). Hundreds of maps embodying remarkably correct information and restrained, yet artistic rendering, bear his name. Abraham Ortelius (q.v.) published the earliest modern atlas, the *Theatrum Orbis Terrarum,* in 1570. Jodocus Hondius and Jan Janszoon followed the Mercator tradition. The House of Blaeu in Amsterdam produced perhaps the best maps of the Renaissance. Among the later Dutch map houses, the Visshers, the Donckerts, Schenck, Allard, and De Witt should be mentioned. The father of English cartography is Charles Saxton (d. 1611); his county maps are superb. The atlases of Norden, Speed, Goss, Pitt, and Seller closely followed the Dutch style.

Surveying Methods.—Hitherto almost all maps were the result of development: one person made a map, his successors improved it, and gradually a fair representation developed, supported by a few latitude measurements, otherwise unsurveyed. Yet the principles of triangulation are described by Gemma Frisius in 1526, and Willem Janszoon Blaeu actually triangulated a portion of Holland. At the end of the 17th century, the sextant, telescopic theodolite, the planetable, the barometer, and accurate pendulum clocks were available for land measurements.

The French School.—Modern cartography dates from the longitude measurements of the French Academy around 1680. About 80 longitudes were accurately measured by simultaneous

FIG. 20.—Famous map of 1529.

observations of the occulations of the satellites of Jupiter, as chronometers were not yet available. The results of these measurements were laid down on a polar map, covering the floor of the Paris Observatory, by Jean Dominique Cassini. French cartographers of the 18th century excelled in fine, accurate work, critical, scientific attitude, and less inclination for decoration. Outstanding men were Guillaume Delisle, Jean Baptiste Bourguignon d'Anville, Gilles, and Didier Robert de Vaugondy, J. N. Bellin, Philippe Buache, Rigobert Bonne and many others.

The English School.—Early British cartography was under Dutch influence. In the 18th century the fine French style prevailed, but by the end of the 18th century the British even surpassed the French in the number and excellency of their maps. The maps of John and Thomas Bowles, Thomas Jefferys, William Faden, John Rocque, John Cary, and Aaron Arrowsmith were popular even in America.

National Surveys.—The triangulation of France was organized by the Academy of Sciences under César François Cassini de Thury and accomplished in 1744. The preparation of detailed topographic sheets was the further life work of this great cartographer. This was the first great national survey, which was soon followed by Austrian Belgium, and the British Ordnance Survey 1791. In the 19th century every civilized nation produced its topographic sheets.

Diversification of Cartography.—The 19th century witnessed a great diversification of cartography. Geologic maps of William Smith, school maps of Emil Sydow, physical maps of Karl Ritter, atlases of meteorology and climates of John Bartholomew, relief models of Albert Heim, historical map reproductions of Jomard and Konrad Miller, are just a few examples of various tasks which found a cartographic answer. The International 1:1,000,000 Map of the World is the first great experiment in international cooperation in mapping.

American Cartography.—The oldest map wholly produced and published in America is John Foster's woodcut of New England from 1677. The Bonner map of Boston of 1722 is the first large city map. Lewis Evans' *Middle British Colonies* in 1755 is the most outstanding colonial map. The British naval and military maps, previous to the Revolution, by Samuel Holland (New York, New England); John Gascoigne (South Carolina, Georgia); G. Gould (Florida); Ross (Mississippi River); Wm. Brassier (Lake Champlain); J. Montresor (New York state); John Hills (New Jersey); and many others formed a fundament for the later maps of the United States. Washington's surveyors, Thomas Hutchins, Simeon De Witt (qq.v.), and others, organized the official cartography of the new state. In the early 19th century almost every state of the Union prepared a state map on 4 to 8 miles to the inch scale. Atlases were published in great numbers since Matthew Carey's *General Atlas,* 1794. Especially famous is Henry S. Tanner's *New American Atlas,* 1823. The two Tanner brothers, John Melish, Samuel Augustus Mitchell, and later the Colton family, were especially productive.

Wax engraving was invented by Sidney Edwards Morse; his *Cerographic Atlas* appeared in 1841. This method, with its stamped-in names and mechanical appearance, imprinted its style upon American cartography for a century. More individual maps were produced by lithography which was introduced around 1827. The county atlases of the second half of the 19th century are typical American products, and their production became a national industry.

The early explorations and mapping of the rapidly expanding country were chiefly due to the army. William Clark's map of 1810 of the Lewis-Clark transcontinental expedition; Major Stephen H. Long's map of the Platte River; Benjamin L. E. Bonneville's map of the Great Basin; Joseph N. Nicollet's map of Minnesota; John Charles Frémont's map of the West are just a few witnesses to the outstanding work of these men under constant danger from Indians.

The westward migration of people was preceded by the host of surveyors commissioned by the General Land Office to make township plots. These men did remarkable work in incredibly short time, but often characterized more by speed than accuracy.

The Coast Survey was established in 1807 under the directorship of Ferdinand Hassler of Switzerland; the first charts, however, did not appear until 1845. This office is responsible for the leveling and triangulation of the country and since 1878 it has carried the name United States Coast and Geodetic Survey.

The many competing surveys of the West were collected in 1878 into the United States Geological Survey, which is in charge of the

Fig 21.
La Cosa
(1500).

Fig. 22.
Contarini
(1506).

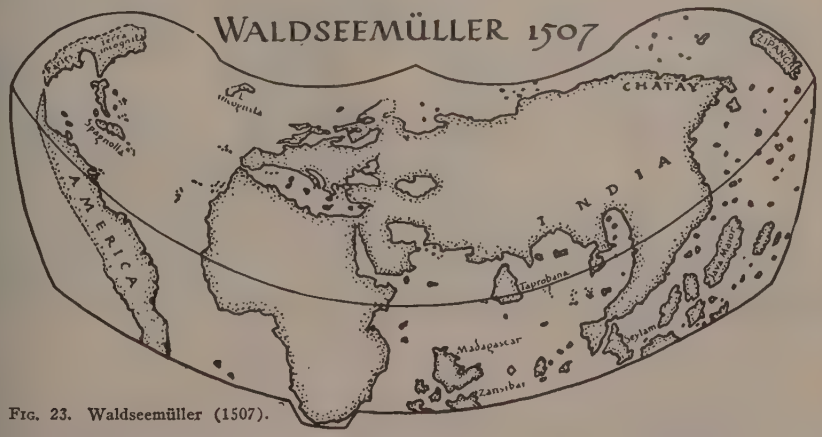

Fig. 23. Waldseemüller (1507).

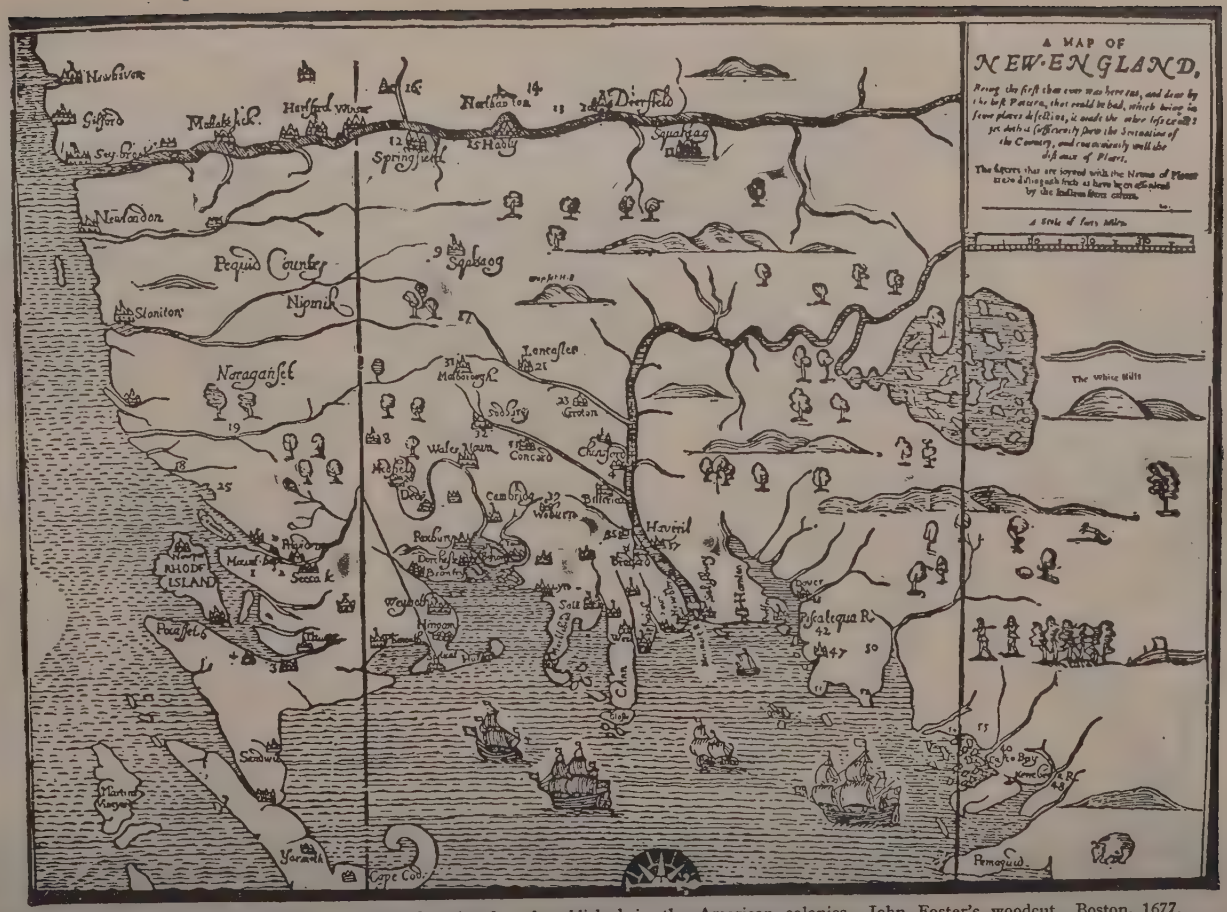

FIG. 24. The first map drawn, engraved, printed and published in the American colonies. John Foster's woodcut, Boston, 1677.

topographic mapping of the country. At the beginning of the Second World War less than half of the country was topographically surveyed. The coverage, however, was greatly expanded by the United States Corps of Engineers in recent years.

Before the war, 24 federal agencies in Washington alone produced all kinds of special maps. Add to this the maps of the various local and state agencies, the number of official maps produced yearly runs into the hundred thousands. Even this production was superceded during the war, when the Army Map Service, the Coast and Geodetic Survey, and the navy produced maps especially of foreign countries with unprecedented speed. Much of this work was aided by airplane photography.

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MAPES, māps, **Victor,** American playwright: b. New York, 10 March 1870. He was graduated from Columbia in 1891, was dramatic critic of the New York *World* 1898–99 and manager of New Theatre Chicago (1906–07). He wrote *Duse and the French* (1897); *Partners Three* (1909); *Gilded Way* (1911); and directed *The Tory's Guest* (1900); *Don Caesar's Return* (1901); *The Dectective* (1908); *The Boomerang* (with Winchell Smith, 1915); *The Amethyst* (1925). D. 27 Sept. 1943.

MAPLE, a genus (*Acer*) of trees, together with a few shrubs of the family *Aceraceæ.* The species, of which there are about 100, are indigenous to the north temperate zone, being best represented in China, Japan, United States and Canada. They are characterized by opposite, palmate or lobed, exstipulate leaves; small polygamo-dioecious flowers in axillary corymbs or racemes; and compound, one- or two-seeded, long-winged nuts (samaras). The maples constitute one of the most widely useful genera of trees, being extensively employed for ornamental and street planting and for windbreaks, while the wood serves well for toolhandles, furniture, flooring and many other purposes. The flowers are rich in nectar and are sought by bees. Most of the species thrive best upon rich moist land suitable for agricultural purposes and are considered an indication of the type of soil. A few grow in wet land, and many upon mountain sides. They are readily propagated by means of seeds which, in the case of the early maturing kinds, should be sown as soon as ripe, the later ones in autumn or spring, being stratified in sand during the winter. Some choice varieties are grafted or budded and others may be increased by cuttings and layers.

In America, the best known, most widely planted and otherwise most important species is probably the rock or sugar maple (*A. saccharum*), a stately round-headed, gray-barked tree, often attaining heights of 120 feet. It is especially characteristic of rich woods from Maine to Michigan and southward in the mountains to Georgia, everywhere being noted for the rich colors of its leaves in autumn. Besides great popularity for all the purposes mentioned above, some of the trees are highly prized for their wavy-grained wood, which, being of satiny appearance and capable of high polish, is used under the name of curly maple often as veneers for choice furniture. It is further the most important of the species which yield a saccharine sap, and is a chief source of maple syrup and sugar, to obtain which the trees are «tapped,» the sap caught in buckets and evaporated. A yield of three pounds per tree annually is considered very profitable; six pounds or even more is often obtained from many specimens whose sap is either especially abundant or particularly rich in sugar. If properly done no injury results to the trees. A form of the sugar maple, the black maple (*A. saccharinum* var. *nigrum*), so called from its very dark bark, is considered a distinct species (*A. nigrum*) by some botanists. It has the same range and habitats as the preceding and in nearly every respect the same uses, including sugar production. This form is more abundant than the preceding in the Central States.

The silver maple (*A. saccharinum*) is a widely spreading tree which attains a height of 120 feet throughout the same range as the above species. Being very ornamental in form and particularly also because of its graceful leaves, which are silvery white beneath, this tree is widely planted where rapid growth and quick effects are desired. Its chief fault is its brittleness; it quickly succumbs to high winds. It will succeed upon a wide variety of soils. Its sap, though rather sweet, is less useful for sugar than the above-mentioned species.

The red, scarlet or swamp maple (*A. rubrum*) attains heights similar to the above, has about the same range, but is most frequently found in wet ground. It is named from the brilliant color of its flowers, which are borne profusely in early spring before the leaves appear and from its red fruits which appear soon after. Being of good habit it is widely planted for ornamental purposes upon all kinds of soils. Its wood is used for most of the purposes enumerated above.

The Norway maple (*A. platanoides*) is somewhat smaller than the preceding species, being more compact and umbrageous. It is widely planted in private grounds and in parks, but is less valuable for street planting than the above because of its shorter trunk. It is a native of Europe. The sycamore maple (*A.*

pseudoplatanus), another European species, is smaller still, attaining only about 70 feet. It is also widely planted in America as well as in Europe, being a vigorous, rapid grower and succeeding upon a great variety of soils. The common maple (*A. campestre*) occasionally attains 50 feet, but is usually a smaller tree or even a shrub. It is of European origin and is widely planted.

The Japanese maples (*A. japonicum, A. palmatum,* and other species) are small trees or shrubs which because of the great diversity of form of their leaves and their dainty habit have become widely popular in the parks and gardens of the United States and Europe. Their exceptionally brilliant autumnal coloring is taken advantage of in Japan where in the fall they approach the chrysanthemum in popularity.

The maples furnish food for a large number of insects, some of which live upon the green parts and others upon the wood. Several species of scale insects (q.v.) are often abundant enough to do considerable damage. The cottony maple scale (*Pulvinaria vitis*) is among the most troublesome. Several caterpillars live upon the leaves, the forest tent caterpillar (*Malacosoma disstria*), the fall webworm (*Hyphantria cunea*), and the larvae of the white-marked tussock moth (*Hemerocampa leucostigma*) being the most generally important. The maple worm (*Anisota rubicunda*), which is the larva of a moth, is frequently very destructive. Of the borers, the larvae of *Dicerca divericata* and *Glycobius speciosus,* which are beetles in the adult state, and those of *Sesia acerni,* a clear-winged moth, are among the most destructive to maples. The second beetle mentioned is known as the sugar maple borer.

Consult Bailey, L. H., *Standard Cyclopedia of Horticulture* (New York 1944); Peattie, Donald Culross, *A Natural History of Trees of Eastern and Central North America* (Boston 1950); Platt, Rutherford B., *American Trees* (New York 1952).

MAPLE HEIGHTS, city, Ohio, is located in Cuyahoga County in the northeastern part of the state, ten miles southeast of Cleveland of which it is a residential suburb. It was incorporated as a village in 1915 and as a city in 1930, and it has a mayor-council type of government. Pop. (1940) 6,728; (1950) 15,586.

MAPLE SHADE, village, New Jersey, is located in Burlington County in southwestern New Jersey seven miles east of Camden, at an altitude of 40 feet. Served by the Pennsylvania Railroad, it is principally a manufacturing and agricultural center, the chief industries being clothing, paper products, radio parts, and lumber milling. It is in a region of truck, fruit, poultry, and dairy farms. Pop. (1950) 4,200.

MAPLE SUGAR INDUSTRY, a trade term in common use, pertaining to the manufacture of sugar and sirup from the sap of the rock or sugar maple (*Acer saccharum*) or from the sap of the black maple (*Acer nigrum*). The maple trees, which are about forty years old when first tapped, are drilled with small and shallow holes a few feet from the base of the trunk during the spring when the sap is rising. The sap drips into buckets, which are hung on the tree, and the flow continues for several weeks. An average tree yields from 10 to 20 gallons of sap, although from 35 to 50 gallons of sap must be boiled down in order to obtain one gallon of sirup.

Vermont and New York are the leading producing states, the next in order being Ohio, Michigan, Pennsylvania, Wisconsin, New Hampshire, Massachusetts, Maine, and Maryland. According to the United States Department of Agriculture, the number of maple trees tapped in these ten states in 1950 was approximately 7,711,000 compared with about 9,957,000 in 1940; there were about 262,000 pounds of sugar made in 1950 compared with about 434,000 pounds in 1940; and approximately 1,968,000 gallons of sirup were produced in 1950 with about 2,597,000 gallons produced ten years previously. This general decline in production has continued over many years and is vividly illustrated by the fact that the annual output of maple sugar and of maple sirup expressed in terms of sugar was on an average of 43,155,000 pounds in the period 1917 to 1920, but had fallen to an average of 14,404,000 pounds in the period 1947 to 1950.

In Canada maple sugar and maple sirup are produced chiefly in Quebec, which is the recognized center of the industry, and in Ontario, New Brunswick, and Nova Scotia. The total Canadian production in 1948 was 2,350,000 pounds of sugar and 2,159,000 gallons of sirup. Of this aggregate Quebec is credited with 2,187,000 pounds of sugar and 1,750,000 gallons of sirup.

History.—Maple sugar and sirup were made by the early pioneers of New England and Canada. The art was a product of "necessity, the mother of invention," or an inheritance from the Indians, who were familiar with the process of making the sugar. But, in either event, the first methods employed were crude, and the article was dark in color and not attractive. Moreover, tapping trees with an axe tended to denude the forest of its maples, and the entire procedure was wasteful in the extreme. The sap was caught in troughs, hewed out of logs, thence carried in pails to the boiling place and reduced to sirup in potash kettles which were suspended by chains from a horizontal pole, supported by forked or crossed sticks at each end and surrounded by a blazing open fire. Improved methods, however, both as to tapping the maples and refining the sap, gradually followed one another, until now modern scientific methods prevail, and it is possible to reduce the sap to sugar or sirup almost immediately by using evaporators.

Adulteration.—Prior to the passage of the National Pure Food and Drugs Act, and before the federal government inaugurated its crusade against misbranding, certain sugar refineries made much more sugar and sirup, labeling it "maple," than the entire natural production. This practice, however, has been suppressed, and, though much maple sirup is sold to concerns which blend it with cane sirup, no attempt is made in marketing the product to deceive the public, the labels simply stating that the article within the container is a sirup made by blending cane and maple sirups.

MAPLEWOOD, city, Missouri, is located at an altitude of 508 feet directly to the southwest of St. Louis of which it is a residential suburb. It is served by the Missouri Pacific Railroad. Settled in about 1865 and incorporated in 1908, Maplewood has a commission type of government. Pop. (1950) 13,416.

MAPLEWOOD, township in Essex County, New Jersey, is situated six miles west of Newark on the Delaware, Lackawanna and Western Railroad. Although largely a residential suburb of Newark and New York City, celluloid, metal products, and golf clubs are manufactured here. Of historic interest in Maplewood, which was incorporated in 1922, is the Timothy Ball House often visited by Washington during the Revolutionary War. Pop. (1950) 25,201.

MAPPA, măp'pă, **Adam Gerard,** Holland-American soldier and type founder: b. Delft, Holland, Nov. 25, 1754; d. Olden Barneveld, N. Y., April 15, 1828. As a young man he entered the military service of his native country, gaining marked distinction. He later engaged in the type-founding business, but his work was interrupted by the political storms which disturbed the Netherlands in 1786–1787. Colonel Mappa again took up the sword and became a leader of volunteer militia forces which aimed at liberalizing Dutch political institutions, but in the abortive revolution of 1787 his forces were overwhelmed and he was banished forever from Delft.

Mappa then went to the court of Versailles to solicit cooperation. Louis XVI, however, had troubles enough of his own, and, as the prospects of civil liberty being established in his own country grew fainter, Colonel Mappa decided to move with his family to America.

While in Paris, Mappa became acquainted with Thomas Jefferson, then American ambassador to France, who advised him to take to America a type-founding plant. Up to this time all printers had been obliged to purchase their type in Europe since there was as yet no type foundry on the western side of the Atlantic. Accordingly, when Mappa arrived in New York in 1789, he brought with him a complete letter foundry.

The infant industry, nevertheless, did not prosper, and in 1794 he advertised his type foundry for sale. Later that same year he moved to Olden Barneveld, later Trenton, now Barneveld, where, as resident agent for the Holland Land Company, he played an important role for more than thirty years in helping to settle that part of New York State.

MAPU, mä'pōō, **Abraham,** Hebrew novelist: b. Slobodka, a suburb of Kovno, Lithuania, Jan. 10, 1808; d. Königsberg, Oct. 9, 1867. Noted as a Talmudist when still very young, Mapu also became well acquainted with French and Latin secular literature, both of which exerted a lasting influence on his literary endeavors. In 1848 he was appointed professor in a Jewish school at Kovno, and in 1853 his historical novel *Ahabat Ziyyon* (*The Love of Zion*) appeared. This important work, which managed effectively to symbolize the spirit of regeneration of the Jews through contact with Palestine, was a significant forerunner of the romantic movement in 19th century Hebrew literature. An English translation, *Amnon, Prince and Peasant,* written by Frank Jaffe was published in 1887. His second major historical novel, *Ashmat Shomeron* (*The Transgression of Samaria*), was published in 1865. He also wrote *Ayit Zabua* (*The Hypocrite*) (1857–1861), a Hebrew manual, and a Hebrew grammar.

MAR is the section of Scotland located between the Dee and the Don rivers. The ancient earldom of Mar, which had previously expired, was restored by being granted in 1565 to John, 6th lord of Erskine, who had been regent of Scotland. His son, the 2d earl of Mar and guardian of James VI, helped to negotiate the question of the succession of James to the English throne. The 6th earl, after helping to negotiate for the union of Scotland and England, returned to Scotland and led an unsuccessful rebellion in 1715 for the Old Pretender.

MAQUI, mä'kē, an evergreen shrub of the family Elaeocarpaceae, found in Chile, from the juice of whose acid berry the Chileans make a wine given to persons ill with fever. It is the best-known species of the genus *Aristotelia* (*A. maqui* or *macqui*) and is sometimes cultivated as an ornamental shrub.

MAQUIS, mä-kē', a dense copselike growth found in the hot, dry regions of thin soil along the coasts of the Mediterranean Sea. It usually consists of a thicket of such bushes as the arbutus, cistus, holm oak, myrtle, tree heath, wild olive, or laurel. In Italy the growth is called the *macchia,* and in California it is called the chaparral, in the latter case generally consisting of dwarf evergreen oak. The name, by extension, also applied to Corsican bandits who, in evading the law, would hide in the maquis growth.

During World War II, when Pierre Laval instituted a compulsory labor draft in Vichy France in 1943, the term began to be applied to those who fled to the countryside to escape this draft and later to all who were participating in underground resistance. Such groups of men, the *maquisards,* concentrated particularly in the mountainous regions of France bordering on Italy and Switzerland. They were organized only on a local basis until 1944 when nation-wide contact was established and they became a part of the French Forces of the Interior (FFI).

MAQUOKETA, mȧ-kō'kĕ-tȧ, city, Iowa, seat of Jackson County, is located at an altitude of 685 feet on the Maquoketa River 30 miles south of Dubuque. Served by the Milwaukee Railroad, it is chiefly an agricultural trading center although the manufacturing of foundry and machine-shop products and fishing tackle is also carried on. Valuable limestone quarries are in the vicinity, and not far distant are forests which furnish excellent hardwood timber. The city owns and operates the waterworks and the electric generating plant and distribution system. Pop. (1950) 4,307.

MARA, mä'rȧ, in Norse legend, was a goblin that seized on men asleep in their beds and took from them all speech and motion. In Buddhist mythology Mara is the tempter, the ruling spirit of evil. Mara is also frequently identified with the incubus and with nightmares.

MARABOU, măr'ȧ-bōō, a large African pink-white pouched stork (*Leptoptilus crumenifer*), which resembles the adjutant (q.v.) of India in appearance and habits. It gives its name to the soft and drooping feathers (coverts) which cover the root of the tail and are prized for millinery and other ornamental purposes. A large part of the "marabou feathers" sold, however, are derived from the Indian adjutant.

MARABOUTS, măr'a-boots, **MARABOOTS,** or **MARABUTS,** Mohammedan Arab hermits or devotees, leading a secluded religious life or occupying a religious station in northern Africa. They have great influence among the Berbers and distribute amulets, affect to work miracles and are thought by their followers to exercise the gift of prophecy. Throughout the Barbary States the tombs of the Marabouts are conspicuous objects, being generally built in the open country and regarded by the people with much reverence. Some of them have degenerated into religious tramps.

MARACAIBO, mä-rä-kī'bō, Venezuela, capital of the state of Zulia, situated on the strait that connects Lake Maracaibo with the Gulf of Venezuela. It has a large and safe harbor, and maintains commercial relations with foreign markets, with the interior and with Colombia. Hundreds of small craft, suitable for shallow waters, carry on the trade of the coast and rivers tributary to the lake. The most important buildings are the Executive Mansion, the public market, Legislative Palace, municipal building, Baralt Theatre, university, churches and the prison. The public plazas contain statues of the patriot, Gen. Rafael Urdaneta, and Don Rafael Baralt, author of a history of Venezuela, who was born in Maracaibo and became a member of the Royal Spanish Academy. There is a dockyard for the construction of sailing-vessels and the city has electric lighting, telegraph and telephone service, submarine cable, street railways, etc. In the last few years rich deposits of petroleum have been found along the shores of Lake Maracaibo, which has resulted in increased activity in the city, and made Maracaibo one of the most important petroleum export centres of Latin America. Petroleum, coffee, cocoa and hides are the chief exports, which have an average annual value of $2,300,000. Maracaibo, at first called Nueva Zamora, was founded in 1571 by Alonzo de Pacheco. This city is the starting point for passenger and freight steamers and rail lines. Pop. about 110,000.

MARACAIBO, Gulf of. See VENEZUELA, GULF OF.

MARACAIBO, Lake of, Venezuela, in the northwestern part, connected with the Gulf of Venezuela by a strait about 50 miles long and from 8 to 15 miles wide. The lake lies between 9° and 11° N. lat. and 71° and 72° W. long., and is about 100 miles long from north to south and 80 miles across the widest part. At the mouth it is about 500 feet deep, but at its head it is shallow and the land near the shore is marshy. Large vessels cannot enter because of a bar at its mouth which leaves only from 8 to 13 feet of water. A number of rivers flow into the lake and keep it fresh, but when strong north winds prevail it becomes brackish. The tides do not affect the lake to any very great extent although it is a marine inlet. It was once much larger than at present, as the shore-marks indicate, but the basin has been filled in. Petroleum deposits have been discovered along its shores and are being extensively developed. See VENEZUELA.

MARAJO, mä-rä-zhō' (called also Joannes), Brazil, an island at or between the deltas that form the mouths of the Amazon and Para rivers; area, about 14,000 square miles. From east to west the greatest dimension is 162 miles and 110 miles north and south. The greater part is low; in the centre are several lakes. In the north and west are swamp lands and in the east and south forests, the rubber tree predominating. The chief settlement is Saure on the eastern coast. There are not many residents, as in the rainy season nearly the whole island is flooded. Cattle raising and gathering rubber are the chief occupations.

MARAL, the red deer of Persia.

MARANHAM, mä-rän-yäñ, or **MARANHÃO,** Brazil, a maritime state, just south of the Equator, bounded on the north by the Atlantic Ocean; area, 177,515 square miles. The surface is uneven, but there is no range of mountains. There are numerous rivers flowing into the Atlantic, large forests, extensive plains where cattle are reared; the climate is fine and the soil fertile. The Paranhyba is the principal river, being 700 miles long, with several large tributaries. The Gurupy, the Mearim and the Itapicurú are each about 500 miles in length. Agriculture has only begun; the emancipation of the slaves, on whose labor the state had depended, was followed by a period of great depression. Cotton, sugar and rubber are the principal products. Coffee, rice, corn, cacao and tropical fruits grow luxuriantly. The population is not great enough to properly develop the rich natural resources, there being only 4.9 persons to the square mile. Efforts are being made to colonize different sections, but the hot climate is not attractive. The present inhabitants are chiefly of Portuguese descent; but there are about 20,000 Indians and a few hundred negroes and mulattoes. The capital is Maranham. Pop. about 1,200,000.

MARANHAM, or **SÃO LUIZ DE MARANHÃO,** sän loo-ēzh' dō mä-rän-yän', Brazil, capital of the state of Maranham, on an island on the bay of São Marcos and between the mouths of the Itapicurú and Mearim rivers. The first settlements were made by the French in 1612. The ground is low and the climate warm but the place is healthful. The harbor, once good, is filling with sand, and little or nothing is done for its improvement. It has considerable trade, the imports and exports totaling $600,000 annually. The chief exports are cotton, sugar, hides, rubber, cotton-seed and the skins of goats. Wool is woven and rugs and felt manufactured. The chief imports are machinery and clothing. The city has many fine buildings, public and private. Pop. including the suburbs, about 60,000.

MARANHÃO. See MARANHAM.

MARASCHINO, măr-ăs-kē'nō, or **MARASQUINO,** a fine liqueur prepared from the sour cherry of southern Europe (*Prunus mahaleb*). The best-known kinds come from Dalmatia and from Corsica. There are other brands that use the name.

MARASMUS, a vague term denoting general emaciation or atrophy with no special cause apparent; now used in relation to the wasting of infants due to malnutrition combined with unhygienic surroundings. See CHILDREN, DISEASES OF.

MARAT, Jean Paul, zhŏñ pōl mä-rä, French revolutionist: b. Boudry, Neuchâtel, Switzerland, 24 may 1744; d. Paris, 13 July 1793. He

studied medicine in Paris, traveled widely and practised in London and later in Paris. The first breath of the Revolution converted the industrious doctor into an audacious fanatic and demagogue. He succeeded, by his violence and energy, in commanding attention. Danton instituted the club of the Cordeliers and collected around him all the fiercest spirits; among the number, Marat, who became the editor of the *Publiciste Parisien,* better known under its later title *L'Ami du Peuple,* again changed to the *Journal de la Republique Française.* This sheet was the oracle of the mob. Denounced to the Constitutional Assembly and proceeded against by the municipal authorities of Paris, he contrived to escape to London and was later in hiding in Paris. During the existence of the Legislative Assembly he continued his outrages, figured among the actors of 10 August and in the assassination of September (1792). He was a member of the Committee of Public Safety to the convention and made the Ministers, General Dumouriez and the Girondists, the objects of his attack. Being charged in the convention with demanding in his journal 270,000 heads, he openly boasted of that demand and declared that he should call for many more if those were not yielded to him. The establishment of the revolutionary tribunal and of the committee for arresting the suspected was adopted on his motions. On the approach of 31 May, as president of the Jacobin Club, he signed an address instigating the people to an insurrection and to massacre all traitors. Even the Mountain party denounced this measure and Marat was delivered over to the revolutionary tribunal, which acquitted him; the people received him in triumph, covered him with civic wreaths and conducted him to the hall of the convention. His bloody career was closed by assassination. (See CORDAY D'ARMANS, CHARLOTTE). His remains were placed in the Pantheon, whence they were later removed. Consult Chevremont, 'Jean Paul Marat' (1881); Bat, 'Jean Paul Marat, the People's Friend' (1901); Velay, C., 'Correspondance de Marat' (Paris 1908).

MARATHI. See MAHRATTAS.

MARATHI LANGUAGE AND LITERATURE. Marathi is one of the principal vernaculars spoken in India. It bears a close affinity to Sindhi and Gujerati and is spoken by about 20,000,000 people. There are several dialects of it, named, respectively, Konkani and Dakhani. The latter is the standard dialect and circulates in the Deccan, the former in the coast region of the Mahrattas and shows a large admixture of Dravidian, while in the district around Goa (a Portuguese possession) it also contains many Portuguese expressions and phrases. Besides, Marathi as a whole has a rather strong infusion of both Arabic and Persian words. All the same, modern Marathi has departed less from the original Sanskrit than most other Prakrits, being a direct descendant from the Maharastri of the Middle Ages. A stock of its vocables are taken from Sanskrit itself, the so-called *tatsamas.* There are three genders in Marathi, the only one of the Prakrits that has retained this feature of Sanskrit. Konkani literature was destroyed by the Portuguese inquisition.

Marathi literature is abundant. It took its inception with Namdev in the 13th century, who wrote descriptive and didactic poems of a religious cast. Tukaram, the most famous of Marathi writers (A.D. 1609), published writings showing Vishnuic convictions. Mayur Pandit in the 18th century also wrote many poems, epic, lyrical and descriptive. Marathi lends itself most readily to rhyme, and there are current among the Marathi people many rhymed proverbs, both pithy and fanciful. In prose not much of consequence has been produced.

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MARATHON, măr'a-thŏn, Greece, an ancient village in Attica, about 20 miles northeast of Athens. It was situated on a plain which extends for about six miles along the sea shore, with a breadth of from one and a half to three miles. The site of the ancient village was not probably that of the present Marathona, but at a place now called Vrana, a little farther south. Through the centre of the plain runs a small brook. Here was fought the great battle between the Athenians and Persians, 490 B.C. (See MILTIADES). A tumulus or «soros» on the plain marks the burial-place of the Athenians who died in battle. It was excavated by the Greek Archæological Society in 1890–91, and yielded many interesting relics.

MARATHON RACE, an athletic contest commemorating the feat of Pheidippides, Greek Olympic runner, who in 490 B.C., ran from Marathon to Athens to carry news of the defeat of the Persians by Athenians and Spartans and fell dead as he cried: «Rejoice, we conquer.» The distance run was 22 miles. The modern race, feature of Olympic games since 1896, is for a distance of 26 miles, 385 yards. For modern records see OLYMPIC GAMES; SPORTS, THEIR DEVELOPMENT, SPEEDS AND RECORDS.

MARATTI, mä-rät'tē, **or MARATTA,** mä-rät'tä, **Carlo,** Italian painter and engraver: b. Camerino, 13 May 1625; d. Rome, 15 Dec. 1713. While a child he amused himself with painting all sorts of figures drawn by himself on the walls of his father's house. In his 11th year he went to Rome, studied the works of Raphael, of the Caracci and of Guido Reni in the school of Sacchi, and formed himself on their manner. His Madonnas were particularly admired. Louis XIV employed him to paint his celebrated picture of Daphne. Clement IX, whose portrait he painted, appointed him overseer of the Vatican Gallery. We are much indebted to him for the preservation of the works of Raphael in the Vatican and of the Caracci in the Farnese Palace. He also erected monuments to those masters in the church Della Rotonda. As an artist Maratti deserves the title given him by Richardson, of the «Last Painter of the Roman School.»

MARATTIALES. See FERNS AND FERN-ALLIES.

MARAVEDI, măr-a-vā'di, the lowest denomination of old Spanish copper coins in use

from 1474 to 1848, varying in value from one-seventh to one-third of a cent. There were also, at an earlier period, maravedis of gold weighing 60 grains.

MARBEAU, Jean Baptiste Firmin, zhŏń bä-tēst fēr-măń mär-bō, French philanthropist, founder of the day nursery: b. Brives, 18 May 1798; d. Saint Cloud, 10 Oct. 1875. He practised law in Paris, and in 1841, being deputed to inspect the charitable institutions of the first arrondissement of the city, planned the crèche or day nursery for the care of children of working mothers. The first crèche was opened 14 Nov. 1844 at Chaillot; a Société des Crèches was founded in 1846; and his plan was described in his book, 'Des Crèches' (1845). Marbeau played a less prominent part in other charities and wrote on various problems of pauperism. Consult the 'Life' by Roussel (1876).

MARBLE, mär'bl, **Manton,** American journalist: b. Worcester, Mass., 16 Nov. 1834; d. Maidstone, England, 24 July 1917. He was educated at the Albany Academy and the University of Rochester, being graduated from the latter in 1855. After spending seven years in the employ of Boston and New York newspapers he bought the New York *World,* on the staff of which he had been employed from 1858 to 1860. Marble was engaged in a controversy with President Lincoln concerning the publication of certain dispatches in the *World.* The latter journal was temporarily suspended from publication. Marble was one of the first to recognize and give publicity to the writings of Herbert Spencer. In 1885 President Cleveland sent Marble to the British, French and German governments as special envoy to discuss the subject of international bimetallism. On his return, after conferences with various European authorities, he advised the President that upon the co-operation of the United Kingdom, for which neither Tory nor Liberal leaders were prepared, depended the German and French resumption of free bimetallic coinage, and advised that United States purchase of silver should cease. Marble was one of the founders of the Manhattan Club and at one time the president of that organization. He belonged also to many literary and scientific societies, among them the Century Association, the Round Table, the Cobden Club and Metropolitan Club. He was the author of 'Letter to Abraham Lincoln,' 'The Presidential Counts,' 'A Secret Chapter of Political History' and a memoir of Alex. G. Mercer, which prefaced his 'Notes of an Outlook on Life.'

MARBLE (from the Greek *marmairein,* to sparkle), a compact rock which, in its pure form, is composed entirely of carbonate of lime or limestone. In its best form it is a variety of calcite, the tiny crystal facets sparkling and flashing in the sun's rays; hence its ancient name. It is seldom found in perfect purity, the tractable qualities of the limestone allowing the introduction of many foreign substances during its formation. Thus there will be seen marble with streaks of various colors running through it, caused by the action of oxide of iron or other chemicals. Almost any limestone rock is commonly called marble, even certain varieties of granite, onyx, porphyry and rock largely composed of gneiss and mica-schist. True marble is a metamorphic equivalent of limestone, from which it has been produced by heat or pressure, or both.

Marble has been a favorite stone for forming into statuary and for decorative work in buildings and monuments, from the very earliest ages. The Greeks, who were the first to endow this lifeless stone with marvelous genius in their statuary and bas-reliefs, were blessed with an almost inexhaustible supply of the very finest and purest marble yet discovered, on the island of Paros, in the Ægean Sea. This marble, so celebrated as "Parian," possesses a peculiar waxy attribute which gave the statues formed from it a beautiful polish. The 'Venus de Medici' was made from this stone, which is almost perfectly white. The Parthenon was built of marble of Pentelicus, which was a little more finely grained. The marbles of Carrara were even then known but not generally put in use till later years, being still among the finest marble in the world, though having some gray streaks.

In many other parts of Continental Europe and in Great Britain are quarries of fairly pure marble. America has a large supply of this useful stone. Each year new occurrences of it are found in the Rocky Mountains, some of them pure white, others with variegated colorings. Perhaps the finest example of these wonderful marbles of the Rockies is found in the new State capitol building of Colorado, at Denver. In the eastern part of the United States there are many quarries of marble which have been in use for many years. Vermont is probably the seat of the largest quarries. Little of this marble is finely grained and white enough to answer for the sculptor's use, but it is admirably adapted for ornamental purposes in architecture and for monuments for the dead. American sculptors still generally use the marbles from Carrara, though the merits of the American product are becoming known. Vermont, although one of the smallest States in the Union, exports more stone for commercial purposes than any other State, except one, Pennsylvania standing first. The money value of Vermont's stone product is approximately $10,000,000 a year, a large part of it being in marbles of various grades.

The quarrying of marble is now carried on extensively, the use of machinery largely taking the place of the ancient hand methods. Fifty years ago the quarries of Rutland, Vt., still the largest in the world, were operated by ox teams and hand work of the crudest form. To-day, these vast quarries have an extensive outfit of electric cranes and derricks, which move the blocks of marble in any desired direction, easily and quickly, one of these traveling cranes having a carrying capacity for 100,000 pounds. The stone is too easily broken to permit the use of blasting powders of any kind. This method is used in some of the Italian quarries, but causes great waste of material and is most unsatisfactory. In the Vermont quarries, a machine called a "channeler" has been found the best for economical work and has been exclusively adopted. It consists of a row of long chisels set in a strong, traveling framework. This gang of chisels vibrate up and down, cutting a channel in any direction desired in the face of the marble ledge. The channel can be made any reasonable depth, according to the size of block desired. When this channel, or groove, is suf-

ficiently long and deep, the machine is reversed and cross channels are cut and the bottom perforated. Then wedges are carefully driven in behind the block of stone and it gently falls over, to be lifted by a crane to the railroad cars or to that part of the quarry devoted to further treatment of the output. As a rule, the stone is sent in its rough state to the purchaser, who dresses it himself. When the order is for monument work or some special design in architecture, the marble is treated at or near the quarry. In thus further treating the product, a toothless saw, or gang of saws, is used. The block of stone is placed on a horse, or platform, and the saws set at work, the size of the cut being gaged by setting the saws close together, or far apart, as needed. A stream of water in which is mixed sea sand or other sharp, hard sand falls upon each saw. The friction of the iron blade, aided by the sand and water, quickly cuts up the marble into any desired shape.

Some marble cutters use saws of wire, but the best seem to be those made of strips of soft iron one sixteenth of an inch thick and, when new, four inches wide. The marble wears down one of the saw blades very rapidly. When the blocks are thus sawn into the requisite shapes by the power gang saws, they are then placed on tables and ground down to size, a small piece of marble being rotated over them by hand or power, water flowing over the surface being ground. With surprising facility, the marble yields to this treatment. Polish, in the final stages, is given by rubbing with wood or other soft material, and finally cloth. Much hand work is, of course, necessary with the mallet and chisel and polisher, but all the rough, heavy work, which formerly made marble so costly and hard to obtain, is now done entirely by electric and steam power. One of the finishing rooms at the Rutland works, located at Proctor, Vt., is 1,000 feet long and contains scores of giant gang saws, cutting up the marble into various shapes. This plant, one of the largest in the world, has an output of $3,000,000 annually and employs hundreds of men. Most of this output is of white marble, though brown, gray, green and other shades are found in profusion.

One ancient method of mining this delicate stone, still used entirely by the Mexicans in mining onyx, is to drill holes in a line, insert plugs of some porous wood, pour in water and allow the wood to swell. This gently forces the precious stone free, without the least injury.

One quality of marble, not usually recalled, is its ability to withstand great heat safely. In the devastating fire in 1903 at Paterson, N. J., buildings built of granite crumbled and perished. Those of marble still stand, almost as good as ever. Its use is, therefore, becoming more and more general in erecting fireproof buildings in the large cities, the floors and often the entire inside wall and ceiling being overlaid with it.

Some really fine examples of craftsmanship in this line are found in the public buildings of New York City and elsewhere in America, notably the buildings of the Hall of Records and the Appellate Division of the Supreme Court, in New York. In the making of monuments for the dead, marble is most extensively used. The floors of bathrooms, tops of toilet tables, basins for washing hands and clothes, tiling of various sorts—all these and a thousand other household purposes find in marble their chief exponent. Probably more than $75,000,000 worth of finished marble products are used in the United States annually, made from domestic quarries entirely. See also Rocks.

MARBLE FAUN, The. *The Marble Faun* was begun by Nathaniel Hawthorne during his visit to Italy in 1858 and was published in 1860. In England it was issued as the *Transformation.* The scene is laid in Rome, but two of the four chief characters are Americans. The most interesting person in the story, however, is Donatello, a young Italian of noble birth who bears a strong resemblance to the statue of a faun by Praxiteles, and who, according to a tradition in his family, numbered a faun among his early progenitors. There are two women characters, of different types. Miriam is of a rich, full-blooded nature, and her past is bound up with some terrible mystery. Hilda, who is said to have been drawn with the writer's daughter in mind, was evidently intended as an example of the pure and self-contained New England maiden, but she has been aptly characterized by one critic as an "admirable little icicle." The romance is a study of the effects of a great guilt on these persons, and especially on Donatello, in whom it brings about the change referred to in the English title of the book.

Hawthorne here seems to be considering the great question of the mission of sin in the world, but in the end the explanation which he allows one of the characters to suggest he makes Hilda reject with horror.

The romance has serious technical defects. It contains an excess of traveler's descriptions, which, however excellent in themselves, have little to do with the story; and it fails to satisfy the curiosity which the author persistently arouses regarding Miriam's past. Dissatisfaction with the ending was so great that in a later edition the author added a chapter of explanation, which, however, he justly regarded as no improvement. The chief merits of the book lie in the conception of Donatello, in the elusive symbolism and suggestiveness which characterize all Hawthorne's best work, and in several impressive scenes. Some of these, like the meeting with the model in the catacombs and the visit to the church of the Capuchins where the murdered monk lies, have a more dramatic quality than is usual with Hawthorne.

William B. Cairns.

MARBLED GODWIT. See Godwits.

MARBLED TIGER CAT. See Tiger-cat.

MARBLEHEAD, mär'b'l-hĕd, town, Massachusetts, Essex County, is located on Massachusetts Bay, 17 miles northeast of Boston; on the Boston and Maine Railroad. The town is located on a double peninsula, with Point Light on the southeastern projection, the "Neck." There are yacht piers and a public landing. Fishing and boatbuilding are carried on, and Marblehead is one of the Atlantic coast's best known yachting centers; it also has many fine summer homes. In the middle decades of the 19th century the town was an industrial community, making shoes, glue, rope, barrels, and paint. Marblehead has many old houses of historic interest. Abbot Hall contains the town administrative offices and the public library. In it is preserved

the original of the famous painting by Archibald M. Willard (q.v.), *The Spirit of '76*. The local art association has quarters in the King Hooper mansion, and the historical society maintains a museum in the Jeremiah Lee mansion (1768). Settled in 1629 by fishermen from Guernsey and Jersey (compare John Greenleaf Whittier's poem, *Skipper Ireson's Ride*), the town was until 1649 a part of Salem. It was the birthplace of Elbridge Gerry (q.v.). In the Revolutionary War Marblehead privateers, the *Hannah* and the *Lee*, rendered noteworthy service. Pop. (1950) 13,765.

MARBLES AND MARBLE PLAYING. Marbles are small balls of baked clay, marble, agate or spheres of glass, used as toys and playthings for children. They were manufactured in large quantities in Saxony for exportation to the United States and to India and China. They were also largely manufactured in the agate mills at Oberstein on the Nahe, in Germany, for the American market. The material used in Saxony was a hard calcareous stone, which was first broken up into square blocks with a hammer. These were then thrown 100 to 150 together into a mill, which was a stationary flat slab of stone, with a number of concentric furrows upon its face. Over this a block of oak of the same diameter, partially resting upon the small stones, was kept rotating, while water flowed upon the stone slab. In 15 minutes the marbles were worn completely round and were fit for sale. An establishment with three mills would manufacture 60,000 marbles in a week. Agates were made into marbles at Oberstein by first chipping the pieces nearly round with a hammer and then wearing them down upon the face of large grindstones.

The game of marbles is variously played; usually with a circular ring marked on the ground, the player taking one marble between the thumb and forefinger and dexterously shooting at other marbles within the circle, striking them with sufficient force to throw them outside the limits of the ring. This form is called ring-taw, and the marbles placed in the ring are apt to be clay ones, called "commys," which is probably short for "commons." A larger and better grade of marble is used for the "shooter." When a player misses a shot, it is then the turn of his opponent. Sometimes he also loses his turn when he drives his shooter outside of the ring. Play is often for "keeps," each boy winning what he knocks out. Another game of marbles is called "nine holes," though it may be played with a less number of holes. A row of small cup-shaped depressions is made in the ground, and the object is to toss or bowl one's marble into each hole in succession, the one accomplishing it with the fewest plays winning. Very likely golf had its fundamental idea in this simple game of marbles. In a variant form the boys shoot at other marbles to knock them into the holes, but their own shooter must not follow, under forfeit, suggesting the basic principle of the game of pool. "Hit and span" is another game much played. One player tosses his marble to a distance, and the other player tosses his marble as close to it as he can; if he hits it, it is for keeps; if he comes within a handsbreadth or span he makes a hit and scores one. Then they reverse, and his opponent tries, the one making the most hits or points winning. This game can be played in walking along a country road, and appears to have been invented by boys who wanted to play on their way to school. In some games of marbles it is fair to toss or bowl the shooter; and in others the player must touch the large knuckle of his forefinger to the ground when shooting, and this the boys call "knuckling down fairly." These games are subject to infinite change, according to the whim of the players, usually boys, of a locality who play them. They make their own rules and pass them along to the smaller players as they grow up. In the United States a National Marbles Tournament is held annually at Wildwood-by-the-Sea, N. J.

MARBLING, *in bookbinding,* the process of coloring paper or the edges of books, in imitation of the veining of variegated marble. In the case of a book, after the volume is formed, but before the cover is put on, the book leaves are trimmed and tied between two boards and taken to a trough or vessel, perhaps two inches deep, which is filled with clean gum water. Various colored pigments, ground in spirits of wine and mixed with a small quantity of oxgall, are thrown upon the surface of the gum water, and disposed in various forms with a quill and comb, forming a variegated, marble-like pattern. When satisfied with the coloring mixture, the workman dips the edges of the book into the trough, and the colors adhere. Cold water is then dashed over the edges, to set the colors and bring them out clearly. Sometimes single leaves are marbled and placed just within the book cover, front and back, for ornamentation. Marbling was formerly quite common, but is now seldom used, solid colors, as red edges, being preferred, or gold edges. The deckle-edged book cannot be marbled, owing to its rough edges. See also BOOKBINDING.

MARBURG, mär'bûrg, or **MARIBOR,** mä'rē-bôr, city, Yugoslavia, in the federated republic of Slovenia, capital of Maribor oblast formed in 1949, is located 55 miles north of Zagreb, on the Drava River, and on the Zagreb-Vienna Railroad. It has railroad repair shops, textile mills, and factories making automobiles, leather goods, shoes, chemicals, and asbestos products. Pop. (1950) 66,498.

MARBURG, mär'bo͝orĸ (Eng. mär'bûrg), also **Marburg an der Lahn,** city, Prussia, Germany, is located on the Lahn River, 46 miles north of Frankfort. It dates from the 12th century. The principal buildings are the castles of the landgraves of Hesse; the 13th century church of Saint Elizabeth; the town house and the celebrated Marburg University, founded in 1527. Here Martin Luther and Ulrich Zwingli debated on transubstantiation in 1529. It became a part of a Prussian province in 1866. It was captured by United States troops in the spring of 1945, during World War II. The town has manufactures of machinery, chemicals, precision instruments, and pottery. Pop. (1950) 39,256.

MARBURY v. MADISON, a well-known decision in law handed down in 1803 by the United States Supreme Court. It is important as affording the earliest instance of the declaration by the court that a Congressional statute is null and void by reason of its repugnance to the Constitution of the United States. Marbury was

appointed justice of the peace in the District of Columbia by President Adams, but the commission, though drawn up, signed and sealed, had never been delivered. Madison, when he became secretary of state, refused to deliver it. An act of Congress empowered the United States Supreme Court to issue to executive officers a writ of mandamus to force them to attend to their duties, and on the basis of this act Marbury brought suit. Now the Constitution nowhere mentions the right to issue a writ of mandamus among the cases of original jurisdiction by the Supreme Court. Chief Justice Marshall therefore decided against Marbury, and his argument, admittedly the only accurate one, established an important precedent which is found only in the courts of the United States.

MARCABRU, mär-kȧ-brü′, a French troubadour: b. in Gascony, about 1140; d. toward the end of the 12th century. He was a special favorite at the court of Alfonso VIII of Castile, where he seems to have been the chief of the royal troubadours.

MARCASITE, mär′kȧ-sīt, *in mineralogy,* an iron disulphide (FeS_2), differing from pyrites in that it crystallizes in the orthorhombic system. It is usually a pale yellow, being thus lighter than true pyrites, but it has gray to brown-black streaks.

MARCEL, mȧr-sĕl, **Étienne,** French political leader: d. Paris, July 31, 1358. From December 1354 he was provost of the Paris merchants and actual ruler of the city. He put to death two officials of the Crown and finally persuaded the dauphin Charles (later King Charles V of France) to act as regent while King John the Good was held by the English. Not finding the Dauphin properly submissive, he obtained assistance from Charles the Bad of Navarre. He was killed during an uprising of the more wealthy and conservative citizens against his power.

MARCELINE, mär-sĕ-lēn′, city, Missouri, in Linn County; altitude 858 feet; 104 miles northeast of Kansas City; on the Santa Fe Railroad. Railroading and mining have been its principal industries, but farming and food processing are advancing here. Walt Disney spent his boyhood years in Marceline. The city owns light and water supply systems. Pop. (1950) 3,172.

MARCELLINUS, mär-sĕ-lī′nŭs, Saint and pope: reigned 296–304. The Diocletian persecution raged during his reign, and he has been accused by the Donatists (q.v.) of relinquishing the sacred books and of offering incense to the gods. This is questioned by Augustine as Marcellinus died a martyr.

MARCELLUS I, mär-sĕl′ŭs, Saint and pope: reigned 308–309. After an interregnum of two years he was elected pope and found the church in great confusion after the Diocletian persecution. He restored some semblance of order by dividing Rome into 25 districts supervised by a presbyter with certain authority. He incurred the enmity of the *lapsi* for refusal to readmit them to the church without doing penance for their apostasy. The tyrant, Maxentius, seized the pope and banished him. He died in exile.

MARCELLUS II (real name MARCELLO CERVINI DEGLI SPANNOCHI), pope: reigned 1555. Of great purity of life and marked ability, Paul III appointed him prothonotary apostolic and papal secretary. He was made advisor and secretary to the pope's able nephew, Cardinal Alessandro Farnese (q.v.), and accompanied him on his various legations to the courts of Europe, participating in important negotiations. Appointed president of the Council of Trent (1545 q.v.) he incurred the enmity of the emperor, Charles V, for fearlessly upholding the interests of the church. As librarian of the Vatican (q.v.) he added priceless manuscripts to its collections. Elected pope, he set about the immediate reform within the church, but was stricken ill and died after a pontificate of 22 days. Palestrina (q.v.) dedicated his famous *Missa Papae Marcelli* to him.

MARCELLUS, Marcus Claudius, Roman general: b. 268 B.C.?; d. near Venusia, 208 B.C. In 222 being consul with Scipio he twice defeated the Insubrians in northern Italy, and with his own hand killed their king, thus winning the *spolia opima.* After the disaster of Cannae in the Second Punic War (216), Marcellus took command, gained several slight victories over the Carthaginians and hence was named "the sword of Rome," Fabius Cunctator being called "the shield of Rome." His third consulship (214) was spent in Sicily, where he attacked Syracuse, and after a two years' siege prolonged by the skill of Archimedes captured the city. In his fifth consulate after two years of varying success against Hannibal in Italy he was killed in a skirmish near Venusia.

MARCELLUS STAGE, *in geology,* a term introduced by the New York State Geological Survey for the thin rock, mostly shale, which is the lowest group of the Upper Devonian System, and which is most typically seen in New York State at the little village of Marcellus.

MARCH, märch, **Alden,** American surgeon: b. Sutton, Mass., Sept. 20, 1795; d. June 17, 1869. He was educated at Boston and at Brown University, receiving the degree of M.D. from the latter in 1820. From 1825 to 1831 he was a professor in the Vermont Academy of Medicine, from 1831 to 1833 at the Albany Medical Seminary, and in 1833–1834 at the Albany Medical School. In the latter year he founded a school of practical anatomy in Albany and in 1839 founded the Albany Medical College, in which he was professor of surgery from the foundation until his death in 1869. Dr. March also founded the Albany City Hospital, and founded the American Medical Association, of which he was president in 1863.

MARCH, Francis Andrew, American philologist: b. Millbury, Mass., Oct. 25, 1825; d. Sept. 9, 1911. He was graduated from Amherst in 1845, studied law in New York in 1849–1850, was admitted to the bar in 1850, in 1856 became adjunct professor of *belles-lettres* and English literature in Lafayette College (Easton, Pa.), and in 1857 professor there of the English language and comparative philology. He was among the earliest advocates of a historical study of the English language and of a philological study of the classic works of that lan-

guage. His contributions to the transactions and proceedings of the American Philological Association and other learned societies have been very extensive. He was a consulting editor of the 'Standard Dictionary,' and decided many spellings and forms for that work. He also edited the Douglass series of Christian Greek and Latin classics (1874–76), was director of the American readers for the great 'Historical Dictionary of English' of the London Philological Society, and published 'A Method of Philological Study of the English Language' (1865); 'Parser and Analyzer for Beginners' (1869); an 'Anglo-Saxon Grammar' (1870); an 'Anglo-Saxon Reader' (1870), an 'Introduction to Anglo-Saxon' (1871), 'Thesaurus Dictionary,' 5th edition, Philadelphia (1930).

MARCH, Peyton Conway, American soldier: b. Easton, Pa., 27 Dec. 1864. He is a son of Francis A. March, the philologist. Graduating from Lafayette College in 1884, he determined upon a military career, and graduated from the military academy in 1888. The same year he entered the army as a lieutenant of artillery. Later he graduated from the Fort Monroe Artillery School. When the Spanish War broke out he volunteered, and commanded the Astor Battery in 1898; the following year he was major of the 33d Volunteer Infantry. He served in Luzon, in the Philippine campaign, and received several promotions for gallantry. He obtained the surrender of General Venancio, Aguinaldo's chief of staff. For a time after the close of active hostilities he was a military and later a civil governor in Ilocus. In 1911 he was commissary-general in the Philippines; in 1916 he was a lieutenant-colonel of field artillery; the next year he was made a brigadier-general, and 5 Aug. 1917 he was raised to the rank of major-general. In 1918 he became Chief of Staff of the U. S. Army and in 1921 was retired.

MARCH, märh, Czechoslovakia, the principal river of Moravia, rising on the Silesian boundary, and flowing 214 miles southward to the Danube, which it joins six miles above Presburg. It is navigable for small boats from Göding, 50 miles from its mouth. In its lower course it forms the boundary between Austria and Hungary. Its chief affluent is the Thaya.

MARCH, in Europe, a frontier or boundary of a territory; especially applied to the boundaries or confines of political divisions; as, for example, the frontiers between England and Scotland, and England and Wales. Geneva is situated in the Marches of France, Savoy and Switzerland. See MARCHES, THE.

MARCH (Latin *Martius*), (1) the third month of the year, originally the first of the Roman year; so named in honor of the Roman deity Mars. Prior to 1752 the 25th of March was the first day of the legal year; hence, in all records, January, February and the first 24 days of March have frequently two years appended, as January 1, 170½ or 1701–2. (See CALENDAR). Until late in the 19th century, the custom of leasing dwellings from the 25th of March persisted in some localities. (2) A movement by regular steps in the manner of soldiers; also a journey performed by a body of soldiers either on foot or on horseback. Soldiers on a march are subject to certain rules very necessary to keep them in good order, and fit to meet the enemy. The march in the first sense of regular step differs on different occasions. In the parade-march from 75 to 95 steps, each of about 30 inches, differing in different armies, are made in a minute; in the quick-march from 108 to 115 steps; and in the double quick 150 running paces. This last cannot be sustained for any length of time, and is only used in a charge, or in storming a commanding position, and in a few internal movements of regiments. (3) A musical composition, chiefly for military bands, with wind instruments, primarily intended to accompany the marching of troops. There are slow and quick marches, and marches peculiar to different countries. Marches are also introduced into oratorios, the best-known examples being the 'Dead March' from the oratorio of 'Saul' and Mendelssohn's 'Wedding March.' See MUSIC.

MARCH FLIES, small, hairy, scavenging flies of the family *Bibionidæ,* seen numerously in early spring, often before the snow has disappeared. The species are over 300, and some appear in vast swarms. The maggots hatch in refuse or manure upon the ground, and are believed to feed upon grass-roots.

MARCH TO THE SEA. There were two plans for a march to the sea by Sherman's army, the first General Grant's, the second General Sherman's, modifying the first. A campaign to the sea to divide the Confederacy was decided upon by General Grant in January 1864, when he was in command of the Military Division of the Mississippi, with headquarters at Nashville. His objectives on the coast were first Mobile, second, Savannah, Atlanta being the intermediate objective for both. Sherman's army was then in the vicinity of Chattanooga, Tenn., and Ringgold, Ga.

In a letter to General Halleck, dated at Nashville, 15 Jan. 1864, General Grant wrote: "I look upon the next line for me to secure, to be that from Chattanooga to Mobile, Montgomery and Atlanta being the important intermediate points." This he repeated on 19 January to General Thomas, then in command of the Army of the Cumberland at Chattanooga, and this officer immediately began to gather information, which General Grant desired, of the number of troops necessary to guard the roads and bridges from Nashville to Atlanta. These preparations were entrusted to General Thomas, as General Sherman was engaged with his Meridian campaign. In this connection, General Thomas expressed his confidence in being able with the Fourteenth and Fourth corps in advance, covered with a strong division of cavalry, and the Eleventh corps in reserve, to overcome all opposition as far as Atlanta.

When Grant was made lieutenant-general and ordered east to command all the armies, he called Sherman to Nashville, and they traveled together as far as Cincinnati. General Sherman was then made acquainted with the plans already set forth. As part of these plans, before leaving Nashville General Grant ordered Banks to concentrate at least 25,000 men to move against Mobile in the spring in co-operation with General Sherman.

In addition to letters to each of the commanders interested — Halleck, Sherman, Thomas and Banks — General Grant, 26 March 1864, sent all army commanders a map upon

which was indicated by red lines the territory occupied by the Union forces at the beginning of the war, and at the opening of the campaign of 1864. The territory which it was proposed to occupy by the campaigns about to begin was indicated by the blue lines. This map reached General Sherman 4 April, and its receipt was acknowledged by him. This map is reproduced in the Atlas of the 'Official Records' of the war, being plate 135 A of that publication. For Sherman's proposed campaign the blue lines extend from Chattanooga to Atlanta, and from this latter point both to Mobile and Savannah.

General Sherman, in acknowledging the map, said: "That map to me contains more information and ideas than a volume of printed matter. Keep your retained copies with infinite care, and if you have occasion to send out to other commanders any more I would advise a special courier. From that map I see *all*, and glad am I that there are minds now at Washington able to devise; and for my part, if we can keep our counsels, I believe I have the men and ability to march square up to the position assigned me, and to hold it."

As the result of the campaign for Atlanta General Slocum occupied that city 2 September. Meantime Farragut had taken possession of Mobile Bay 5 August. On 10 September Grant telegraphed Sherman from City Point as follows: "As soon as your men are properly rested, and preparations can be made, it is desirable that another campaign should be commenced. We want to keep the enemy continually pressed to the end of the war. If we give him no peace while the war lasts, the end can not be far distant. Now that we have all of Mobile Bay that is valuable, I do not know, but it will be the best move for Major-General Canby's troops to act upon Savannah, while you move on Augusta. I should like to hear from you, however, on this matter."

To this Sherman telegraphed in reply: "If you can manage to take the Savannah River as high as Augusta, or the Chattahoochee as far up as Columbus, I can sweep the whole State of Georgia, otherwise I would risk our whole army by going too far from Atlanta."

In a letter from Atlanta, dated 20 September, Sherman gave Grant the conditions under which he could successfully co-operate in a movement on Savannah: "If you will secure Wilmington and the city of Savannah from your centre, and let General Canby have command over the Mississippi River and the country west of it, I will send a force to the Alabama and Appalachicola, provided you give me 100,000 of the drafted men to fill up my old regiments; and if you will fix a day to be in Savannah I will insure our possession of Macon and a point on the river below Augusta."

General Grant thereupon conferred by letter with General Halleck in regard to establishing a base on the coast for General Sherman and providing supplies, giving his own opinion that Savannah could be captured by troops from the East assisted by those in the Department of the South, and that the line of Augusta and Savannah would be a better one than Montgomery, Selma and Mobile. Grant further said in this letter 4 October: "Whichever way Sherman moves he will undoubtedly encounter Hood's army, and in crossing to the sea-coast will sever the connection between Lee's army and his section of the country."

General Sherman fixes the day after his letter of 20 September as the date when his plan of a march to the sea came first into his mind. It differed from Grant's plan based upon first disposing of Hood's army, in that it involved leaving Hood in his rear, to be taken care of by Thomas, and marching through to Savannah with no enemy in his front. Upon this plan a discussion arose with Grant, who for some time held to the necessity of first dealing with Hood. This discussion between Grant and Sherman lasted for several weeks. While it was in progress Hood became active. On 20 September Forrest's cavalry began vigorous operations about Athens and Decatur, Ala., and Pulaski, Tenn. Sherman at once sent troops to Chattanooga and 28 September General Thomas was ordered to proceed to Nashville to organize a force to meet a possible northward move of Hood. The first attempt of the latter was to break Sherman's communications by heavy movements upon his railroad. These met with only temporary success, as Sherman promptly pursued. The fighting at Allatoona 5 October was the most prominent affair. Hood then moved to the westward, and occupied Gadsden, Ala. Sherman again followed as far as Gaylesville. Sherman, 10 October, again proposed to Grant to leave Hood and march to the sea. Grant replied the same day. "If you are satisfied the trip to the sea-coast can be made, holding the line of the Tennessee firmly, you may make it, destroying all the railroads south of Dalton or Chattanooga as you think best." This condition of firmly holding the line of the Tennessee held Sherman for a time. Although this conditional permission had been given by Grant, he telegraphed Sherman 1 November: "Do you not think it advisable, now that Hood has gone so far north, to entirely settle with him before starting on your proposed campaign? With Hood's army destroyed you can go where you please with impunity." Sherman learned, 26 October, that Hood's army had appeared about Decatur. This clearly indicated an invasion of Tennessee. General Sherman then decided to strengthen General Thomas, leave him to take care of Hood, withdraw his own army to Atlanta and prepare for a march to the sea provided General Grant's consent could finally be obtained. He sent the Fourth and the Twenty-third corps back to Thomas. Thus the discussion with Grant over the question of first destroying Hood continued until 1 November, when, in response to a later telegram on that day from Sherman, which represented that Hood's whole force was only from 37,000 to 40,000, while Thomas would have from 63,000 to 70,000, and that he himself had retained only 50,000 men for his proposed campaign to the coast, General Grant telegraphed, "With the force, however, that you have left with General Thomas, he must be able to take care of Hood and destroy him. I really do not see that you can withdraw from where you are, without giving up all that we have gained in territory. I say then go on as you propose."

Having obtained this permission Sherman pushed his preparations with the greatest energy. The entire population of Atlanta had

already been deported; the various divisions of the army designed for the march were ordered to concentrate at Atlanta; all mills and factories at Rome were burned; the surplus stores, the sick, convalescent, and many thousands whose terms of service were about to expire were rushed to Chattanooga; the garrisons south of that place were withdrawn, and the railroad destroyed. Every command was carefully inspected, and soldiers found in any degree physically unsound were dispatched to Nashville. Care was taken that every man's accoutrements were complete. In the same way the horses, mules and trains were inspected. Wilson's cavalry was dismounted to make Kilpatrick's division perfect, and the remnants sent with Wilson to Nashville.

The march to the sea began on the morning of 15 November. As General Sherman wrote: "It surely was a strange event — two armies marching in opposite directions, each in the full belief that it was achieving a final and conclusive result in a great war;—" Hood's army, which had required the active work of three armies from May until September to push it back to Atlanta, had crossed the Tennessee at Decatur, strengthened by Forrest's cavalry and aiming for Nashville and the Ohio River. The situation at Nashville was thus described by Sherman: "General Thomas was at Nashville, with Wilson's dismounted cavalry and a mass of new troops and quartermaster's employees amply sufficient to defend the place. The Fourth and Twenty-third corps, under Generals Stanley and Schofield, were posted at Pulaski, Tennessee, and the cavalry of Hatch, Croxton and Capron, were about Florence, watching Hood. Smith's (A.J.) two divisions of the Sixteenth corps were still in Missouri, but were reported as ready to embark at Lexington for the Cumberland River and Nashville. Of course, General Thomas saw that on him would likely fall the real blow, and was naturally anxious."

Sherman started with 62,204 officers and men. Of his army he wrote: "The most extraordinary efforts had been made to purge this army of non-combatants and of sick men, for we knew well that there was to be no place of safety save with the army itself; our wagons were loaded with ammunition, provisions and forage, and we could ill afford to haul even sick men in the ambulances, so that all on this exhibit may be assumed to have been able-bodied, experienced soldiers, well armed, well equipped and provided, as far as human foresight could, with all the essentials of life, strength and vigorous action."

The artillery, wagon and ambulance trains were perfect. Each gun, caisson and forge was drawn by eight horses. There were 2,500 wagons with six mules to each, and the ambulances each had two horses. Each soldier carried 40 rounds, and in the ammunition wagons were 200 rounds for men and artillery.

The right wing, Gen. O. O. Howard, was composed of the Fifteenth and Seventeenth corps; the left wing, Gen. H. W. Slocum, of the Fourteenth and the Twentieth.

The war had not produced a more thoroughly organized and equipped army, or one in which more men had passed a thorough physical inspection. As it started for the sea, General Sherman in his 'Memoirs' thus describes the feelings of the men, and his own: "There was a devil-may-care feeling pervading officers and men, that made me feel the full load of responsibility, for success would be accepted as a matter of course, whereas, should we fail, this 'march' would be adjudged the wild adventure of a crazy fool." This question was to be decided at Nashville, as General Sherman wrote the day after he entered Savannah: "Thomas' complete success is necessary to vindicate my plans for this campaign—" The march to the sea cannot, therefore, be fully understood without considering the Nashville campaign as one of its essential parts. See NASHVILLE, CAMPAIGN AND BATTLE OF.

Sherman's army was composed of 55,329 infantry, 5,063 cavalry, and 1,812 artillery. There were two corps, 13 infantry divisions, one cavalry division, 36 brigades of infantry, two of cavalry and 16 batteries. There was no Confederate army between Atlanta and Savannah. Wheeler's cavalry was active on the flanks guarded by Kilpatrick's cavalry, and a considerable force of militia was encountered at Griswoldville.

The order for this historic march clearly presents its organization, its order of daily movement, its methods of living upon the country, the restrictions placed on its dealings with citizens, in short, the whole military machinery of the campaign. It, therefore, deserves a place in every history of the March to the Sea, General Sherman himself holding that no account of that event could be perfect without it It was as follows:

(Special Field Orders, No. 120).

Headquarters Military Division of the Mississippi. In the Field, Kingston, Georgia, November 9, 1864.

1. For the purpose of military operations, this army is divided into two wings, viz.:

The right wing, Major-General O. O. Howard commanding, composed of the Fifteenth and Seventeenth corps; the left wing, Major-General H. W. Slocum commanding, composed of the Fourteenth and Twentieth corps.

2. The habitual order of march will be, wherever practicable, by four roads, as nearly parallel as possible, and converging at points hereafter to be indicated in orders. The cavalry, Brigadier-General Kilpatrick commanding, will receive special orders from the commander-in-chief.

3. There will be no general train of supplies, but each corps will have its ammunition-train and provision-train, distributed habitually as follows: Behind each regiment should follow one wagon and one ambulance; behind each brigade should follow a due proportion of ammunition-wagons, provision-wagons, and ambulances. In case of danger, each corps commander should change this order of march, by having his advance and rear brigades unencumbered by wheels. The separate columns will start habitually at 7 A. M., and make about fifteen miles per day, unless otherwise fixed in orders.

4. The army will forage liberally on the country during the march. To this end, each brigade commander will organize a good and sufficient foraging party, under the command of one or more discreet officers, who will gather, near the route traveled, corn or forage of any kind, meat of any kind, vegetables, corn-meal, or whatever is needed by the command, aiming at all times to keep in the wagons at least ten days' provisions for his command, and three days' forage. Soldiers must not enter the dwellings of the inhabitants, or commit any trespass; but, during a halt or camp, they may be permitted to gather turnips, potatoes, and other vegetables, and to drive in stock in sight of their camp. To regular foraging-parties must be entrusted the gathering of provisions and forage, at any distance from the road traveled.

5. To corps commanders alone is entrusted the power to destroy mills, houses, cotton-gins, etc.; and for them this general principle is laid down: In districts and neighborhoods where the army is unmolested, no destruction of such property should be permitted; but should guerillas or bushwhackers molest our march, or should the inhabitants burn bridges, obstruct roads, or otherwise manifest local hostility, then army commanders should order and enforce a devastation more or less relentless, according to the measure of such hostility.

6. As for horses, mules, wagons, etc., belonging to the inhabitants, the cavalry and artillery may appropriate freely and without limit; discriminating, however, between the rich, who are usually hostile, and the poor and industrious, usually neutral or friendly. Foraging parties may also take mules or horses, to replace the jaded animals of their trains, or to serve as pack-mules for the regiments or brigades. In all foraging of whatever kind, the parties engaged will refrain from abusive or threatening language, and may, where the officer in command thinks proper, give written certificates of the facts, but no receipts; and they will endeavor to leave with each family a reasonable portion for their maintenance.

7. Negroes who are able-bodied and can be of service to the several columns may be taken along; but each army commander will bear in mind that the question of supplies is a very important one, and that his first duty is to see to those who bear arms.

8. The organization, at once, of a good pioneer battalion for each army corps, composed if possible of negroes, should be attended to. This battalion should follow the advance-guard, repair roads and double them if possible, so that the columns will not be delayed after reaching bad places. Also, army commanders should practise the habit of giving the artillery and wagons the road, marching their troops on one side, and instruct their troops to assist wagons at steep hills or bad crossings of streams.

9. Captain O. M. Poe, chief-engineer, will assign to each wing of the army a pontoon-train, fully equipped and organized; and the commanders thereof will see to their being properly protected at all times.

By order of Major-General W. T. Sherman,
L. M. Dayton, Aide-de-Camp.

Leaving Atlanta in ruins, 15 November, the left wing, which General Sherman accompanied, marched by Decatur, Stone Mountain and Covington. At this point it turned toward Milledgeville, the capital of Georgia, which was the first objective. It was reached on the 22d. Meantime the right wing had marched by Jonesboro, McDonough and Monticello, and was in communication with Sherman at Gordon. Kilpatrick's cavalry, which was operating on the right of the advance, kept in contact with Wheeler's cavalry, and reached the defenses of Macon, thence retiring to Griswoldville, where Walcutt's brigade of Wood's division was halted as a rear-guard. Gen. G. W. Smith attacked Walcutt, but was repulsed (see GRISWOLDVILLE, BATTLE OF). Governor Brown, the State officers and members of the legislature left the capital on Sherman's approach. The arsenal and various public buildings were destroyed.

The march was resumed 24 November, with Millen as the next objective. The two wings followed the general line of the railroad. Millen was reached 3 December. From Millen the army proceeded by the four main roads for Savannah. The effort of the Confederate authorities to organize a force at Augusta to attack Sherman in flank failed, and the march to Savannah was only slightly disturbed by the persistent skirmishing of Wheeler's cavalry. McLaw's division of Hardee's force had advanced to Ogeechee Church, but fell back to the city upon Sherman's approach. The several corps reached the defenses of Savannah 9 and 10 December, and occupied a line from the Ogeechee River on the right to the Savannah River on the left. Hardee occupied the city with something less than 10,000 men. Sherman's effective force numbered a little over 60,000. Hood held the Savannah River below Sherman's lines.

The march had cut a swath of many miles in width through the richest part of Georgia. The heads of the columns and the flanks swarmed with foraging parties, and a country which was daily scoured to supply food for a marching column of 60,000 soldiers was of necessity stripped of provisions, and of everything else that could contribute to the use or comfort of an army. Railroads had been destroyed for long distances, and all factories and other buildings burned which could contribute to army purposes. There had been no fighting worth mentioning, Griswoldville excepted, and that had only involved one Union brigade.

General Sherman had left Atlanta with 62,204 officers and men of all arms. He reached Savannah with 60,057. On the march 103 were killed, 428 wounded, 278 missing and 1,338 captured. Of those captured, a large proportion were foragers, better known in army vernacular as "bummers."

The night of 12 December a bridge had been completed over the Ogeechee, and the next morning Hazen's division crossed and marched at once to assault Fort McAllister (q.v.) and open the way to the sea. An hour before sunset the assault was delivered and the fort taken.

This success gave Sherman communication with the fleet which was awaiting him with supplies, and mails for the army.

General Slocum, upon establishing his flank on the Savannah River, had captured two steamboats and sent a force to Hutchinson and Argyle islands just above the city, and sought permission to transfer a corps to the left bank of the river to close Hardee's only line of escape, General Slocum having already sent a brigade under Col. E. A. Carman to the South Carolina shore. General Sherman did not deem this prudent, and as a result Hardee later withdrew his entire force intact and without molestation.

On 17 December General Sherman sent in a flag of truce demanding Hardee's surrender on the ground that he (Sherman) had received guns that could "cast heavy and destructive shot as far as the heart of the city"; that he controlled all avenues by which the city could be supplied with food; that he would grant liberal terms, but if forced to assault he should "feel justified in resorting to the harshest measures," and should make little effort to restrain his army.

General Hardee returned a defiant reply, saying he was not shut in, but had free and constant communication with his department. To the specific call for surrender he replied: "Your demand for the surrender of Savannah and its dependent forts is refused."

General Sherman then proceeded by boat to General Foster's headquarters at Hilton Head to request that a division be sent to occupy the road north of the Savannah River, which line of communication was still open to Hardee. On his return he received the news that during his absence Hardee had put down his bridges and withdrawn with his entire force. The next day General Sherman's forces occupied Savannah.

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H. V. BOYNTON.

MARCHAND, mär-shäñ, **Félix Gabriel,** Canadian legislator and author: b. Saint John's, province of Quebec, 9 Jan. 1832; d. 1900. He was educated at Saint Hyacinth College, was admitted a notary public in 1855, entered practice at Saint John's, and from 1867 sat for the county of Saint John's in the legislative assembly of the province of Quebec. From 8 March 1878 to 19 March 1879 he was provincial secretary, from 19 March to 30 Oct. 1879 was commissioner of Crown lands, and from 29 Jan. 1887 to 1892 speaker of the assembly. In 1897 he became Premier, with the Treasury portfolio. Subsequent to the invasion at Eccles Hill during the Fenian troubles (1870), he commanded a militia brigade. He did much to improve Canadian journalism, and for many years was proprietor and editor of *Le Franco-Canadien.* He published a 'Manuel et Formulaire du Notariat'; and also the comedies 'Fatenville' and 'Erreur n'est pas Compte' in prose, and 'Un Bonheur en Attire un Autre' and 'Les Faux Brillants' in verse.

MARCHAND, Jean Baptiste, French officer: b. Thoissey, Ain, 1863; d. 14 Jan. 1934. He entered the army in 1883 and after gaining a commission three years later won fame as an explorer, particularly in Africa. He sought an improved route from the valley of the Niger to the Gulf of Guinea. He became one of the most notable figures in the French public life because of his clash with Lord Kitchener in 1898. Marchand had established the post of Fashoda on the White Nile and had resisted several attacks of the dervishes, when General Kitchener appeared at the head of a British force and requested Marchand to withdraw. The latter refused and soon after departed for France to make his report but the French government receded from its position and the threatened clash between England and France was averted. Marchand was present at the relief of Peking in 1902 and resigned his commission in 1904, when his government refused him permission to enter the Russian army in the war with Japan. He was made Commander of the Legion of Honor, was again in the French army with rank of general in the Great War, was severely wounded in 1915 and was retired in 1919. Consult Murphy, 'Le commandant Marchand et ses compagnons d'armes à travers l'Afrique' (Paris 1900).

MARCHANT, mär'chănt, **James,** English reformer: b. 18 Dec. 1867. He was educated in private and public schools and for some years was engaged as social writer and worker in East London and the provinces. In 1889–94 he was evidential lecturer to the bishop of Saint Albans; in 1895–97 preacher-in-charge of the Trinity Presbyterian Church, London; and in 1900–02 was civil minister of Saint Andrew's Church, Chatham. From 1903 to 1906 Mr. Marchant was secretary of Dr. Barnardo's Homes and Memorial. In 1905 he traveled on the Continent with Dr. Barnardo's successor investigating conditions of child-life and rescue work. In November 1911 he was dedicated to the work of the National Council of Public Morals in the private chapel of the dean of Westminster Abbey by the bishop of Durham and Rev. F. B. Meyer. His writings include 'Life of Dr. Paton' (1909); joint-author of 'The Memoirs of Dr. Bernardo' (1907); 'Letters and Reminiscences of Dr. A. Russel Wallace' (1916); 'History of the House of Cassell' (1917); 'The Master Problem' (1917); 'Coffins or Cradles' (1916); 'Birth-Rate and Empire' (1917); 'The Person of Christ'; 'Theories of the Resurrection' (1899); 'Anthology of Jesus' (1926); 'Deeds Done for Christ' (1928). He has also edited numerous publications.

MARCHES, The, Italy, a territory now included in the kingdom, but formerly constituting one of the legations of the Papal States. It comprises the region lying between the Apennines and the Adriatic, and is divided into the modern four provinces — Urbino and Pesaro, Ancona, Macerata and Ascoli Piceno. See ITALY.

MARCHESI, mär-kā'sē, **Mathilde,** German singer: b. Frankfort-on-Main, 26 March 1826; d. 17 Nov. 1913. Her maiden name was Graumann; she studied under Nicolai in Vienna, and in Paris under Garcia, whose assistant she became. A splendid mezzo-soprano she toured Europe for several years, married, in 1852, the Marchese della Rajata Castrone, a political Italian refugee of 1848, also a singer, who had adopted the *nom de théâtre* of Salvatore Marchesi, and in 1854 became professor at the Vienna Conservatory. She removed to Paris in 1861, where she published her «École de Chant.» In 1865 she accepted a professorship in Cologne, but resigned in 1868 and returned to Vienna, staying at the Conservatoire 10 years. She settled in Paris again in 1881, and prepared many of the greatest singers of the younger generation, including Melba. Her later years were spent in London, where she conducted a singing academy with her daughter. She was a teacher of rare merit, and author of a method of singing, of two volumes of personal recollections in German (1877; 1888), and of 'Marchesi and Music' (1897). She received decorations and medals from the rulers of Italy, Great Britain, Germany and Austria.

MARCHIALI, mär-kē-ä'lē, or **MARCHIALY.** See IRON MASK, MAN WITH THE.

MARCHING THROUGH GEORGIA, a popular ballad sung during the American Civil War, and commemorating Sherman's March to the Sea. It was written by H. C. Work (q.v.) 16 Nov. 1864.

MARCIL, mär'sēl', **Charles,** Canadian statesman and journalist: b. Sainte Scholastique, Quebec, 1 July 1860. He was educated in the common schools and at Ottawa University. In 1879 he became a member of the staff of the Montreal *Gazette,* and subsequently was successively member of the staffs of the *Herald,* the *Post, La Patrie,* and the *Star,* all of Montreal. In 1897 Mr. Marcil was an unsuccessful candidate for the Quebec legislative assembly for Gaspé County. In 1900 he was elected to the Dominion Parliament as Liberal member for Bonaventure; in 1905 he became deputy speaker and in 1909–11 was speaker of the House of Commons. Mr. Marcil became a member of the Privy Council for Canada in 1911. D. 30 Jan. 1937.

MARCION, mär'shi-ŏn, founder of a Gnostic sect, called Marcionites: b. Sinope about the beginning of the 2d century, A.D.; d. about 160. He became a wealthy shipowner, was very liberal, and went to Rome about 140 where he

gave generously to the Church but his views were so unusual that he was not warmly received. He attached himself while there to the Gnostic teacher Cerdo of Antioch, and founded a system antagonistic in many respects to Christianity. Its principal feature was the irreconcilable opposition which it supposed to exist between the Creator and the Christian God, and between the religious systems, the law and the gospel, which it believed they respectively founded The sect held the existence of three original principles — the supreme and invisible, whom Marcion called the Good; the visible God, the Creator; and the devil, or perhaps matter, the source of evil. Marcion could not perceive in nature, or in the Old Testament, the same love which was in the gospel of Christ. He accordingly made the Creator, the God of the Old Testament, the author of suffering. Jesus was not the Messiah promised by this being, but the son of the unseen God, who took the form but not the substance of man. Marcion denied the resurrection of the body; he condemned marriage, thinking it wrong to increase a race born in subjection to the harsh rule of the Creator. He rejected the whole of the Old Testament, and of the New all except a few epistles and a mutilation of the Gospel of Luke. He led quite a following, which is traced for 500 years, and then disappeared. Consult Tertullian, 'Contra Marcionem'; Harnack, 'History of Dogma.'

MARCO BOZZARIS. See Bozzaris, Marcos.

MARCO POLO. See Polo, Marco.

MARCOMANNI, märk-kō-măn'nī ("men of the marches," "borderers"), ancient German tribe, belonging to the federation of the Suevi. About 10 B.C., under their King Marbod or Maroboduus, they retired from their territory between the Elbe and the Oder before the advance of the Romans, settled in Bohemia, and there built up a powerful state, with which Tiberius made a treaty 6 A.D. Thirteen years later Maroboduus was defeated by Hermann, or Arminius, leader of the Cherusci, who also drove from power Catualda, Marbod's successor. About the middle of the 2d century the Marcomanni, with other Teutonic tribes, attempted to make inroads into Pannonia; they were defeated by Marcus Aurelius in 178; Commodus made peace with them in 180; they furnished Roman troops and were heavily subsidized till the time of Aurelian, when in 270 they were again rebellious and again driven across the Danube. In the 4th century the Marcomanni drop out of history.

MARCONI, Guglielmo, Italian inventor and electrical engineer: b. Marzabotto, Bologna, Italy, 25 April 1874; d. Rome, 20 July 1937. He was educated at Leghorn, under Prof. Rosa, and at Bologna University, and so early as 1890 undertook experiments in demonstration of his theory that the electric current readily passes through any substance, and when started in a given direction follows a direct course without the assistance of any sort of conductor. After various experiments in Italy, he finally invented an apparatus for wireless telegraphy, which was successfully tested in both Italy and England by Sir William Henry Preece, engineer and electrician-in-chief of the English postal-telegraph service. Marconi was the first to perfect the appliances used in space telegraphy or radiography, and the first to patent the application of the electric waves discovered by Heinrich Hertz to the purposes of actual telegraphy as distinguished from mere signaling. This remains true in spite of all the discussion respecting the originality of Marconi's work. It was he who combined the important elements of the wireless telegraph that had previously been invented, and to him the scientific triumph of so-called "wireless" telegraphy is due. He came to the United States in 1899, there continued his experiments, and in 1900 employed his method in reporting the presidential election of that year. He had sent (27 March 1899) messages across the English Channel from the vicinity of Boulogne, France, to the South Foreland, England, 32 miles distant. In December 1901 he began his first experiments in transatlantic telegraphy without wires at Signal Hill, at the entrance to the harbor of Saint John's, N. F. He succeeded with these because of an exceedingly sensitive magnetic detector, that was affected by the very faint etheric vibrations. When his success became apparent through his receiving and plainly distinguishing signals from the Poldhu Station, England, the Anglo-American Cable Company, which holds a monopoly from Newfoundland, compelled him to withdraw, and he selected another station at Table Head, on the east of Glace Bay, Cape Breton Island. On 25–26 Feb. 1902, Marconi, on his way to the United States on board the steamship *Philadelphia,* received signals at a distance of 2,099 miles and worded messages at a distance of 1,551.5 miles. On 21 Dec. 1902 the first official transatlantic telegrams were sent from Table Head. Marconi later (18 Jan. 1903) sent from the South Wellfleet station, Cape Cod, Mass., direct to Poldhu (3,000 miles), a message from President Roosevelt to King Edward. In 1910 the Argentina station received messages of 5,600 miles transit, and since then South American stations have sent and received abou 7,000 miles. The Italian government early introduced the Marconi system on its warships. and granted an annual subsidy of $200,000. The English government also paid a royalty for the use of the system on its ships. On 18 Oct. 1907 the Marconi system between Nova Scotia and Ireland was formally opened for commercial service.

He continued his experiments and inventions, continually improving radiography and the methods employed. In 1906 his new persistent wave system was introduced, and devices developed for giving desired forms to the wave energy sent out. In 1910 his detector was radically improved, and he also brought into use a new receiver. A little later he developed a duplex by which messages could be sent and received at the same time by the same apparatus, without conflict, as is done in regular wire telegraphy. Mr. Marconi received numerous honors, in Italy, England, America and also in Continental Europe. He divided the Nobel prize for physics with Ferdinand Braun in 1909. He was decorated in Britain, Russia and Spain, and received the Grand Cross of the Crown of Italy. The great universities of the world showered degrees on him; Edison accepted official position in one of his companies; he was nominated a senator in the kingdom of Italy, and given the

freedom of war. During the First World War he had charge of Italy's wireless services, at this period developing short-wave transmission as a means of secret communication. After the war he fitted his yacht for experimental purposes, using it as a floating laboratory. The last years of his life were devoted to experiments with short waves and with microwaves, which he believed held the secret of television.

MARCOU, mär-koo', **Jules,** American geologist: b. Salins, France, April 20, 1824; d. Cambridge, Mass., April 17, 1898. In 1848, having been appointed traveling geologist to the Jardin des Plantes, Paris, he went to the United States. He explored the Lake Superior country together with Louis Agassiz (q.v.), and made wide and important geological studies in Virginia, Pennsylvania and New Jersey. After several trips back to Europe, he settled in Cambridge, where he assisted Agassiz in the Museum of Comparative Zoology. From 1853 to 1855 he was in the employ of the United States government, and from 1875 till shortly before his death he was again in the service. Marcou made a section map of the 35th parallel from the Mississippi to the Pacific, and published *Geological Map of the United States and British Provinces of North America* (1853); *A Catalogue of Geological Maps of America* (1884); *Geology of North America* (1858); *Life, Letters and Works of Louis Agassiz* (1896).

MARCOUX, Joseph, Canadian missionary: b. Canada, about 1770; d. 1855. Soon after his ordination as a Roman Catholic priest, his ecclesiastical superiors dispatched him as missionary to the Iroquois. In 1819 he settled among these Indians at Caughnawaga, on the Saint Lawrence, near Montreal. The school and church at Caughnawaga were monuments to the zeal of this modern apostle. Father Marcoux acquired a perfect mastery of the Iroquois tongue, of which he published a grammar and dictionary. Other works by him in Iroquois were *Life of Christ; Letters to Iroquois Chiefs* (1848–49); *Prayer Book* (1852); *Catechism* (1854).

MARCUS, an island in the Pacific Ocean, north of the Tropic of Cancer, 700 miles northwest of Wake Island and about the same distance due east of the Volcano (Kazan) Islands. The Japanese took possession of it in 1899; subsequently they fortified the island, which had a garrison estimated to number 5,000 men when Japan entered the Second World War. A heavy raid on Marcus by United States naval vessels and carrier-based planes on Sept. 1, 1943, was the first of a series that continued through 1944, when it was attacked seven times from September to the end of the year. American assaults on the island were resumed in January 1945, and continued almost every month.

MARCUS AURELIUS ANTONINUS, mär'kŭs â-rē'lĭ-ŭs, often called simply MARCUS AURELIUS, Roman emperor: b. Rome April 29, 121 A.D.; d. Vindobona—the modern Vienna—March 17, 180 A.D. He was descended from an illustrious line which tradition declared extended to the good Numa, the second king of Rome. In the descendant Marcus were certainly to be found, with a great increment of many centuries of noble life, all the virtues of his illustrious ancestor. Doubtless the cruel persecutions of the infamous emperors who preceded Hadrian account for the fact that the ancestors of Aurelius left the imperial city and found safety in Hispania Baetica, where, in a town called Succubo —not far from the present city of Cordova—the emperor's great-grandfather, Annius Verus, was born. From Spain also came the family of the Emperor Hadrian, who was an intimate friend of Annius Verus. The death of the father of Marcus Aurelius when the lad was of tender years led to his adoption by his grandfather and subsequently by Antoninus Pius. By Antoninus he was subsequently named as joint heir to the imperial dignity with Commodus, the son of Aelius Caesar, who had previously been adopted by Hadrian. Among the many statues of Marcus extant is one representing him at the tender age of eight years offering sacrifice. He was even then a priest of Mars. It was the hand of Marcus alone that threw the crown so carefully and skilfully that it invariably alighted upon the head of the statue of the god. The great Emperor Antoninus Pius lived in the most simple and unostentatious manner, yet even this did not satisfy the exacting, lofty spirit of Marcus. At 12 years of age he began to practice all the austerities of Stoicism and became a veritable ascetic. He ate most sparingly; slept little, and when he did so it was upon a bed of boards. Only the repeated entreaties of his mother induced him to spread a few skins upon his couch. His health was seriously affected for a time; and it was, perhaps, to this extreme privation that his subsequent feebleness was largely due. His tutors, like Nero's, were the most distinguished teachers of the age; but unlike Nero, the lad was in every way worthy of his instructors. His letters to his dearly beloved teacher, Fronto, are still extant, and in a very striking and charming way they illustrate the extreme simplicity of life in the imperial household in the villa of Antoninus Pius at Lorium by the sea. In 140 he was made consul, and he held other offices before becoming emperor. He married Faustina, daughter of Antoninus Pius, about 145.

When his predecessor and adoptive father, Antoninus, felt the approach of death in 161, he gave to the tribune who asked him for the watchword for the night, the reply "Equanimity," directed that the golden statue of "Fortune" that always stood in the emperor's chamber should be transferred to that of Marcus Aurelius, and then turned his face and passed away as peacefully as if he had fallen asleep. The watchword of the father became the lifeword of the son, who pronounced upon that father, in the *Meditations,* one of the noblest eulogies ever written. Among the good works rendered to the empire during the 20 years of his reign were these: the establishment, upon eternal foundation, of the noble fabric of the civil law—the prototype and basis of Justinian's task; the founding of schools for the education of poor children; the endowment of hospitals and homes for orphans of both sexes; the creation of trust companies to receive and distribute legacies and endowments; the just government of provinces; the complete reform of the system of collecting taxes; the abolition of the cruelty of the criminal laws and the mitigation of sentences unnecessarily severe; the regulation of gladiatorial exhibitions;

the diminution of the absolute power possessed by fathers over their children and of masters over their slaves; the admission of women to equal rights to succession to property from their children; the rigid suppression of spies and informers; and the adoption of the principle that merit, as distinguished from rank or political friendship, alone justified promotion in the public service. But the greatest reform was the reform in the imperial dignity itself, as examplified in the life and character of the emperor. It is this fact which gives to the 'Meditations' their distinctive value. The infinite charm, the tenderness and sweetness of their moral teachings, and their broad humanity, are chiefly noteworthy because the emperor himself practised in his daily life the principles of which he speaks, and because tenderness and sweetness, patience and pity, suffused his daily conduct and permeated his actions. The horrible cruelties of the reigns of Nero and Domitian seemed only awful dreams under the benignant rule of Marcus Aurelius. It is not surprising that the deification of a deceased emperor, usually regarded by Senate and people as a hollow mockery, became a veritable fact upon the death of Marcus Aurelius. He was not regarded in any sense as mortal. All men said he had but returned to his heavenly place among the immortal gods. As his body passed, in the pomp of an imperial funeral, to its last resting-place, the tomb of Hadrian,—the modern Castle of Saint Angelo at Rome,—thousands invoked the divine blessing of Antoninus. His memory was sacredly cherished. His portrait was preserved as an inspiration in innumerable homes. His statue was almost universally given an honored place among the household gods. And all this continued during successive generations of men. Marcus Aurelius has been censured for two acts: the first, the massacre of the Christians which took place during his reign; the second, the selection of his son, Commodus, as his successor. In extenuation of his persecution of the followers of Christianity, it has been alleged in his behalf that he was deceived by evil councillors, who misrepresented the conduct of the Christians to him. This excuse impinges upon his wisdom as a ruler and his admittedly wide knowledge of the conditions of the empire. It is further urged that when we take into consideration the environment of the emperor, no just cause for condemnation of his course remains. He imbibed a bitter prejudice against the new religion from his beloved friend and instructor, Fronto. In the writings of Epictetus, whom he greatly revered, he found severe condemnation of the Christians as fanatics. With such a profound natural bias, it is urged, it is no wonder that he was led to regard the new creed with aversion. But the reason of his course is to be found rather in his deep-rooted attachment to the heathen beliefs of his ancestors and of the empire. It was rather his fear that the ancient cult, bound up as it seemed in the character of Roman rule, was seriously menaced by the progress of Christianity, which actuated him to the severe and bloody measures he took to root out a dangerous rival. He regarded Christianity as a "pernicious sect," a "secret conspiracy" against the empire, an "immoral superstition," whose poison was eating into the social life, and himself as the conservator of the empire and its traditions. Therefore some extenuation might be conceded to such fierce zeal in persecuting the Christians in almost any other emperor than Marcus Aurelius. But there is a glaring inconsistency in his character in the adoption of so cruel and monstrous a course by one who appears otherwise so admirable. In this signal instance he is as bloody and heartless as a Domitian, a Nero or a Caligula; in all other things merciful, in this pitiless; in his general administration, just and humane; in this, singularly unjust and even vindictive. Whatsoever may be urged in his defense, this relentless persecution of the Christians is a dark blot on his fame. Whatever extenuating circumstances may seem to condone it, his policy in this instance was utterly inconsistent with his general character.

His first edict against the Christians was published in 177. Multitudes perished in the fierce persecutions which followed. Notable amongst the victims were Saint Polycarp in Smyrna and Saint Cecilia at Rome. The manner in which they were tortured before being relieved from sufferings by death was more befitting a savage chief than a civilized ruler.

Of the appointment of Commodus as his successor, it may be said that the paternal heart hoped against hope for filial excellence. Marcus Aurelius believed, as clearly appears from many passages in the 'Meditations,' that men did not do evil willingly, but through ignorance; and that when the exceeding beauty of goodness had been fully disclosed to them, the depravity of evil conduct would appear no less clearly. The emperor who, when the head of his rebellious general was brought to him, grieved because that general had not lived to be forgiven; the ruler who burned unread all treasonable correspondence, would not, nay, could not believe in the existence of such an inhuman monster as Commodus proved himself to be. The appointment of Commodus was a calamity of the most terrific character; but it testifies in trumpet tones to the nobility of the emperor's heart, the sincerity of his own belief in the triumph of right and justice. Compare Farrar, 'Seekers after God' (1868); Renan, 'Marc Aurèle' (1881); Pater, 'Marius the Epicurean'; Arnold, M., 'Essays in Criticism' (First Series, New York 1883); 'Marcus Aurelius Antoninus to Himself' (English tr. by G. H. Randall, London 1910); 'The Communings with Himself of Marcus Aurelius Antoninus, Emperor of Rome, together with his Speeches and Sayings' (tr. C. R. Haines, London 1916); 'The Thoughts of the Emperor Marcus Aurelius Antoninus' (tr. George Long, illustr. W. Russell Flint, London 1909). Consult also Robinson, Ellis, 'Correspondence of Fronto and Marcus Aurelius' (Oxford 1904).

MARCUS GRÆCUS, grē'kŭs, alchemist, who lived not later than the 11th century, since he is cited by an Arabian physician of that date. In the National Library at Paris are two manuscript copies of a small treatise, entitled 'Liber Ignium ad Comburendos Hostes, Auctore Marco Græco,' one of which appears to belong to the 14th and the other to the 15th century. The work contains an account of an explosive substance the ingredients of which are the same as those used in making gunpowder, though differently proportioned. It may have been that Schwartz, the reputed inventor of gunpowder,

did nothing more than experiment on the lines indicated by Marcus Graecus.

MARCUS HOOK, borough, Pennsylvania, in Delaware County, on the Delaware River 18 miles west-southwest of Philadelphia. There are oil refineries, and manufactures of rayon and linoleum. Pop. (1940) 4,123; (1950) 3,843.

MARCY, Randolph Barnes, American army officer: b. Greenwich, Mass., April 9, 1812; d. West Orange, N. J., Nov. 22, 1887. Throughout the American Civil War he served as chief of staff to his son-in-law, Gen. George Brinton McClellan (q.v.), being appointed brigadier general in 1861 and brevet major general in 1865. From 1878 to 1881 he was inspector general of the United States Army.

MARCY, William Learned, American statesman: b. Sturbridge (now Southbridge), Mass., Dec. 12, 1786; d. Ballston Spa, N. Y., July 4, 1857. He studied at Leicester Academy, in Massachusetts, and was graduated at Brown University in 1808. At Troy, N. Y., he studied law and was admitted to the bar. When the War of 1812 broke out he volunteered as a lieutenant, and on Oct. 22, 1812, led an attack resulting in the capture of a Canadian post at Saint Regis. He was soon promoted to be captain, and served almost to the end of the war. Returning to Troy, he engaged in newspaper work and in politics, opposing DeWitt Clinton and becoming prominent in the Albany Regency (q.v.). He had already held several offices when, in 1823, he was elected comptroller of the state. This position he filled six years, and in 1829 was appointed associate justice of the New York Supreme Court. The Democrats in 1831 elected him to the United States Senate, but the next year he was chosen governor of New York and resigned his senatorship. While in the Senate he was chairman of the Judiciary Committee; in a debate with Henry Clay he made a memorable defense of Martin Van Buren. It was during a speech in the Senate vindicating the course of President Van Buren in giving offices to his political supporters that Marcy uttered the words associated with the beginning of the spoils system (q.v.): "We can see nothing wrong in the rule that to the victors belong the spoils." Having served three terms as governor, he was once more nominated in 1838, but was defeated by William Henry Seward (q.v.). In the following year Marcy was appointed by President Van Buren a commissioner on Mexican claims, serving till 1842. In 1845 he became secretary of war under President Polk, and in that office bore arduous responsibilities created by the Mexican War. He also used his official influence in the settlement of the momentous Oregon boundary question. In 1848 he supported Lewis Cass as presidential candidate, and when President Taylor was inaugurated Marcy retired to private life. But during the administration of President Pierce he served from 1853 to 1857 as secretary of state, greatly distinguishing himself at home and abroad by his handling of grave matters—the Mexican boundary dispute, the reciprocity treaty with Canada, the British fishery question, and the Koszta affair (see INGRAHAM, DUNCAN NATHANIEL).

MARCY, Mount, highest peak in the Adirondack Mountains, New York, in Essex County about 28 miles west of Lake Champlain. The altitude is 5,344 feet.

MARDEN, Charles Carroll, university professor: b. Baltimore, Md., Dec. 21, 1867; d. Princeton, N. J., May 11, 1932. He received his bachelor's degree in 1889 and his doctorate in romance languages in 1894 from Johns Hopkins University. He was established in the first American professorship in Spanish at Johns Hopkins University in 1905 and, in 1916, was elected to the Emery L. Ford chair of Spanish at Princeton University where he served until his death. He was managing editor of *Modern Language Notes* from 1911 to 1915 and, after serving as a member on the executive council of the Modern Language Association from 1924 to 1926, he served as president of the association in 1932. He wrote *A First Spanish Grammar* in 1926 (collaborating with F. C. Tarr) and edited *Poema de Fernan Gonçalez* in 1904 and *Cuatro Poemas de Berces* in 1928.

MARDEN, Orison Swett, American editor and author: b. Thornton, N. H., about 1850; d. March 10, 1924. He was graduated at the Boston University in 1877; at the school of oratory there in 1879; at the law school of the same institution in 1881; and in 1882 at the Harvard Medical School. He was founder and editor of *Success* and later of the *New Success,* and was the author of many works, among which are *Pushing to the Front* (1894); *How to Succeed* (1896); *The Secret of Achievement* (1898); *Character the Grandest Thing in the World* (1899); *The Hour of Opportunity* (1900); *Stepping Stones* (1902); *Every Man a King* (1906); *The Optimistic Life* (1907); *Why Grow Old* (1909); *Getting On* (1910); *Self Investment* (1911); *The Joys of Living* (1913); *The Crime of Silence* (1915); *Everybody Ahead* (1917).

MARDI GRAS, mär'dē grä, Shrove Tuesday, the last day before Lent. (See CARNIVAL.) In the United States the day is observed in New Orleans and Memphis with processions, masquerade balls, and other gay entertainments.

MARDONIUS, mär-dō'nĭ-ŭs, Persian general: d. 479 B.C. He was the son of Gobryas and son-in-law of Darius Hystaspis. He commanded the first Persian armament sent against Greece, 492 B.C., when a storm at Mount Athos destroyed his fleet, and his army was beaten in Macedonia. He accompanied Xerxes in his invasion of Greece, of which he had been the chief promoter; and after the battle of Salamis, and the return of Xerxes to Asia, Mardonius was left in occupation at Athens, which he held for 10 months. According to Herodotus he was defeated by Pausanias, and probably was killed at the battle of Plataea.

MARE AU DIABLE, La. See DEVIL'S POOL, THE.

MARE CLAUSUM, mā'rē klô'sŭm, a Latin phrase meaning closed sea, or that portion of the sea under the jurisdiction of a particular nation or government, as distinguished from the high sea. For many years it was held that a nation had no authority over waters more than three miles from its shores. See also INTERNATIONAL LAW; SEAS, FREEDOM OF.

MARE ISLAND, Calif., at the mouth of the Napa River and the head of San Pablo Bay, in Solano County, opposite Vallejo. In 1853 Mare Island was established by the United States Government as a navy yard. See also NAVY YARD.

MAREE, Loch, mȧ-rē′lŏĸ, Scotland, a lake in Ross and Cromarty County, forming a long and comparatively narrow expanse, stretching southeast to northwest for 12½ miles with a breadth of from one half to two miles. Its depth in most places is 60 fathoms; it has never been known to freeze. The scenery along its shores is bold and picturesque, and its surface is studded with 32 wooded islands, on one of which are found the remains of an ancient chapel, with a graveyard. One is Saint Swithin's Isle, shaped like a doughnut, enclosing a lake 750 feet long. The loch discharges itself into Loch Ewe by a small river of the same name.

MAREES, mä-rā′, **Hans von,** German historical painter: b. Elberfeld, Dec. 24, 1837; d. Rome, Italy, June 5, 1887. He painted in Munich from 1856 until 1864, when he moved to Rome, thereafter most of his life being spent in Italy. His most notable work was the execution of the frescoes in the library of the Zoological Museum in Naples, the commission for which was given to him in 1873.

MAREMMA, mȧ-rĕm′ȧ, Italy, a low, swampy region in the southwestern part of Tuscany, chiefly in Grosseto Province. It extends from the mouth of the Cecina to Orbetello, having a length of 92 miles, breadth of 6 to 20 miles, and area of about 1,000 square miles. Formerly these regions were fruitful, healthful and populous; but after the 15th century the neglect of the watercourses of the district permitted the formation of marshes and they generated insects and fevers and presented an aspect of dreary desolation during the summer months, when the inhabitants fled from the pestilences. In winter, on the other hand, the Maremma were habitable and afforded a luxuriant pasturage for cattle, which grazed in summer on the Apennines. The district was gradually reclaimed and improved in the 20th century.

MARENGO, mȧ-rĕng′gō, city, Iowa, seat of Iowa County, located on the Iowa River 25 miles west-southwest of Cedar Rapids. It is served by the Chicago, Rock Island and Pacific Railroad. The city is the center of a fertile agricultural and stock raising region. Food processing is the principal industry. Marengo was settled in 1845 and incorporated in 1859. Government is by mayor and council. Pop. (1940) 2,260; (1950) 2,151.

MARENGO, village, Italy, located in southeast Piedmont 5 miles east of Alessandria. In the vicinity, on June 14, 1800, Napoleon scored one of his greatest victories, defeating the Austrians commanded by Baron Michael Friedrich Benedikt von Melas (1729–1806). The Austrians were at first successful, but with the arrival of French reinforcements a cavalry charge led by Gen. François Étienne de Kellermann (q.v.) turned what looked like certain defeat into a decisive victory. The French lost about 4,000 men, including Gen. Louis Charles Antoine Desaix de Veygoux (q.v.); the Austrians, 9,500. The main consequence of the victory at Marengo was the cession of northern Italy to France.

MAREOTIS, mȧr-ē-ō′tĭs, or **MARYUT,** mŭr-yōōt′, Egypt, a salt lake separated from the Mediterranean on the west by the long, narrow strip of land on which stands part of the city of Alexandria. The most westerly of the lakes in the Nile Delta, it is about 28 miles long by 20 broad. At one time it was deep enough for inland navigation, and had its shores covered with beautiful gardens and vineyards. During the siege of Alexandria in 1801 the British let the sea into it, and it now yields great quantities of salt by evaporation.

MARE'S TAIL, a genus (*Hippuris*) of plants with whorled narrow leaves and small inconspicuous flowers set in their axils. They are aquatic or marsh plants. *H. vulgaris* is common in Europe and in some parts of North America.

MARESÇOT, Mount, peak, highest point (3,900 feet) on Santa Isabel Island, east central Solomon Islands, in the Pacific Ocean.

MARET, mȧ-rĕ′, **Hugues Bernard,** DUC DE BASSANO, French statesman: b. Dijon, 1763; d. Paris, 1839. An ardent supporter of the French Revolution, he published the debates of the National Assembly in the *Bulletin de l'Assemblée,* later expanded into the *Moniteur Universel.* After the monarchy fell in 1792 he undertook a diplomatic mission to London, and the next year he was sent to Naples as ambassador of the French Republic. Seized by the Austrians, he was imprisoned at Brünn until 1796. During 1797 he conducted negotiations with Great Britain, and after Napoleon became first consul of France in 1799 Maret became the latter's confidential adviser. He was created a count in 1807 and duke of Bassano (q.v.) in 1809, and from 1811 to 1813 he was minister of foreign affairs. During the Hundred Days (q.v.) he was minister of state, but after Napoleon went into exile in 1815 he was banished from France. In 1820 he was permitted to return, and Louis Philippe created him a peer of France in 1831.

MARETZEK, mä′rĕ-tsĕk, **Max,** American musician: b. Brünn, Moravia, Jan. 28, 1821; d. Pleasant Plains, Staten Island, May 14, 1887. He was educated at the University of Vienna, but desirous of a wider field went to London and was connected for a time with its Italian Opera as chorus-master, writing in addition some music. In 1848 he came to New York, where he was appointed leader of the orchestra at the Italian Opera and subsequently at the Astor Place Theatre and the Grand Opera House. He wrote the operas of *Hamlet, Sleepy Hollow,* and an interesting book on contemporary life entitled *Crotchets and Quavers* (1858). Under his management many notable operas and artists, among the latter Adelina Patti and Pauline Lucca, were presented to American audiences.

MAREY, mȧ-rā′, **Étienne Jules,** French physiologist: b. Beaune, 1830; d. Paris, 1904. He became a professor of natural history on the faculty of the Collège de France in 1867, and he made investigations on the physiology of circulation and the heart, on the action of poisons, on animal heat, and motion in animals. He invented the

improved form of the sphygmograph (q.v.) in 1863.

MARFA, mär'fȧ, city in western Texas and Presidio County seat, on the Texas and New Orleans railroad about 175 miles southeast of El Paso and about 55 miles from the Rio Grande, at the foot of the Davis Mountains; alt. 4,688 feet. It is a trading center for large livestock ranches, shipping cattle, goats, sheep and mohair. The brisk mountains in the vicinity are increasingly visited by tourists and hunters. Silver was once mined in the region. Outside Marfa is Fort D. A. Russell, an old army post set up in 1833. The city, founded in 1884, was incorporated in 1887. Pop. (1950) 3,603.

MARGARET, Saint, a 3d-century virgin and martyr, said to have been born in Antioch as daughter of a pagan priest. She performed several miracles until martyred (about 275, some sources give 307) for refusing to abandon her faith. Known in Greek as Marina, she is held to be identical with St. Pelagia. Her day is July 20 (Greek church: July 17).

MARGARET, Saint, queen of Scotland, elder sister of Edgar Aethling, and granddaughter of Edmund Ironside: b. Hungary about 1045; d. Edinburgh, Scotland, Nov. 16/17, 1093. She and her brother Edgar went to Scotland and placed themselves under the protection of Malcolm III Canmore, the Scottish king, who, c.1067, became her husband. It was largely through her influence with the king that the Scottish Church was brought into conformity with those of England and the Continent. Margaret is said to have elevated the manners of the Scottish court and to have set a noble example to the people. In 1251 she was canonized. Her daughter Matilda married the English king, Henry I, and thus the old Anglo-Saxon line became united with that of the usurping Normans. Her feast is June 10.

MARGARET, queen of Denmark, Norway and Sweden, sometimes called "The Semiramis of the North," daughter of Waldemar IV, king of Denmark: b. Søborg, near Copenhagen, Denmark, 1353; d. Flensburg (now Germany), Oct. 28/29, 1412. Married to Haakon VI, king of Norway, in 1363, the death of her husband in 1380 placed Norway in her hands; that of her son Olaf in 1387 enabled her to secure also the throne of Denmark; and after defeating Albert of Mecklenburg, the Swedish king, she obtained possession of the throne of Sweden as well. She endeavored to place the union of the three kingdoms on a permanent basis by the celebrated Act of Union or Treaty of Kalmar (1397).

MARGARET OF ANJOU, ăn'jōō or ănzhōō', queen consort of Henry VI of England: b. probably at Pont-à-Mousson, Lorraine, France, March 23, 1430; d. Dampièrre, near Saumur in Anjou, France, Aug. 25, 1482. The daughter of René the Good of Anjou, titular king of Naples, she was married to Henry in 1445. The imbecility of the king made her practically regent, and her power being contested by the Duke of York, a claimant of the throne by an older line, the protracted Wars of the Roses began. At first victorious, she was afterward compelled to flee to Scotland, but raising an army in the north, she secured by the battle of Wakefield (1460) and the 2d battle of Saint Albans (1461) the death of York, and the release of the king. Her army, however, was soon afterward annihilated at Towton (1461), and Edward IV, the son of the late Duke of York, was declared king. In a last attempt, Margaret, collecting her partisans, fought the battle of Tewkesbury (1471), and was totally defeated. She and her son were made prisoners, and the latter, when led into the presence of the royal victor, was killed. Henry soon after died or was murdered in the Tower, and Margaret remained in prison for almost five years. Louis XI ransomed her (1476) for 50,000 crowns. See also HENRY VI; ROSES, WARS OF THE.

MARGARET OF AUSTRIA, regent of the Netherlands, and daughter of Maximilian I of Austria: b. Brussels, now Belgium, Jan. 10, 1480; d. Mechlin, now Belgium, Dec. 1, 1530. Educated at the French court, she was betrothed to the Dauphin Charles (later Charles VIII), who, however, married Anne of Brittany. She married instead John, the Spanish crown prince, in 1497; and, after his death in the same year, married Philibert II of Savoy in 1501, only to be widowed again in 1504. Three years afterward her father made her regent of the Netherlands, where she ruled with much ability, although a bitter enemy of the Reformation. She took a prominent part in the peace of Cambrai in 1529, which is called, because negotiated by her and Louise of Savoy, the "Paix des Dames."

MARGARET OF CARINTHIA, kȧ-rĭn'-thĭ-ȧ, or **MARGARET MAULTASCH,** moul'-tȧsh, countess of Tirol: b. 1318; d. Vienna, Austria, Oct. 3, 1369. She retained rule over the Tirol after her father's death (1335) despite the opposition of Emperor Louis IV. After divorcing her husband John Henry, son of the king of Bohemia, she married the Emperor's son, Louis, margrave of Brandenburg. In 1363 she abdicated. Also called Ugly Duchess (the title of a historical novel by Lion Feuchtwanger), she has become almost proverbial for her rancor and hideous looks.

MARGARET OF FLANDERS, countess of Flanders and Hainaut, sometimes called Margaret of Constantinople: b. Valenciennes, France, about 1200; d. Lille, France, Feb. 10, 1279. She was a daughter of Baldwin IX of Flanders and Hainaut (Baldwin I of Constantinople), who was succeeded by her older sister, Jeanne. Upon the latter's death in 1244 Margaret acceded. Her son by a first marriage, Jean d'Avesnes, took Hainaut (1246), but she retained Flanders.

MARGARET or **MARGUERITE OF NAVARRE,** nȧ-vär', queen of Navarre, variously known as Margaret of Angoulême, of Orléans, and of Valois: b. Angoulême, France, April 11, 1492; d. Odos en Bigorre, Hautes-Pyrénées, France, Dec. 21, 1549. The daughter of Charles d'Orléans, Count of Angoulême, and a sister of Francis I of France, she was brought up at the court of Louis XII and married the Duke of Alençon in 1509. Widowed in 1525, she married in 1527 Henri d'Albert, titular king of Navarre. She resided at the French court or at Nérac and Paul. A protector of Protestant reformers, she was also a great patroness of men of letters. In 1533 she published a re-

ligious poem, *Le Miroir de l'Ame Pécheresse,* which incurred the censure of the Sorbonne as heretical. In 1547 a collection of her poems and other pieces was printed under the title of *Marguerites de la Marguerite des Princesses.* The *Heptaméron, ou sept Journées de la Reyne de Navarre,* a famous collection of tales long attributed to her exclusively, is probably of composite authorship. She left one child, Jeanne d'Albret; afterward mother of Henry IV of France. See HEPTAMERON, THE.

MARGARET OF PARMA, regent of the Netherlands: b. Oudenarde, 1522; d. Ortona, 1586. She was also known as Margaret of Austria. She was a natural daughter of Charles V of Spain by a Flemish woman. Brought up in Brussels, she was married to Alessandro de Medici in 1536, and in 1538 to Ottavio Farnese, duke of Parma, to whom she bore the great general, Alexander Farnese. In 1559 Philip II made her regent of the Netherlands. There she sided with Cardinal de Granvelle, introduced the Inquisition and provoked the provinces to revolt by her strong, masculine policy. She resigned in 1567 when the duke of Alva was sent to the Netherlands.

MARGARET OF VALOIS, OF FRANCE, known as QUEEN MARGOT: b. Saint Germain-en-Laye, France, May 14, 1553; d. Paris, March 27, 1615. She was the daughter of Henry II of France and Catherine de Médicis. She married in 1572 Henry of Navarre, afterward Henry IV of France. It was entirely a marriage of policy, and on Henry's accession to the throne their marriage was dissolved by mutual consent. She resided thereafter in Paris where her house became the rendezvous of the learning and fashion of the time. Some very agreeable poems by her are extant and her *Memoirs* (1842) are extremely interesting.

MARGARET TUDOR, queen of Scotland, wife of James IV and daughter of Henry VII of England: b. Westminster, Nov. 29, 1489; d. Methven Castle, Oct. 18, 1541. She was married to the king of Scotland when 14; bore him three children, of whom two, James, later fifth king of Scotland of that name and father of Mary Stuart, and Margaret, mother of Lord Darnley, survived her; and after the king's death (1514) married Archibald Douglas, earl of Angus, from whom she was divorced in 1527, to marry soon after Henry Stewart, lord of Methven. By descent from Margaret Tudor her great-grandson, James VI of Scotland, was Elizabeth's successor as James I of England.

MARGARETTA, The, a British armed schooner, captured by Americans near Machias, Me., June 12, 1775, in the first naval contest of the American Revolution.

MARGARIC ACID, name formerly given to an acid having the chemical formula $C_{17}H_{34}O_2$, and supposed to exist in natural fats. Later the name came to be applied only to an acid obtained by boiling cetylic cyanide with potassic hydrate solution.

MARGARINE, mär'jär-ĭn, a concentration of highly refined vegetable oils emulsified in fresh pasteurized skim milk. Domestic vegetable oils, primarily soybean and cottonseed, contribute practically all of the fats and oils used in American margarine. Margarine consists of 80 per cent fat content by weight which is made up of highly refined oils. Approximately 16 per cent by weight is pasteurized, cultured skim milk. The remainder is made up of salt, Vitamin A, and minor ingredients. Margarines are emulsified under scientific control so that the finished product is a smooth-textured spread for bread.

Hippolyte Mège-Mouriès, a French scientist, invented the product now known as margarine as a result of a contest sponsored by Napoleon III for a palatable table fat. Mège-Mouriès won the prize and the product was patented in England in 1869. A small production in France was resumed after the Franco-Prussian War in 1870.

In 1874, margarine was introduced into the United States during a period when a surplus of farm products was being produced. Almost immediately 22 states levied discriminatory taxes on the product to give butter a frankly competitive advantage. Federal legislation, which was to last 64 years, went into effect in 1886. This legislation consisted of taxes and restrictions designed to curtail the sale of margarine. Amendments increasing the severity of the original law were passed in 1902 and 1930. Congress repealed these restrictions by the act approved March 16, 1950, effective July 1, 1950. The new law:

(1) Repealed all federal taxes on yellow and white margarine and annual license fees on retailers, wholesalers and manufacturers handling yellow and/or white margarine.
(2) Defines the product as "margarine."
(3) Stipulates labeling requirements on the package so as to leave no doubt that the consumer would be purchasing margarine.
(4) Specifies notification and serving requirements for public eating places serving yellow margarine as follows:
    (a) A sign must be displayed or a notice carried on the menu stating that margarine is served and,
    (b) Each separate serving must be in triangular shape or bear or be accompanied by labeling identifying it as margarine.

Margarine today bears little resemblance to the product manufactured before the turn of the century. Its ingredients and technology have radically changed. During the early part of this century, methods of refining vegetable oils were materially improved, thus leading to the gradual increase in the use of vegetable oils in margarine. Odors and flavors were eliminated, producing a blandness which would then readily absorb the flavor of the milk to be incorporated. The shortage of fats during and after World War I intensified the trend toward wider use of vegetable oils and for the first time soybean oil was used in significant quantities.

With the discovery of new processes in 1937, cottonseed oil became the major fat ingredient, supplanting coconut oil, which was temporarily a major fat contributor Since that time American cottonseed and soybean oil have been the two major fat ingredients. Margarine is now second only to shortening as the major user of soybean and of cottonseed oil and is thus of vital interest to American farmers. In 1951, for example, the value of soybean oil used in the production of

margarine was estimated at 79 million dollars and the value of cottonseed oil used amounted to 60 million. Cottonseed oil amounted to 56.8 per cent of all the oils used in margarine production in 1950. For the same year soybean oil contributed 39.5 per cent while the remaining 3.7 per cent included corn oil, peanut oil, and other vegetable and animal fats and oils. Milk products make up about 16 per cent of margarine, amounting to 166,000,000 pounds of skim milk in 1951. Since only about one per cent of margarine contains meat fat, which refers to "oleo," the term "oleomargarine" has become inaccurate. Some existing laws, however, still require that margarine be labeled with its out-of-date name.

Margarine is manufactured and distributed under the Federal Food, Drug and Cosmetic Act and the similar laws of the various states. In 1941 the United States Food and Drug Administration established the "Definition and Standard of Identity for Oleomargarine" in order to assure consumers a product of uniformly high quality. As amended effective Aug. 18, 1952, this regulation sets forth required and optional ingredients; fixes the fat content at 80 per cent; permits coloring; and requires each pound that is fortified with Vitamin A be fortified with a minimum of 15,000 U.S.P. units. The standard, following the act of March 16, 1950, recognizes the word margarine as well as oleomargarine to describe the product.

Leading authorities have long recognized the high food value of margarine. The following nutritional experts have attested that margarine is the nutritional equal of any other table spread: The American Medical Association's Council on Food and Nutrition; The United States Department of Agriculture, which includes margarine on its "Basic 7" food list; The Food and Nutrition Board of the National Research Council; The New York Academy of Medicine's Committee on Public Health Relations; and the United States Army. One scientific test, the results of which appeared in the American Medical Association *Journal*, February 7, 1948, concluded that "Growing children experience normal growth in height and weight when their diets contain only fortified margarine as table fat, as shown by comparison with children fed on similar diets with butter as the source of table fat . . ." and "Whether the greater part of the fat of the diet is derived from vegetable or animal sources has no effect on growth and health. . . ."

The Committee of Public Health Relations of the New York Academy of Medicine has said: "From a nutritional viewpoint, when it is fortified with Vitamin A in the required amount, oleomargarine is the equal of butter, containing the same amounts of protein, fat, carbohydrates and calories per unit of weight. Moreover, since the minimum Vitamin A content of 'enriched' margarine is fixed, and the amount of this Vitamin A in butter may range from 500 to 20,000 units per pound, 'Enriched' oleomargarine is a more dependable source of Vitamin A than is butter. Since it is a cheaper product than butter, fortified oleomargarine constitutes a good vehicle for the distribution of Vitamin A and fats. . . ."

With the advent of World War II margarine consumption increased rapidly despite restrictive regulation. In 1941 the average per capita consumption of margarine was 2.7 pounds. At the close of the war in 1945 consumption reached a new high of 3.8 pounds per capita, and continued to increase. Public interest in removing discriminatory restrictions on the product, manifested over many years and successful in several states, crystallized. Although a large majority—consumer, farm, labor, grocer and other groups—asked for federal and state repeal actions, butter interests almost alone sought to keep the restrictions on the grounds of protecting the price of butter. On April 28, 1948, a repeal bill was passed by the House of Representatives by a heavy majority, but adjournment prevented any action by the Senate.

Further hearings before the 81st Congress resulted in another repeal bill being passed by the House of Representatives by a large majority on April 1, 1949. On Jan. 18, 1950, the bill, with certain amendments, was easily passed by the Senate and became law as of July 1, 1950. Certain labeling requirements and other provisions were incorporated with the purpose of safeguarding the sale of margarine.

New York State and Washington State repealed bans on the sale and manufacture of yellow margarine in 1952, the latter in a popular referendum, reducing to only six the number of states still prohibiting such sale. In the six—Iowa, Minnesota, Montana, South Dakota, Vermont, and Wisconsin—consumer, dealer, and farm groups are seeking repeal.

The situation for butter is quite different. Per capita butter consumption declined from 16.9 pounds in 1940 to 9.7 pounds in 1951. The amount of milk used in buttermaking declined from 40 per cent in 1940 to 24.6 per cent in 1951.

Thus, though margarine consumption has almost trebled since 1940 butter consumption has nearly halved, the result being that combined consumption of both is less today (1952) than a decade ago. This leaves a "nutritional gap" in table fat consumption. Some dietitians feel that margarine can fill this "nutritional gap."

CLARA GEBHARD SNYDER,
Food Consultant.

MARGARITA, mär-gä-rē'tä, Venezuela, an island off the northeast coast, in the Caribbean Sea, about 35 miles north of Cumana. In 1901 it was made a province and is known by the name of Nueva Esparta. Its area is 450 square miles. This island was discovered by Columbus in 1498; it was settled by the Spanish about 1525. The name Margarita, meaning "pearl," was given to it because of the pearl fisheries still existing in surrounding waters. The capital of the province is La Asunción; the chief port Pampatar. The natives are mostly civilized Indians. Pop. (1950 est.) 62,381.

MARGATE, mär'gāt, England, a seaport and popular summer watering resort of Londoners, in Kent, in the Isle of Thanet division, 64 miles by rail east of London. The restored parish church of Saint John the Baptist dates from 1050. It was originally a fishing village, but began to develop as a resort about the year 1800. Its sea walks are continuous with those of Westgate and Broadstairs.

MARGATE FISH, a handsome, pearly white, brown-striped fish (*Haemulon album*) of West Indian waters, important as a food fish.

MARGHERITA, queen dowager of Italy: b. Turin, Nov. 20, 1851; d. Jan. 4, 1926. She was

the daughter of Ferdinand, Duke of Genoa. In 1868 she was married to Humbert, then crown prince of Italy, who ascended the throne of Italy in 1878. In that same year an attempt was made upon the life of the king, and the nervous shock to the queen seriously affected her health for a number of years. Her winning personality and dignified performance of her duty as queen gained her wide popularity in Italy. In 1900 her husband was assassinated and their son, Victor Emmanuel III, succeeded him as king.

MARGHERITA PUSTERLA, for many years the most popular historical novel in Italy with the exception of Manzoni's masterpiece, *I promessi sposi,* was written between 1833 and 1834 while the author, Cesare Cantù, lay in prison charged with political offenses against the Austrian authorities. Composed under great difficulties, suppressed by the foreign oppressors who felt themselves attacked through this work, the novel was not published till 1838. The theme deals with the period of the Italian despots of the 14th century—a period which had already been treated in Tommaso Grossi's *Marco Visconti* (1834), to which novel Cantù alludes in his own work. The scene is laid in Milan in 1340–1341 during the reign of Luchino Visconti. The latter attempts to seduce Margherita, the wife of the rich and noble Franciscolo Pusterla. Rebuffed by her, the tyrant seeks revenge by sending to the scaffold husband, wife and their young son, a mere child, after having had the parents condemned for treason against the state and conspiracy against his life. Vain attempts to save his master and mistress by the devoted young squire, Alpinolo, an effort to deter the vindictive Luchino from his cruel purpose on the part of the good monk Fra Buonvicino (a replica of the famous Fra Cristoforo of *I promessi sposi*), heighten the interest of this somber tale. With the exception of the impulsive and engaging Alpinolo, the sardonic court-jester Grillincervello and the saintly Fra Buonvicino, the characterization is mediocre. The book owes its success to the splendid pictures of mediaeval life and to the pathos and horror of its situations. The execution of Margherita Pusterla, a powerful but revolting scene, has been much admired. For a historian of no mean ability, Cantù, as has been justly pointed out by Mazzoni, makes curious blunders and takes singular liberties with his sources. Written when Romanticism was supreme in Italy, *Margherita Pusterla* is an imitation of *I promessi sposi* combined with an attempt to rival the vast panoramas, the highly colored realism and the violent contrasts of *Notre Dame de Paris.*

ALFRED G. PANARONI.

MARGOLIOUTH, mär-gō'lĭ-ŭth, *later* mär-gŭl-yōōth, **David Samuel,** English Arabic scholar: b. London, Oct. 17, 1858; d. Mar. 23, 1940. He was educated at Oxford, and was Laudian Professor of Arabic at Oxford in 1889–1937. His published works are associated chiefly with Arabic literature, and include *Letters of Abul Ala* (1898); *Mohammed and the Rise of Islam* (1905); *Yakut's Dictionary of Learned Men* (edited in Arabic, 1907–25); *The Homer of Aristotle* (1924).

MARGOLIS, Max Leopold, American Hebrew philologist: b. Merech, Vilna, Russia, Oct. 15, 1866; d. April 2, 1932. In 1889 he was graduated at the Leibniz Gymnasium, Berlin, and in 1890 received the degree of A.M. at Columbia University and the degree of Ph.D. the following year. In 1892 Dr. Margolis was lecturer on Jewish literature at the Glenmore School for Culture Sciences, Keene, N. Y. From 1892 to 1897 he was connected with the Hebrew Union College, Cincinnati, as assistant professor of Hebrew and Biblical exegesis. In 1897 he became professor of Semitic languages and literatures at the University of California, where he was associate professor from 1898 to 1905 In 1905–07 he held the chair of Biblical exegesis at Hebrew Union College. In 1907–1908 Dr. Margolis visited European libraries and in the following year was editor-in-chief of Bible translation for the Jewish Publication Society of American. From 1909 he was professor of Biblical philology at the Dropsie College for Hebrew and Cognate Learning, Philadelphia. He was the author of *Commentarius Isaacidis quatenus ad textum talmudicum investigandum adhiberi possit tractatu Erubhin ostenditur* (1891); *The Columbia College Manuscript of Meghilla* (1892); *An Elementary Text-Book of Hebrew Accidence* (1893); *The Theological Aspect of Reformed Judaism* (1904); *The Holy Scriptures with Commentary on Micah* (1908); *A Manual of the Aramaic Language of the Babylonian Talmud* (1910); *The Story of Bible Translations* (1917); *The Hebrew Scriptures in the Making* (1922); and contributions to philological and theological publications. In 1922 Dr. Margolis became editor of the *Journal* of the American Oriental Society.

MARGRAVE, in mediaeval times, in continental Europe, a border count or commander entrusted with the protection of a *mark,* or district on the frontier. As early as the times of Charlemagne marks and margraves appear. The margraves stood immediately under the German kings and emperors. In the 12th century margraviates became hereditary and at last the margraves acquired the rank of princes of the empire, between counts and dukes.

MARGUERITE, mär'gĕ-rēt, a popular name for several flowers of the family *Asteraceae.* The blue marguerite (*Felicia amelloides*), or blue daisy, is a native of southern Africa, and has long been popular in greenhouses and window gardens because of its simple culture and large solitary flower-heads. The Paris daisy or marguerite (*Chrysanthemum frutescens*), a native of the Canary Islands, was introduced into cultivation in Great Britain about the close of the 18th century and has continued a popular florist's flower ever since. It is the one usually obtainable throughout the year in the stores, but especially during the winter. Because of a close resemblance, the name is applied to its near relative, the ox-eye daisy (*C. leucanthemum*), which is common in mismanaged pastures and fields, especially in the New England and adjacent States. The Reine marguerite (*Callistephus hortensis*) is better known in America as China aster (see ASTER) and is one of the most popular out-of-door annuals of the garden, being easily grown from seed and readily adaptable to any garden soil. The English daisy (*Bellis perennis*) is also called marguerite, but less frequently.

MARIA II, usually known as **Maria da Gloria,** thä glō'ryà, queen of Portugal: b. Rio de Janeiro, April 4, 1819; d. Lisbon, Nov. 15, 1853. She was a daughter of Dom Pedro I of Brazil and on the death of her grandfather, John VI of Portugal in 1826, her father ceded to her the succession to the throne. Her uncle, Dom Miguel, to whom she was betrothed was appointed regent, but in 1828 upon the sailing of the young queen for Spain he usurped the throne and barred the landing of the queen. In 1832–1833 Dom Pedro instigated a civil war against his brother and, through the intervention of England and France, Maria was placed on the throne in 1834. She married Duke Ferdinand of Saxe-Coburg and though retaining her throne had a troubled and rather unsuccessful reign. Upon her death her son, Pedro V, ascended the throne.

MARIA CHAPDELAINE, a novel of French-Canadian pioneer life written by Louis Hémon while he was working on a farm, also the locale of the story, near Péribonca, Quebec. It was first published in a Paris newspaper in Jan., 1914. The lives of Samuel Chapdelaine's family revolve around the ceaseless struggle to wrest a farm from the unbroken forest of the St. Johns Lake country. Maria, his daughter, loves François Paradis, a young trapper. Before they can be married, Paradis is lost in the winter's snow and dies. In the spring, Maria refuses Lorenzo Surprenant who offers her the pleasures of civilization, and gives her promise of marriage to a neighboring farmer, choosing to live the life her parents had lived, in the open, beside the forest. This simple story of devoted resignation, unaffectedly told, gives a vivid picture of the compensations of pioneer life.

MARIA CRISTINA, queen of Spain: b. Austria, July 21, 1858; d. Madrid, Feb. 6, 1929. She was the daughter of Archduke Karl Ferdinand of Austria, and was married by proxy to Alfonso XII of Spain in 1879. At the death of Alfonso XII in 1885, she was appointed queen-regent during the minority of her daughter, Queen Mercedes, who was succeeded six months later by Alfonso XIII, a posthumous son. The queen-regent faced a difficult problem; she was a foreigner, the people were unsympathetic, and the political and financial condition of the country was in a precarious state. She formed a new cabinet with Sagasta, the Liberal leader at its head, and soon won the hearts of her people by her wise and able rule. Throughout the time of her regency she commanded the respect and admiration of the world as well as her own country for her clear, far-sighted administration of the affairs of state and her careful training of the young king whom she endeavored to inspire with her own high sense of the responsibilities of his position. Even the disastrous outcome of the Spanish-American War failed to unsettle the stability of her government which on May 17, 1902 she surrendered into the hands of her son, Alfonso XIII.

MARIA CRISTINA DE BOURBON, ma-rē'ä krēs-tē'nä thä bôr-bôn', queen of Spain: b. Naples, April 27, 1806; d. Havre, France, Aug. 22, 1878. She was a daughter of Francis I, king of the Two Sicilies, and was married to Ferdinand VII of Spain in 1829. Upon Ferdinand's death in 1833, Maria Christina by her husband's will became regent until her daughter, Queen Isabella, should become 18. A civil war which was waged until 1840 ensued, its purpose being to place Don Carlos on the throne, and its outcome was for a long period doubtful, but the queen-regent appeared to care only for her chamberlain, Don Fernando Muñoz, with whom she secretly contracted a morganatic marriage. Her policy as regent was entirely subject to the will of the minister of the day which naturally resulted in a reign alternately liberal and despotic. When she affixed her signature to the law concerning the Ayuntamientos the public protested so strongly that she was obliged to resign the regency to the Prime Minister, Espartero, in 1840. In 1843, after the fall of Espartero, she returned to Madrid and in 1844 publicly married Muñoz, who was made Duke of Rianzares. A revolution in 1854 compelled her to flee the country and her return to Spain in 1864 was followed by the revolution which dethroned Queen Isabella in 1868 and she was again exiled and though allowed to return to Madrid after the accession of Alfonso XII, she died in exile.

MARIA LESZCZYNSKA, lĕsh-chĭn'y-skä, queen of France: b. Breslau, June 23, 1703; d. Versailles, June 24, 1768. She was a daughter of Stanislas Leszczynska, king of Poland, and shared the obscurity which followed upon his exile. Her marriage to Louis XV in 1725 was arranged by the regent Duc de Bourbon and the minister Fleury and was regarded as an intrigue to further their interests since it antagonized Spain by sending back the young infanta with whom an alliance had been projected. The queen after a brief period in which she tried to control state matters lived very quietly and was noted for her charities.

MARIA LUISA or **MARIE LOUISE,** empress of the French and grand duchess of Parma: b. Vienna, Dec. 12, 1791; d. there, Dec. 17, 1847. The eldest daughter of Emperor Francis I of Austria, she was 18 when Napoleon, in order to have an heir and ally himself to the old royal families of Europe, divorced Josephine and, after the Battle of Wagram and capture of Vienna, demanded her hand of her father and Prince Metternich. From her first arrival in Paris (April 1810) the very cool reception accorded her by the populace which sympathized with Josephine evoked in the new empress an equal coolness toward France and the French. Napoleon, however, was deeply in love with her. While she greatly admired him and feared him a little, she seems never to have loved him. In March 1811 she gave birth to the king of Rome. During Napoleon's absences on campaign she acted as regent, but showed utter incapacity. At the close of the campaign of France, on Napoleon's instructions she quitted the menaced capital and went with her son to Blois, but refused to continue on across the Loire with his brothers. After the emperor's abdication she went to Orléans, then joined her father at Rambouillet. During the Hundred Days she was kept secluded and separated from her son whom she would not see again until at his death. In 1816 the former empress was given the sovereignty of the duchies of Parma, Piacenza and Guastalla. She lost her throne of Parma in 1831 in consequence of a popular revolt. As a ruler she was kindhearted, but her character was light and vacillating and she was devoid of political sense.

MARIA LOUISA, Order of. See ORDERS (ROYAL) AND DECORATIONS.

MARIA MAGDELENA, by C. F. Hebbel. 'Maria Magdelena,' which Hebbel called a "tragedy of common life," is more important as the forerunner of the peasant tragedies of Ibsen and Hauptmann than for any outstanding virtue of its own. It lacks the grandeur, the large stage and large feeling, which give their special quality to 'Herod and Mariamne'; 'Judith' and 'Gyges and his Ring.' It exaggerates the asides and the soliloquies whose dramatic fitness Hebbel defended; it cannot pass the final test of tragedy, which is inevitability. And yet it is the work of a master-dramatist, and the history of realistic drama is not complete which does not include it. For it is one of the first dramas in which the tragedy is centred, not upon a situation but upon the character of a group; in which the conflict is not between the rights of the classes, but between individuals in a family for their personal rights as against "the cruelest of tyrants, the commonplace man in the home circle." It has been called a "tragedy of the fallen woman," and, as such, its weaknesses are apparent. But it is not that. The name of the play is peculiarly unsuitable. It is the tragedy of narrow vision, the tragedy of that fear of what people will say which actuates the life of Master Anton, of Clara, his daughter, and Carl his son, and of their friends and neighbors. 'Maria Magdelena,' was one of the most popular of Hebbel's creations, and is still played in the repertory theaters.

EDITH J. R. ISAACS.

MARIA PIA, queen of Portugal: b. Turin, 1847; d. Italy, 1911. Her father was Victor Emmanuel II of Italy. At the age of 15 she was married to Luiz I, king of Portugal. She became dowager queen on 9 Oct. 1889, when her son, Carlos I, ascended the Portuguese throne. The latter and his son, Crown Prince Luiz, were assassinated in Lisbon 1 Feb. 1908, and the aged Maria Pia saw her grandson, Manuel II (q.v.), ascend the throne. Maria Pia devoted herself to charitable work and took no part in the public life of the nation. When the republic was proclaimed in 1910 she fled to Italy and sought refuge with her sister, Princess Clotilda.

MARIA THERESA, tē-rē'sa (Ger. tā-rā'zä), German empress, queen of Hungary and Bohemia, Archduchess of Austria: b. Vienna, 13 May 1717; d. there, 29 Nov. 1780. The oldest daughter of the Emperor Charles VI, she was carefully educated, was named heir to the throne by the Pragmatic Sanction, and in 1736 married Stephen, Duke of Lorraine, who became Grand-Duke of Tuscany in the next year, and who in November 1740, a month after Maria's accession to the throne of Hungary, Austria and Bohemia, was named joint regent with her. France and Bavaria invaded Bohemia; and at the same time she was beset by Frederick the Great in Silesia, by Spain and Naples in Italy, and by the counterclaims of Charles Albert, who was proclaimed first Archduke of Austria and then German emperor. She fled from Vienna to Presburg, convoked the Diet, raised a Hungarian army, won the alliance of England, made a secret peace with Prussia, surrendering Silesia and Glatz, and gained peace by the Treaty of Aix-la-Chapelle, October 1748, securing the election of her husband as German emperor in return for the cession to Spain of Parma, Piacenza and Guastalla. To revenge herself on Frederick she formed an alliance with Russia, and, by the help of her chancellor, Kaunitz, with France. With the further help of Sweden and Saxony she was preparing to strike at Prussia, when Frederick forestalled her by striking the first blow and opening the Seven Years' War (q.v.). This terrible struggle availed Austria nothing and Maria Theresa had to admit Prussia's right to Silesia in the Peace of Hubertsburg 15 Feb. 1763. Francis I, her husband, died 18 Aug. 1765, and Maria associated with her as emperor her oldest son, Joseph II, but kept in her own hands everything save military administration. Seven years afterward, upon the first partition of Poland, she received Galicia and Ludomeria; and in 1775 Bukovina was granted to Austria by Turkey Twen the Peace of Teschen, closing the War of the Bavarian Succession, brought Austria the Inn Valley in 1779; but the Princes' League (Fürstenbund), under the lead of Frederick II, struck a heavy blow at Austrian supremacy. Though best known for her part in European politics, Maria Theresa was equally great in interior administration; Austrian finance was revived, agriculture encouraged and higher education fostered. The empress was a strict Catholic and an enemy of the Protestant Reformation, but in this latter part of her reign under the influence of her free-thinking son's policies, she was induced to enact some anti-ecclesiastical legislation, which he subsequently developed into persecutions. She was a pure and noble woman, strikingly beautiful in her youth. Ten of her 16 children survived her. Monuments to Maria Theresa are to be found in Klagenfurt, Vienna and Presburg. Her letters to her children and her friends were edited by Arneth (1881), who wrote 'Maria Theresa' (1888). Consult also de Broglie, 'Marie Thérèse' (1888); de Villermont, 'Marie Thérèse' (1895); Wolf and Zwiedineck-Südenhorst, 'Oesterreich unter Maria Theresa' (1884); Bright, 'Maria Theresa' (1897).

MARIA THERESA, Order of. See ORDERS AND DECORATIONS.

MARIAMNE, mā-rī-ăm'nē, granddaughter of Aristobulus and Hyrcanus, the high-priest, and wife of Herod the Great. Her history is related by Josephus from whom we learn that Herod was devotedly attached to her. She was condemned to death through the machinations of Salome, her husband's sister, on a false charge of adultery, 28 B.C. She met her fate with an intrepidity worthy of her noble ancestry, and was bitterly deplored by the king after her decease. Several plays have been based on the story.

MARIANA, Juan, hoo-ăn' mä-rē-ä'nä, Spanish historian: b. Talavera, 1536; d. Madrid, 17 Feb. 1623. Taking holy orders he entered the Society of Jesus. To his training at the University of Alcala he owes the pure taste and eloquence of his writings. He taught theology for 13 years with distinction in Rome, Sicily and Paris, returning to the Jesuits' College at Toledo in 1574, where he wrote his 'Historia de Rebus Hispaniæ' (1st ed., Toledo, 1592), in elegant Latin, but afterward translated it into Castilian. His tone is impartial, though he

defended, in *De Rege et Regis Institutione* (1599), killing of kings who proved tyrants.

MARIANA, mâr-ĭ-ăn'ȧ, in American colonial history, a name given by John Mason (q.v.) to the tract granted to him between the Salem River and the Merrimac. Here he founded an agricultural settlement and formed the Laconia Company in 1629. Mason returned to England in 1633 and died there two years later. In 1691 his heirs sold all his lands and rights in New Hampshire to Gov. Samuel Allen.

MARIANA ISLANDS (commonly MARIANAS, formerly LADRONE ISLANDS), an island group in the Pacific Ocean, north of the Tropic of Cancer, 1,500 miles east of the Philippine Islands; from north to south, the group extends for 380 miles. The islands were discovered in 1521 by Ferdinand Magellan (q.v.), who sighted Guam and Rota, and were settled by the Spaniards, who named them Islas de los Ladrones ("Thieves Islands") because they were a rendezvous for pirates; after Jesuit missionaries were sent to the islands in 1667 by Mariana of Austria, queen of Spain, they were renamed Marianas for her. Spain ceded Guam (q.v.), southernmost of the group, to the United States in 1898, following the Spanish-American War, and in 1899 sold the remaining islands to Germany for $5,000,000; after World War I the German islands, together with the Marshalls and the Carolines, became a mandate of the League of Nations and were entrusted to Japan for administration.

The Japanese Marianas comprised 14 islands, besides islets and reefs, with an aggregate area of 246 square miles; the population in 1935 numbered 44,025, including 39,728 Japanese. Northward from Guam, the islands are Rota, Tinian, Saipan (on which was Garapan, pop. 6,000, the seat of administration), Farallon de Medinilla, Anatahan, Sarigan, Guguan, Zealandia Bank, Alamagan, Pagan, Agrihan, Asuncion, Maug, and Farallon de Pajaros—all lost to Japan in World War II. The northernmost 10 islands are volcanic and uninhabited. Sugar and cotton are grown on Saipan (15 miles long by 4 in width), Tinian (13 miles by 6), and Rota (12 miles by 4); and other crops, on most of the islands, include coconuts, rice, sugar, corn (maize), tobacco, and coffee. The breadfruit tree was first discovered on the Marianas.

Early in 1944 United States naval and air forces commenced a series of attacks to retake Guam and capture the Japanese Marianas. Troops were landed on Saipan on June 15, and on July 4 they occupied Garapan and Tanapag, a second town; the entire island fell to the Americans on July 9, the total cost being 3,426 killed and 13,099 wounded. The Japanese lost 27,586 killed and 2,161 captured, many of these being subsequently accounted for on hills and in caves to which they had retreated. The invasion of Tinian was launched on July 23, 1944, and the island was completely occupied by the end of the month, the United States suffering 1,829 casualties, of whom 314 represented men killed; 6,939 Japanese were killed, and 523 captured. Several other islands remained in Japanese hands, including Rota and Pagan, until September 1945. The islands, exclusive of Guam, were assigned by the United Nations to the United States in 1947 as a trust territory.

MARIANNA, mâr-ĭ-ăn'ȧ, city, Arkansas, and Lee County seat, altitude 235 feet, on L'Anguille River; on the Missouri Pacific Railroad, 22 miles northwest of Helena. It is in an agricultural region, and cotton processing is the principal industry. Pop. (1950) 4,530.

MARIANNA, city, Florida, and Jackson County seat, altitude 80 to 117 feet, on the Louisville and Nashville and the Marianna and Blountstown railroads. It is the trading center for a region producing corn, cotton, pecans, peanuts and fruit. Pop. (1950) 5,845.

MARIAZELL, mä-rē-ä-tsĕl', town, Austria, in Styria, near the Salza, 60 miles southwest of Vienna. It is a noted pilgrim resort, annually visited by about 200,000 persons, attracted by the 12th century image of the Virgin and Child. It is noted as a winter and summer resort. Pop. (1948) 2,330.

MARICOPA, măr-ĭ-kō'pȧ, or **COCOMARICOPA,** an Arizona tribe of Indians, a branch of the Yumans, formerly inhabiting the region around the confluence of the Gila and Colorado rivers. Their descendants and the Pimas, with whom they subsequently confederated, are to be found in the Gila River Reservation.

MARIE ANTOINETTE, mȧ-rē' ăN-twȧnĕt' (in full JOSÈPHE JEANNE MARIE ANTOINETTE), queen of France: b. Vienna, Austria, Nov. 2, 1755; d. Paris, Oct. 16, 1793. She was the daughter of the Emperor Francis I and Maria Theresa. In 1770 she was married to the Duc de Berri, dauphin of France, and after he ascended the throne in 1774 as Louis XVI she made enemies about the court because of youthful frivolities and extravagances. Spoken of contemptuously as *l'Autrichienne* ("the Austrian woman"), she was considered to be too much under the influence of her mother. Her name was further tarnished by the affair of the diamond necklace (q.v.), in which the Cardinal Louis de Rohan, the imposter Alessandro di Cagliostro, and the Countess de La Motte were the chief actors. Her unpopularity was increased by the enthusiastic reception given her at a banquet on Oct. 1, 1789, where the white bourbon cockades were worn and the national cockade trampled under foot. The attack on Versailles and transfer of the royal family to Paris shortly followed. The queen advised the flight of the royal family from Paris in June 1791, which ended in their capture at Varennes. From that time they were viewed as traitors. On Aug. 10, 1792, the last day of the royalty, the queen exerted all her power to induce the king to resistance. This he thought was vain, and he was led with his consort before the Legislative Assembly. She heard his deposition announced, and then accompanied him to the prison of the Temple. There, deprived of every semblance of royalty, she displayed magnanimity and patient endurance. In August 1793, she was removed to the Conciergerie, and in October was brought before the revolutionary tribunal. She was charged with having dissipated the finances, exhausted the public treasury, corresponded with foreign enemies of France, and favored its domestic foes. She replied with firmness and decision, and heard her sentence pronounced with

perfect calmness. On the same day she was guillotined. Marie Antoinette's faults were due in great measure to her defective education and difficult position. Her expiation of them made her a general object of pitying interest.

MARIE BYRD LAND, mȧ-rē' bûrd' lănd, large section of Antarctica, situated east of Ross Sea and Ross Shelf Ice, and south of Amundsen Sea, at a latitude of approximately 73° to 85° S. and longitude 100° to 150° W. It was named for Richard E. Byrd who claimed the land for the United States in 1929.

MARIE DE FRANCE, mȧ-rē' dĕ frȧns', French poetess of the 12th century, a native of Ile de France, whence her surname, who spent her life in England, where she was well known at the court of Henry II. Her *Lais,* largely based on Breton stories, and full of Celtic spirit and pathos; fables, a revision under the title *Isopet* (that is, *Aesop*) of an English collection; and a tale, *L'Espurgatoire Seint Patriz,* make up the body of her work.

MARIE DE MEDICIS, mȧ-rē' dĕ mā-dē-sēs (Italian MARIA DE' MEDICI), queen of France: b. Florence, April 26, 1573; d. Cologne, July 3, 1642. She was the daughter of Francesco de' Medici, grand duke of Tuscany, and was married by proxy, Oct. 5, 1600, to Henry IV of France, with whom she constantly quarreled, partly because of his inconstancy and his open favor to the Marquise de Verneuil, and partly because of her own haughty, obstinate character, which was not unmixed with ambition. For years she urged him to have her crowned queen; the ceremony took place May 13, 1610, and on the next day the king was assassinated. Marie was accused of complicity in the plot, but the charge is not proven. For seven years she acted as regent and showed a strong friendship for Spain and the Catholic Church, being advised by the nuncio and the Spanish ambassador as well as by such favorites as Concini. She quarreled with her son, later Louis XIII, was reconciled to him by Richelieu, and upon her attempt to displace the latter was forced by that great minister again to leave court in 1630. Her last years were spent in exile in Belgium, England and Cologne. The story of her poverty during these years is untrue.

MARIE GALANTE, mā-rē' gä-länt', island, about 16 miles southeast from Guadeloupe. The area is about 60 square miles. The chief productions are sugar, coffee, tobacco, indigo and cotton. It is a dependency of the French overseas territory of Guadeloupe. Columbus discovered it in 1493, and named it from his vessel, the *Santa Maria.* The French occupied it in 1647, and lost it several times. In 1825 it suffered severely from the hurricane which desolated Guadeloupe (q.v.). Pop. (1946) 29,349.

MARIE LOUISE, empress of France. See MARIA LUISA.

MARIE THERESE or **MARIA THERESA,** queen consort of Louis XIV of France: b. Escorial, Sept. 10, 1638; d. Versailles, France, July 30, 1683. She was the daughter of Philip IV of Spain and of Elizabeth of France. By the Treaty of the Pyrenees in 1659 she renounced any claim to the Spanish throne. In the following year she married Louis XIV, but the union was unhappy. Only one of her six children, Dauphin Louis, survived her.

MARIETTA, mâr-ĭ-ĕt'ȧ, city, Georgia, county seat of Cobb County, on the Nashville, Chattanooga and St. Louis, and Louisville and Nashville railroads, about 16 miles north by west of Atlanta. Kennesaw Mountain is west of the city. It was settled in 1834 and incorporated in 1852. A city charter was granted in 1885. It is in a fertile agricultural region in which stock-raising is one of the prominent occupations. Large marble quarries are in the vicinity. The chief manufactures are chairs, prefabricated houses, castings, hosiery, lumber, marble products, pottery, and frozen foods. There is a United States Air Force base here, and a large aircraft plant built during World War II. The Clarke Library, which contains about 5,500 volumes, is in Marietta. Marietta National Cemetery, located here, contains the graves of 10,279 soldiers.

The mayor and council are chosen at a popular election. Pop. (1940) 8,667; (1950) 20,687.

Marietta was an intermediate objective point in Gen. William Sherman's campaign for Atlanta, and when he crossed the Etowah May 23, 1864, his columns were headed for that place by way of Dallas and New Hope Church, but Gen. J. E. Johnston threw his army in his front and checked him at New Hope Church and Dallas. After many hard-fought battles and constant severe skirmishing, Johnston abandoned his Dallas lines (see DALLAS, GA., BATTLE LINES AT) on June 4, and took position covering Marietta, his left on Lost Mountain, his right beyond the railroad and behind Noonday Creek, with a strong advanced position on Pine Mountain. Sherman repaired the railroad, established a secondary, fortified base at Allatoona Pass, and joined by Blair's Seventeenth corps advanced June 10 and confronted Johnston in his new and strong position, and by the 14th was strongly intrenched before it in a continuous line of 10 miles. Johnston abandoned Pine Mountain on the night of the 14th, and Sherman advanced his lines, bringing on the engagement at Pine Mountain (q.v.) June 15. The general movement was continued on the 16th and the right thrown forward to threaten the railroad below Marietta. On the 18th Johnston fell back to a new line, including Kennesaw Mountain, which was strongly fortified, and Sherman pressed in closely on the center and left, north of Marietta, still continuing the extension of his line to the right, south of it. Johnston, making a corresponding movement by his left, encountered Sherman's right at Kolb's Farm (q.v.) on the 22d. Sherman assaulted Kennesaw Mountain on the 27th, and was repulsed. Flanking operations were then renewed to the right to reach the railroad, and Johnston, finding it in danger and his communications with Atlanta threatened, after being 26 days under an uninterrupted cannonade and infantry fire, abandoned Marietta on the night of July 2 and fell back to a new line, previously selected and intrenched, 10 miles south of Marietta, and covering the railroad and his pontoon-bridges across the Chattahoochee, with an advanced position at Smyrna Campground. Sherman occupied Marietta on the morning of July 3. The Union loss in the operations around Marietta was 1,790 killed and

missing, and 5,740 wounded, an aggregate of 7,530. Johnston reported a Confederate loss of 468 killed and 3,480 wounded.

MARIETTA, city, Ohio, and Washington County seat, altitude 650 feet, on the Ohio River at the mouth of the Muskingum; on the Pennsylvania and the Baltimore and Ohio railroads, 95 miles in direct line southeast of Columbus; and on two federal and two state highways. It has river transportation, with service to many cities; and an airport. It lies in a region of fertile valleys, with coal, iron, oil, and natural gas deposits in the hilly parts. It handles large quantities of fruits and vegetables, shipped to various urban markets. The city's manufactures and industries include castings of iron, brass, aluminum; drilling tools; grindstones; metal signs and markers; paints and varnishes; gas engines and ranges; chemicals; household and office furniture; harness; and a varied list of miscellaneous trade articles.

Marietta has a National Guard armory; a Civil War monument, a monument to the pioneers, and a monument commemorating French participation in the settlement of America; a public library and a state museum, the Campus Martius; and two hospitals. It is the seat of Marietta College, chartered in 1835, but developed from an academy established in 1797.

The Marietta College museum contains some valuable relics of the early history of the western country, especially the records of the Ohio Company.

The city was settled in 1788. The Ohio Company of Associates, under the leadership of Manasseh Cutler (q.v.) and Gen. Rufus Putnam, in Boston, bought lands in the southeastern part of the present State of Ohio, and Putnam led a party of settlers to Western Pennsylvania and thence down the rivers. Upon landing at the mouth of the Muskingum, they called their community by that river's name, but soon changed it to Marietta, in honor of Marie Antoinette. The city developed as the westward country opened up; in its early years it was a thriving river town. The Mound Cemetery, which was set apart for public use in 1788, has the graves of a number of officers of the Revolution; it also contains an ancient Indian mound. An interesting relic of the historic past is the old Northwest Territory land office, a small structure of hand-hewn timbers, in which the first official maps of the region were made and records of transactions in land were kept; it is one of the oldest buildings in the state. At Blennerhassett Island, in the river, Aaron Burr visited his co-conspirator, Harman Blennerhassett, discussing plans for his "empire" in the Southwest.

Marietta has mayor and council, with a service director (city manager). The water supply system is under municipal ownership. Pop. (1940) 14,543; (1950) 16,006.

MARIETTA COLLEGE, in Marietta, Ohio, was founded in 1835 for men and women. It has college and preparatory departments; the latter is known as Marietta Academy. The courses lead to the degrees of A.B., Ph.B. and B.L. Courses are provided for work in music, art and military science, and short summer schools are given for work in the arts and sciences. The library, which has about 100,000 volumes and 30,000 pamphlets, is noted for its books on the history of the Northwest.

MARIETTE, mȧ-ryĕt', **Auguste Edouard,** French Egyptologist: b. Boulogne, France, Feb. 11, 1821; d. Cairo, Jan. 19, 1881. He was educated at the Boulogne Municipal College and in 1839 went to England as professor of French and drawing. He returned to France in 1840, took his degree at Douai in 1841 and became professor at his alma mater, the Boulogne Municipal College. While so engaged he became interested in archaeology and in 1847 published *Lettres à M. Bouillet,* an essay on the history of Boulogne. In 1848 he received a position in the Egyptian museum of the Louvre; and in 1850 was sent by the government to gather Coptic, Syriac, Arabic and Ethiopic manuscripts in Egypt. His excavations and discoveries in connection with his search for the true site of Memphis led to the finding of many important remains, such as the Serapeum, the first Memphian temple discovered near the three great pyramids. Beginning to excavate four miles west of the accepted site of Memphis, Mariette came first upon an avenue of sphinxes, which led directly up to the magnificent granite and alabaster temple of Serapis mentioned by Strabo, which contained the sarcophagi of the sacred bulls of Apis from the 19th dynasty to the Roman supremacy. Besides these he found no less than 2,000 sphinxes, and over 4,000 statues, bas-reliefs and inscriptions, some evidently of Greek construction; and various streets, colonnades, and other structures belonging to a great city. His excavations around the base of the sphinx near Gizeh not only disclosed the entrance to it, but proved it to be sculptured out of the solid rock.

In 1854 he returned to Paris and was made assistant conservator of the Louvre; and in 1855 was sent to Berlin to study Egyptian remains in the museums there. On his return to Egypt, in 1858, the viceroy made him conservator of the monuments and antiquities of the land, with the title of bey, later promoted to pasha, with an annual appropriation for the prosecution of his researches, and the foundation and maintenance of the museum of Boulak. His discoveries at Tanis revealed the monuments of the Hyksos dynasty, and those at Thebes explain the chronology of the various dynasties. In 1860 he made the important discovery of the mummy of Queen Aahhotep, of the 18th dynasty, with a wealth of jewels of exquisite workmanship belonging to her. In 1873 the Institute of France awarded him the biennial prize of 20,000 francs. His discoveries have been of utmost importance for the light that they have thrown upon the earliest periods of Egyptian history.

His chief published works are *Mémoire sur la mère d'Apis* (1856); *Aperçu de l'Histoire d'Egypte* (1864); *Nouvelle table d'Abydos* (1856), account of a second tablet found in Abydos which supplies the vacancies of the first and gives a list of the kings of the first six dynasties, corroborating that of Manethos; *Le Sérapéum de Memphis* (1857–1864); *Fouilles exécutées en Égypte, en Nubia, et au Soudan d'après les ordres du vice-roi d'Égypte* (1867); *Notice des principaux monuments du musée de Boulak* (1870); *Les Papyrus égyptiens du musée de Boulak* (1871); *Album du musée de Boulak* (1873); *Les Mastabas de l'Ancien Empire* (1881–1889), issued posthumously by G. Maspero.

Mariette lies buried in the museum-garden at Boulak, inclosed in an ancient Egyptian sarcophagus. Consult Mariette, Edouard, *Mariette Pacha* (Paris 1904) and Maspero, G. C. C., *Notice biographique sur Auguste Mariette* (Paris 1905).

MARIGNOLLI, mä'rē-nyōl'lē, Giovanni de', Italian traveler: b. Florence, probably about 1290; date of death unknown, but subsequent to 1357. Entering the priesthood, he was appointed one of the four legates sent by Benedict XII to the great khan of Cathay in 1338. The four legates accompanied by about 46 followers traveled east via Constantinople, whence in June 1339 they sailed across the Black Sea to Kaffa. They spent the winter of 1339 at Sarai on the Volga, enjoying the hospitality of Mahommed Uzbeg, khan of the Golden Horde. From his court the party traversed the steppes to Almalig (Kulja), in the modern Ili. They reached Peking via Kamul about June 1342, and were well received by the khan. The arrival of this embassy is chronicled in Chinese annals. Marignolli remained three or four years in Peking, after which he wandered through eastern China to Amoy Harbor. In 1348 he reached Columbum (Quilon) in Malabar, where he founded a Latin church. He stayed 18 months there after which he appears to have visited the coast near Madras, thence journeyed to Java, and on a voyage to Europe was wrecked at Bernwala (Pervily), Ceylon, where he was detained four months by the native ruler, Khoja Jahan. Marignolli returned via Armuz, Baghdad, Mosul, Aleppo, Damascus and Jerusalem, arriving at Avignon in 1353 and delivering a letter from the Khan to Pope Innocent VI. In 1354 the emperor, Charles IV, made Marignolli one of his chaplains, and soon afterward he was consecrated bishop of Bisignano. It does not appear, however, that he ever took possession of his see. About 1355 he removed in the retinue of the emperor to Prague and was papal envoy to Florence in 1356. In 1357 he was at Bologna. The last trace of Marignolli is a letter to him from Richard Fitz Ralph, archbishop of Armagh, Ireland, in which the writer objects to the sending of Marignolli as papal envoy to Ireland. In 1768 (in Prague) Marignolli's work appeared in volume 2 of *Monumenta historiae Bohemiae,* edited by G. Dobner. Modern readers were first attracted by the account published by J. G. Meinert (Munich 1820). Consult Beazley, C. R., *Dawn of Modern Geography,* vol. 3, pp. 142, 180-181, 184-185, 215, 231, 288-309 (1906).

MARIGOLD, a popular name for several unrelated plants. The pot marigold (*Calendula officinalis*) is one of the most widely popular of garden plants. It is grown for its brilliant flowers which range from white to rich orange, and for its flower-heads, which are often used to flavor soups, stews and dressings. The African marigold (*Tagetes erecta*) and the French marigold (*T. patula*) are also widely used for ornament. Their flowers are usually some shade of yellow, but some are brown and some striped. The Cape marigold (*Dimorphortheca spp.*) is also grown for ornament but is less popular than the above. The corn marigold (*Chrysanthemum segetum*) is a weed especially common in European grainfields, but also cultivated for its flowers, for which the plant is sometimes forced in greenhouses. All these belong to the family Asteraceae. The marsh marigold (*Caltha palustris*) is a member of the family (Ranunculaceae. It is a well-known plant in the marshes and wet meadows of North America. The leaves, gathered before flowering, are widely used as a potherb under the name of "cowslip greens." The name fig marigold is applied to various members of the genus *Mesembryanthemum,* several of which are cultivated for their grotesque forms, and their peculiar foliage.

MARIKINA, măr-ĭ-kē'nạ, a Brazilian name for a marmoset (q.v.).

MARIMBA, mà-rĭm'bà, a musical instrument consisting of tuned bars of hardwood graduated in size and suspended over the open ends of tuned resonators. The bars, arranged like the keys of the piano, are sounded by striking with rubber-tipped mallets. The marimba is of ancient origin and is found among many primitive peoples. Its existence in the New World is due originally to the importation of Africans. At the end of the 19th century, Sebastian Hurtado of Guatemala improved the instrument, extending its compass and using as resonators wooden boxes shaped like the gourds formerly used. Near the end of each box is an opening covered with cured pig's gut which in vibrating increases the volume and imparts a string-like tone to the instrument. Such resonators are peculiar to the Central American marimba and give it the compass and versatility of the piano. The manufactured type of marimba has a range of four octaves and uses metal tubes as resonators. In recent years the marimba has grown in popularity, attracting the attention of serious musicians. Though similar to the xylophone (q.v.), which originated in Europe, the marimba has greater range and superior tone quality.

FRANK K. MACCALLUM.

MARINDUQUE, mä'rên-dōō'kâ, Republic of the Philippines, island and province southwest of Tayabas, Luzon. Area, 356 square miles; pop. (1939) 81,768; capital, Boac (20,977).

MARINE CITY, Mich., city in Saint Clair County, situated on the Saint Clair River and the Port Huron and Detroit Railroad, 45 miles north of Detroit. It enjoys a considerable reputation as a summer resort, but it is also a busy manufacturing center with salt works, beet sugar factories, and shipyards. Pop. (1950) 4,270.

MARINE CORPS, United States. Established Nov. 10, 1775, by resolution of the first Continental Congress, the Marine Corps is a component part of the naval establishment. It is headed by its commandant, a four-star general, who, with his operational and administrative staffs, maintains headquarters in Washington, D.C. The commandant is appointed by the president to serve a four-year term. Since the corps was created it has participated in all wars of the United States, and at various times detachments have been in action in China, Nicaragua, Haiti, and Mexico, and many other foreign lands, where they have been sent to protect American lives or American interests. The world-wide service of the Marine Corps of the United States is symbolized in its insignia represented

by the globe, foul anchor, and surmounting eagle holding in its bill a streamer upon which is inscribed the motto of the organization: «Semper Fidelis.»

Despite the fact that the marine corps regards 10 Nov. 1775 as its birthday, the history of the American marines antedates that of the United States as an independent country. As early as 1740 three marine regiments were recruited in America, assembled in New York under the command of General Alexander Spotswood of Virginia, and performed valiant service in the West Indies for the Royal British Navy. Included among the officers of these marines was Lawrence Washington, a brother of General George Washington. During the colonial period, which ended in 1775, thousands of men acting as marines, and known as such, served on American vessels, and took part in many expeditions, including those against Acadia, Louisburg, Quebec, Cartegena, and Porto Bello. During the Revolutionary War the navies of several of the colonies came into existence, and many of their vessels carried marines who played an important part in the operations against the enemy. In May 1775 marines served with Benedict Arnold at Lake Champlain, and a few months later, on board Washington's cruisers in New England waters.

In 1776 a detachment of marines took part in the expedition of Commodore Esek Hopkins against New Providence, in the Bahamas, where occurred the first fight in the history of the regular navy. In this engagement the attacking party of some 300 marines and sailors under Major Samuel Nicholas—first commandant of the marines—captured the enemy forts and a quantity of military stores, including a large amount of powder which was badly needed by the colonial forces. One battalion of marines, sent as reinforcement to Washington after the retreat across New Jersey, fought with him at the Battle of Princeton, and in subsequent land engagements. Other marines, serving on board all the larger vessels of the navy, took part in various sea fights that helped to bring success to American arms. Under John Paul Jones, they participated in the famous battle between the *Ranger* and the *Drake,* and in the great victory of the *Bon Homme Richard* over the British *Serapis,* which has been termed «one of the most remarkable and desperate fights in the annals of our navy.»

Following the close of the war, the marines, like the army and the navy, were disbanded with nothing remaining but a glorious record. However, when the threatening attitude of various foreign countries called for the creation of defense forces, a regular Navy Department was set up and on 11 July 1798 President John Adams approved an act of the Congress providing for the establishment of a marine corps, patterned somewhat after the Royal Marines of Great Britain. The naval war with France (1799–1801) afforded the newly created marines their first opportunity for action, and in the various sea fights they gave a good account of themselves. During the war with the Barbary States, marines serving with the navy not only took part in the bombardment of Tripoli, but served under Commodore Stephen Decatur in all of his daring exploits, including the burning of the *Philadelphia* in the face of enemy fire. In April 1805 a detachment of marines under Lieutenant P. N. O'Bannon, U.S.M.C., marched 600 miles across the North African desert, and took part in the capture of Derne. After lowering the Tripolitan flag, they hoisted in its place the Stars and Stripes—the first time the American flag ever flew over an Old World fort. «To the Shores of Tripoli» has ever since been inscribed on the banners of the corps, and is recorded in the Marines' Hymn. (See BARBARY POWERS; PHILADELPHIA, DESTRUCTION OF THE.)

The marines also took an active part in the War of 1812 on both land and sea. They participated in all of the many sea fights and were aboard the *Constitution* in her memorable fight with and defeat of the *Guerriere,* when their commander, Lieutenant Bush, was killed repelling boarders; they took part in the sanguinary combat between the *Chesapeake* and the *Shannon* when Lieutenant Brown and 11 of his men were killed; under Commodore Decatur, they fought with great steadiness in the battle that resulted in the capture of the frigate *Madedonian* by the *United States;* they shared in the decisive victory on Lake Erie; and won additional honors as part of the military force under General Dearborn which invaded Canada. They also fought in the Battle of Bladensburg under Commodore Barney, and with General Andrew Jackson in the Battle of New Orleans. In succeeding years the marines saw action in many parts of the world. They served against Indians in Georgia and Florida, against pirates in the West Indies, and on punitive expeditions against the South Sea islanders of Quallah Battoo, Sumatra, and the Fijis.

During the War with Mexico, marines served under Commodores Sloat, Shubrick and Stockton; on the Pacific Coast; under Commodores Connor and Perry on the East Coast; and on shore under Generals Scott, Taylor and Worth. They were present at the capture of Monterey, Yerba Buena (San Francisco), and Mazatlan, and were highly commended by Commodore Shubrick for their conduct at Los Angeles, San Diego, San Gabriel and Guaymas. They took part in the capture of Vera Cruz; marched with General Scott on Mexico City; aided in the storming and capture of Chapultepec; then entered the Grand Plaza, in Mexico City, and led the way to the Hall of the Montezumas. Hence the inscription «From the Hall of the Montezumas to the Shores of Tripoli,» which appears on the banners of the corps. Detachments of marines formed part of Commodore Perry's expedition to Japan which opened the doors of the Mikado's realm in 1853–54 to civilization and commerce.

During the Civil War marines took part in all of the more important naval engagements, including those of the Gulf and the lower Mississippi, and the Battle of Mobile Bay, also in many of the battles on land. They fought in the first Battle of Bull Run, participated in the night attack on Fort Sumter in 1863, in the operations leading to the capture of New Orleans, in the fight between the *Alabama* and the *Kearsarge,* and in the attack on Fort Fisher, the last big operation of the war. In 1859 marines constituted a part of the force under Colonel Robert E. Lee, then an officer in the United States Army, that captured John Brown, and suppressed the riot at Harpers Ferry. After the close of the Civil War the marines devoted a large part of their time to aiding the civil

MARINE CORPS

Above: Victorious United States Marines entering Mexico City, 1847. *Right:* Painting showing marines landing near Seoul, Korea, in 1871. *Center below:* Federal marines, Civil War period. An officer stands at the left. *Bottom:* Marines at Guantanamo, Cuba, 1898, during Spanish-American War.

Official U.S. Marine Corps Photos

of existing marine units and the creation of new units for service on newly commissioned vessels. Marine detachments form a part of the complement in all American battleships, aircraft carriers, heavy cruisers, and in the later type of light cruisers, as well as in other types of combat ships.

During the Second World War the Marine Corps was recruited to a strength of nearly 500,000 officers and men. It served almost entirely in the Pacific theater of operations, and took part in numerous engagements with the Japanese, notably on Guadalcanal, Iwo Jima and Okinawa. Marine casualties in the Battle of Iwo Jima numbered 19,938, including 4,189 killed. In the Battle of Okinawa the 3d Marine Amphibious Corps joined the 24th Army Corps to comprise the Tenth Army which struck at Okinawa, principal island of the Ryukyus chain, on Easter Sunday, April 1, 1945. Marine casualties in this battle, which ended June 21, 1945, totaled 16,013, including 3,044 killed. On Sept. 3, 1945, Brig. Gen. Lawson Sanderson, commanding the 4th Marine Air Wing, accepted surrender of the Japanese garrison on Wake Island.

The Marine Corps maintains a reserve corps, and during the Second World War recruited a Woman's Reserve Corps, which at its peak in 1945 numbered 19,000.

MARINE ENGINE. See DIESEL ENGINE.

MARINE ENGINEERING. That branch of engineering which pertains to the design and operation of the machinery required for propelling, working and handling of ships. The last two items include such details as steering, loading and unloading cargo, and in general embrace a highly complex organization of electrical and mechanical devices designed for the safety and comfort of the passengers and crew. Marine machinery must possess the highest degree of reliability without being unduly heavy or bulky.

The early history of marine engineering is a story of the development of the steam engine beginning with the rudimentary but somewhat successful pumping engines used for pumping water from mines. These early steam plants were so heavy and inefficient it was doubted if a ship equipped with an engine could ever carry enough fuel to complete a long voyage. The first steamships were simply sailing vessels with engines; the limited bunker space would permit using the engines only part of the time.

The foremost problem of the marine engineer has always been one of reducing the weight and improving the efficiency of the power plant so that the ship, by carrying less machinery and fuel, will be able to carry more cargo.

The machinery aboard a ship is divided into two classes: (1) main engine; (2) auxiliaries, Fig. 1 shows an elementary marine steam plant. It includes only the equipment necessary to drive the propeller. All of this machinery except the boilers and triple expansion engine are *main engine auxiliaries.* The other class of auxiliaries includes such items as electrical generators, steering engines, anchor windlasses, refrigerating machines, etc. Another way of classifying auxiliaries is to refer to them as either *machinery space auxiliaries,* or *deck and hull machinery.*

The cycle of steam and water in the elementary power plant is indicated by the arrows in Fig. 1. The steam from the boilers passes successively through the three cylinders of the engine and is finally exhausted to the condenser. The circulating pump forces sea water through tubes in the condenser while the exhaust steam condenses on the outside surface of these water-cooled tubes. A vacuum is maintained in the condenser by the air ejector. The condensate pump discharges the condensed steam to the hot well which is filled with trays of some filtering medium, as loofa sponges, which removes any oil which might be carried over from the main engine. (If the oil were returned to the boiler it would cause overheating and perhaps failure of the tubes or plates.) The water in the hot well is pumped back to the boilers via the feed heater. The feed heater is required by law to prevent stresses in the boilers due to the entrance of cold water. The heater receives its heating steam from auxiliary exhaust steam that would otherwise be wasted and its use increases the efficiency of the entire plant. Hence, it should be used regardless of the safety requirements.

The main condenser performs two important functions: (1) it conserves the fresh water needed to supply the boilers as *feedwater;* (2) it increases the efficiency and power output of the entire plant. The fact that a condensing engine exhausts into a vacuum instead of the atmosphere increases the power produced from a given quantity of steam supplied. Also the feedwater taken from the hot well, or feedwater tank as it is sometimes called, will be hotter than water taken from the ship's tanks, thus less heat will be required in the feedwater heater and boiler to transform it into steam. The condenser referred to above is a *surface condenser* wherein the cooling water and steam are separated by the walls of the tubes so that the boiler water recovered is literally distilled water. Another type of condenser is used on vessels which operate in fresh water, or in harbors where their fresh water tanks can be refilled readily. This condenser is called a *jet condenser,* or *direct contact condenser.* The cooling water is sprayed directly into the chamber which receives the exhaust steam. A vacuum is produced, but the resulting mixture of condensed steam and cooling water is unfit for boiler feed unless the cooling water itself is free from impurities. Early seagoing steamships used sea water in their boilers with reasonable success according to the standards of the day. The steam plants were inefficient but the low steam pressures and types of boilers used did permit the use of sea water which was a very important consideration in the absence of a dependable surface condenser.

The demands of modern watertube steam generators in regard to boiler water can only be obtained with a tight surface condenser plus a scientific procedure of feedwater treatment to prevent corrosion and formation of scale. The deposit of scale on the heating surfaces can be prevented by chemical treatment of the boiler water, while corrosion can be prevented by maintaining the water slightly alkaline and by removing dissolved oxygen before the water enters the boiler. Oxygen can be kept out of the boiler to a satisfactory degree by using the deaerating type of feedwater heater wherein the water and heating steam are brought into direct contact. The water enters the heater in a fine spray which exposes the highest possible surface contact with the steam jets. Under the influence of the high velocity steam the air becomes disengaged from

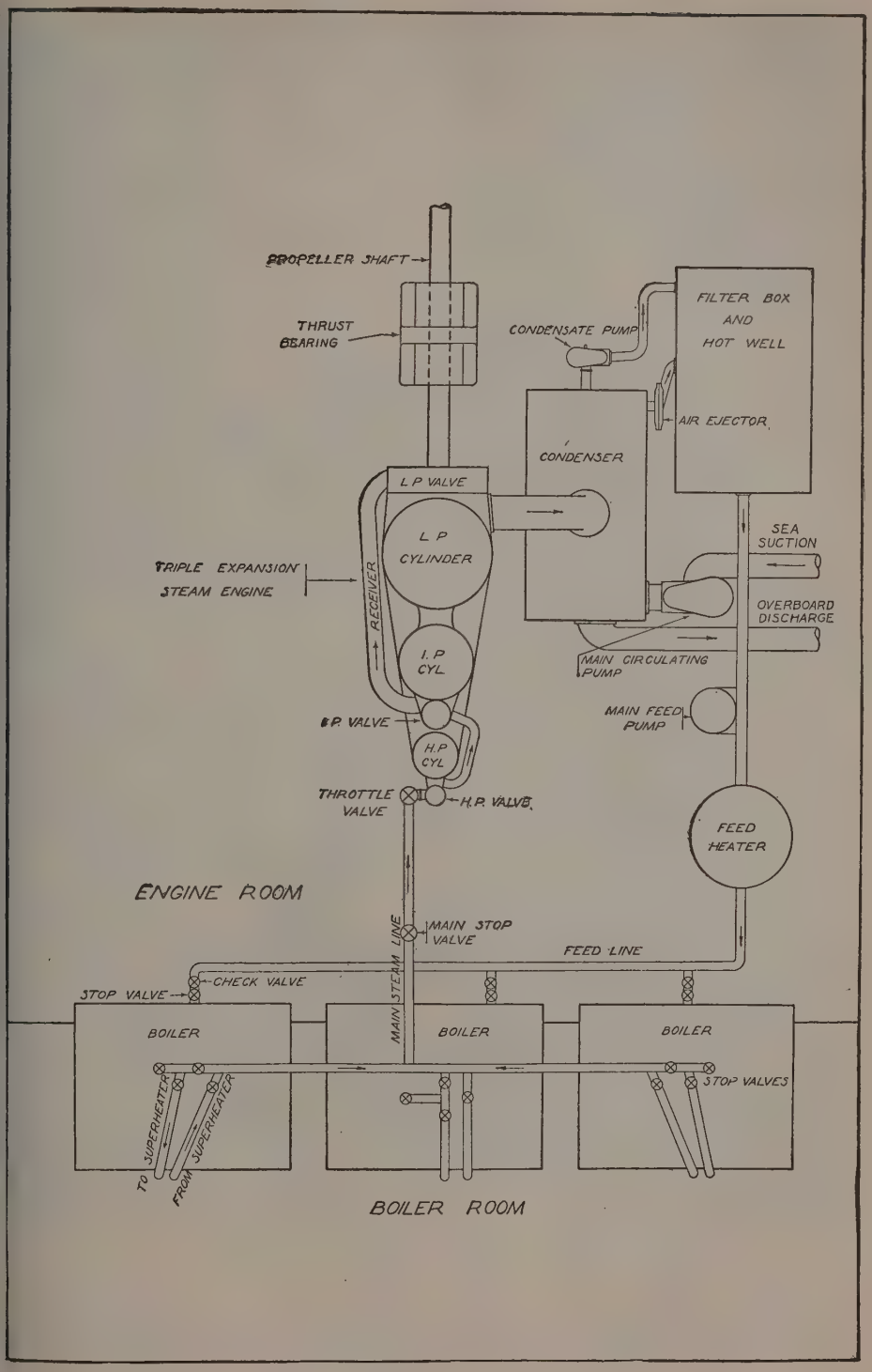


Fig. 1. Elementary Marine Steam Plant.

the water particles and joins the steam flow which carries the air out of the heater. There is no waste of steam as provision is made for condensing it after it has cleared the air from contact with the water. In the elementary steam plant of Fig. 1, the air is removed from the condenser by a steam-jet pump which discharges into the hot well. Since the hot well is open to the atmosphere, this arrangement permits the water to absorb considerable air. An improvement is found in the *closed feedwater system* where the open hot well is replaced by a closed *surge tank,* and where the air ejecter discharges into a separate condenser vented to the atmosphere.

Propulsion.—Early steamships were propelled by *paddle wheels* not only because this method of mechanical rowing was the most obvious but because the paddle wheels were suitable for the slow-turning engines then in use. Paddle wheels proved entirely unfit for seagoing vessels. If the wheels were properly submerged when the ship was fully loaded, they would probably be entirely out of water with the vessel in light condition; also the paddles were quite likely to be damaged by waves in rough weather. Paddle-wheel propulsion is well adapted to vessels of shallow and more or less constant draft, such as river steamers.

The *screw propeller,* generally referred to simply as a *propeller* or a *screw,* is the most efficient and widely used method of propulsion. It began to replace the paddle wheel about 1837. In the first installation the engines were adaptations of the paddle-wheel engines which were fairly satisfactory at rotative speeds on the order of 30 revolutions per minute or less, but were dangerous to the wooden hulls at higher speeds on account of the vibration due to unbalanced forces. For good efficiency the propeller requires a speed of about twice that of a paddle wheel. These higher speeds were frequently obtained by the use of gearing involving wooden-toothed gears on the engine shafts driving smaller iron gears on the propeller shafts. All of these engines were a practical failure due to their great weight as well as their mechanical infirmities. The propeller came into its own with the development of better balanced multicylinder steam engines that could be run fast enough to be connected directly to the propulsion shafting. The only restriction on the use of the propeller is sufficient depth of water and draft of hull to allow it to operate completely submerged. Depending upon the size and type of ship, one to four propellers are used, and the ship is designated as single-screw, twin-screw, triple-screw, or quadruple-screw. See NAVAL ARCHITECTURE—*Model Basins;* SCREW PROPELLER.

Jet propulsion is too inefficient to be considered as a general means of moving a ship through the water. Its principle is simply one of pumping a submerged jet of water opposite to the direction in which the vessel is to be propelled. In order to obtain high efficiency the jet of water must be larger in diameter than is practicable to obtain from any type of pump. Jet propulsion can be used in the special case of a fire boat where the large pumping capacity can be used as effective if not efficient propulsion while running to or from a fire.

Main Engines.—There are two general types of power plants used aboard ship—*steam plants* and *internal combustion engines.*

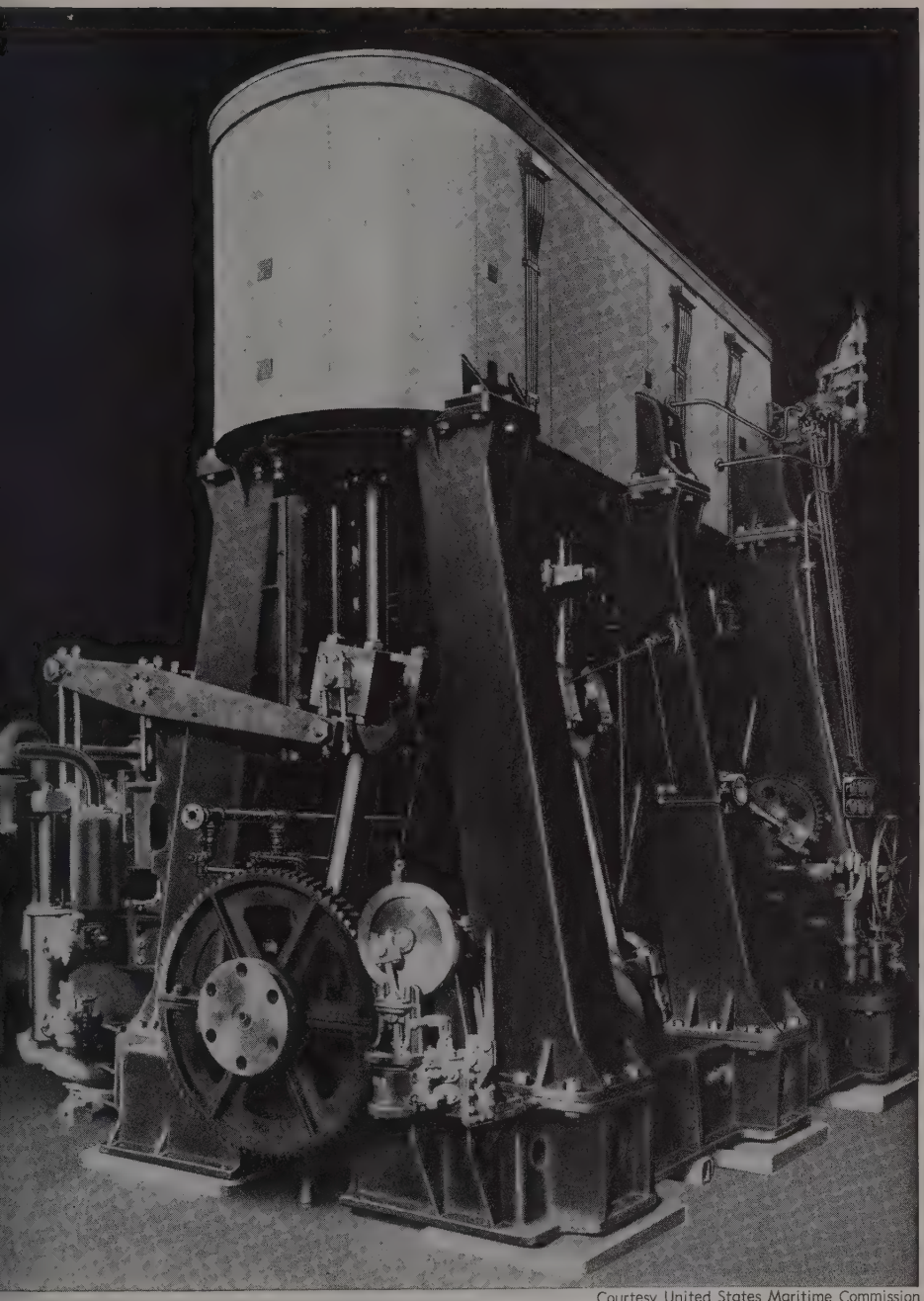
The extent to which a steam engine will convert steam into mechanical power depends primarily upon its ability to permit expansion of the steam within the engine. In the multistage reciprocating engine the steam is admitted and expanded successively in two, three, or four cylinders depending upon whether it is a *compound, triple expansion,* or *quadruple expansion* engine. The extent to which the steam can be expanded is obviously limited by the size of the low-pressure cylinder. In the *steam turbine* the steam passes through the nozzles and blading at a high velocity which permits a large volume of steam to be accommodated and gives a much higher ratio of expansion than would be practicable in a piston type of engine. However, this inherent efficiency of the steam turbine is not fully gained in turbines of small size. In powers under 3,000 hp. (horsepower) the reciprocating engine becomes competitive with the steam turbine on a basis of economy. The exact line of demarcation depends upon the individual reciprocating engine and turbine being compared. For very high powers the steam turbine has no competitor. It has been built in units as large as 50,000 hp. per shaft.

The principal internal combustion engine used for ship propulsion is the *Diesel engine.* It has been built in all sizes up to 10,000 hp. It has the lowest fuel rate of any prime mover, but in general requires a higher grade of fuel oil than steam boilers.

The question of superiority of one type of propelling machinery over any other involves many factors such as relative fuel costs, importance of weight ratio of fuel to cargo, facilities for maintenance and repair, etc.

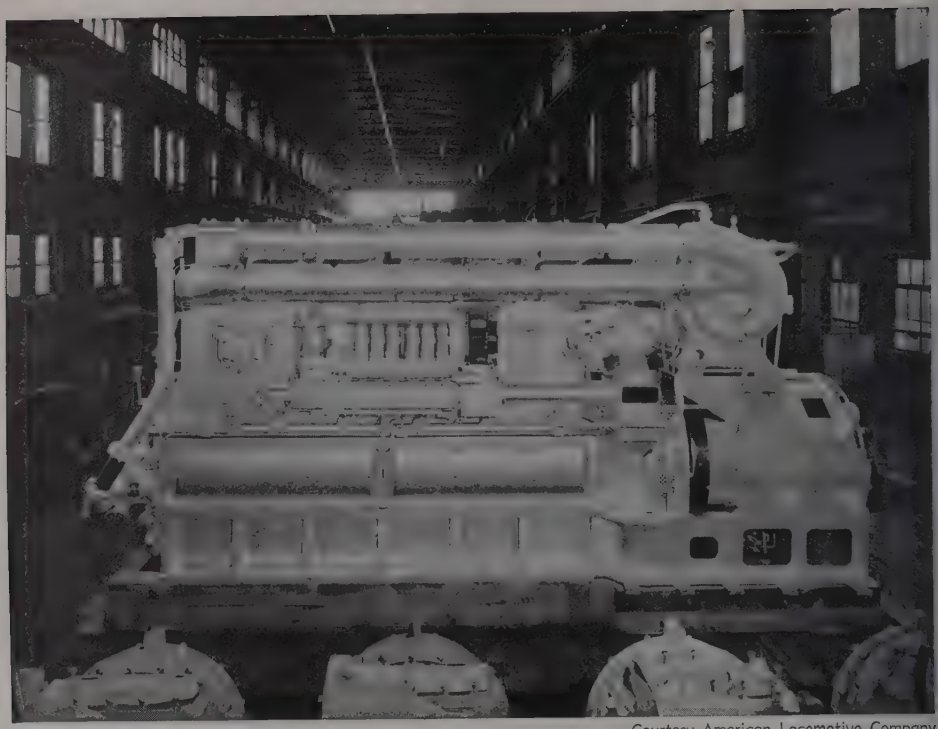
Transmission of Power.—There are three ways of transmitting power from the main engine to the propeller: (1) By *direct drive* when the engine is connected directly to the propeller shaft. In this type of drive the rotative speeds of the engine and propeller cannot be selected independently, which may result in a very inefficient combination. The screw propeller requires a relatively low rotative speed for good efficiency whereas the steam turbine requires a high speed. The early direct-drive turbine vessels such as the *Leviathan, Majestic* and old *Mauretania* were inefficient because the shaft speed in each case was a compromise between the most efficient propeller speed and the most efficient turbine speed. The reciprocating and rotary steam engines, and the Diesel engine, can all be used successfully in direct drive.

(2) The *geared drive* was developed mainly to take advantage of the inherent efficiency of the steam turbine. Most of the turbine installations employ double reduction, double-helical gears with speed reductions running as high as 80 to 1. Single-reduction gears are used only on larger high-speed vessels such as the S.S. *West Point* (formerly the S.S. *America*). The single-reduction gear is used for geared Diesel jobs where the required speed reduction is not as high as for steam turbines. The purpose of the geared Diesel drive is to reduce machinery weight and provide greater reliability and ease of maintenance through the use of one or more small high-speed units instead of one large slow engine directly connected. Also, the power which can be transmitted by one shaft is considerably greater in the multiengine drive. In the geared-Diesel it is good practice to introduce a slip-type coupling



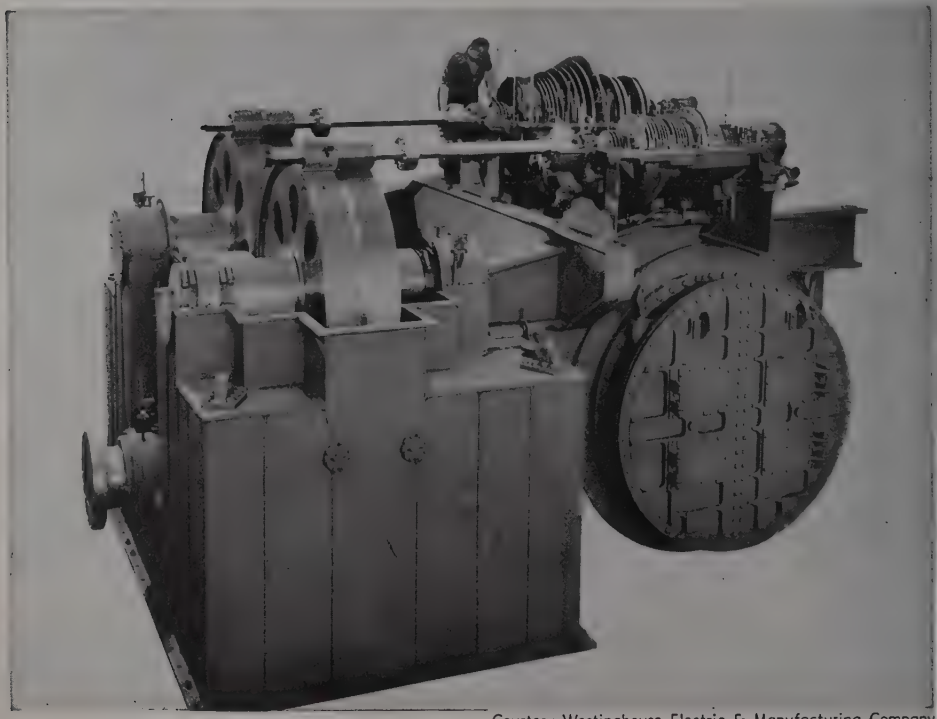
Courtesy United States Maritime Commission

Fig. 2. Slide valve engine installed in Liberty ships.



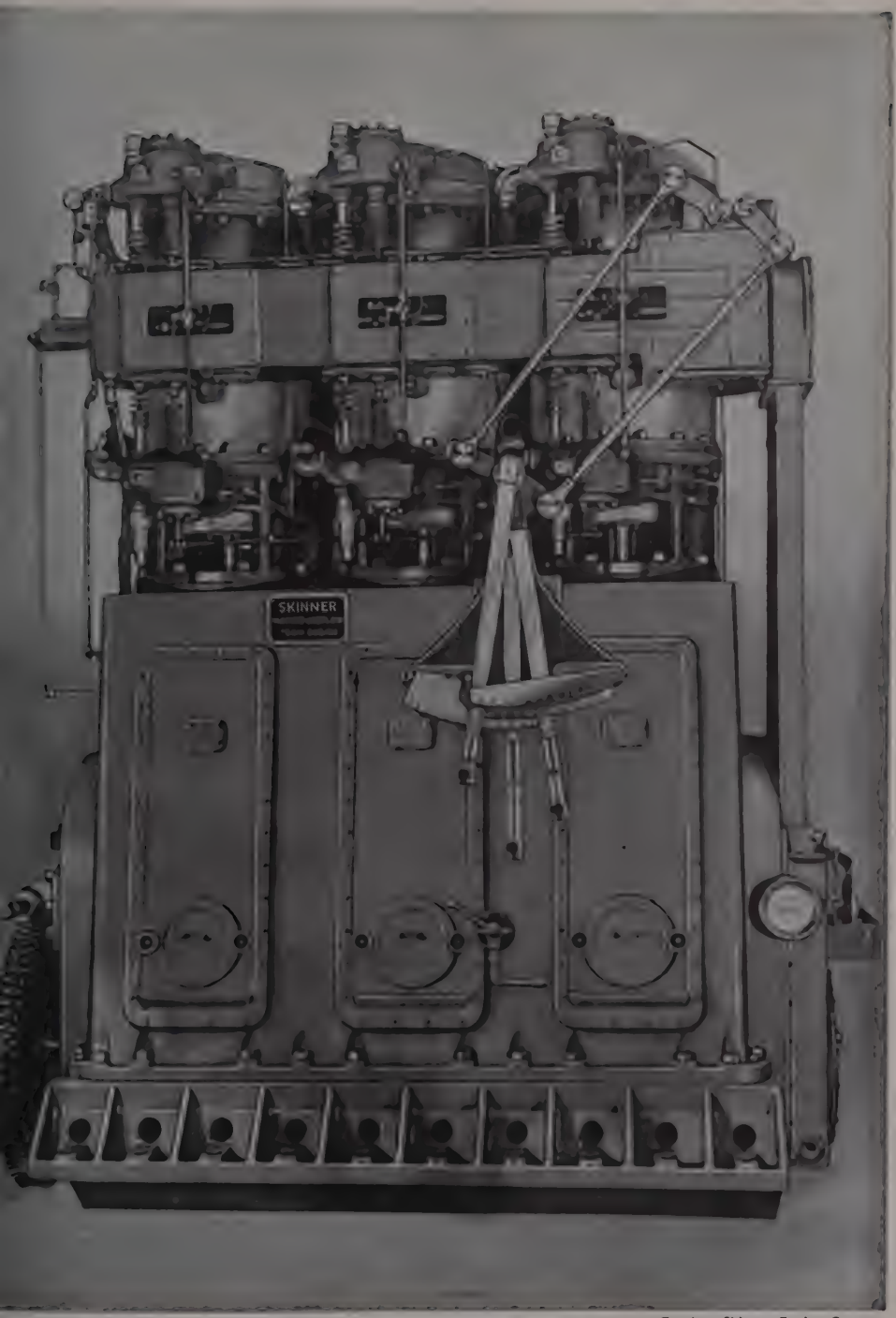
Courtesy American Locomotive Company

Fig. 3. Supercharged Diesel electric unit for direct-current electric drive.



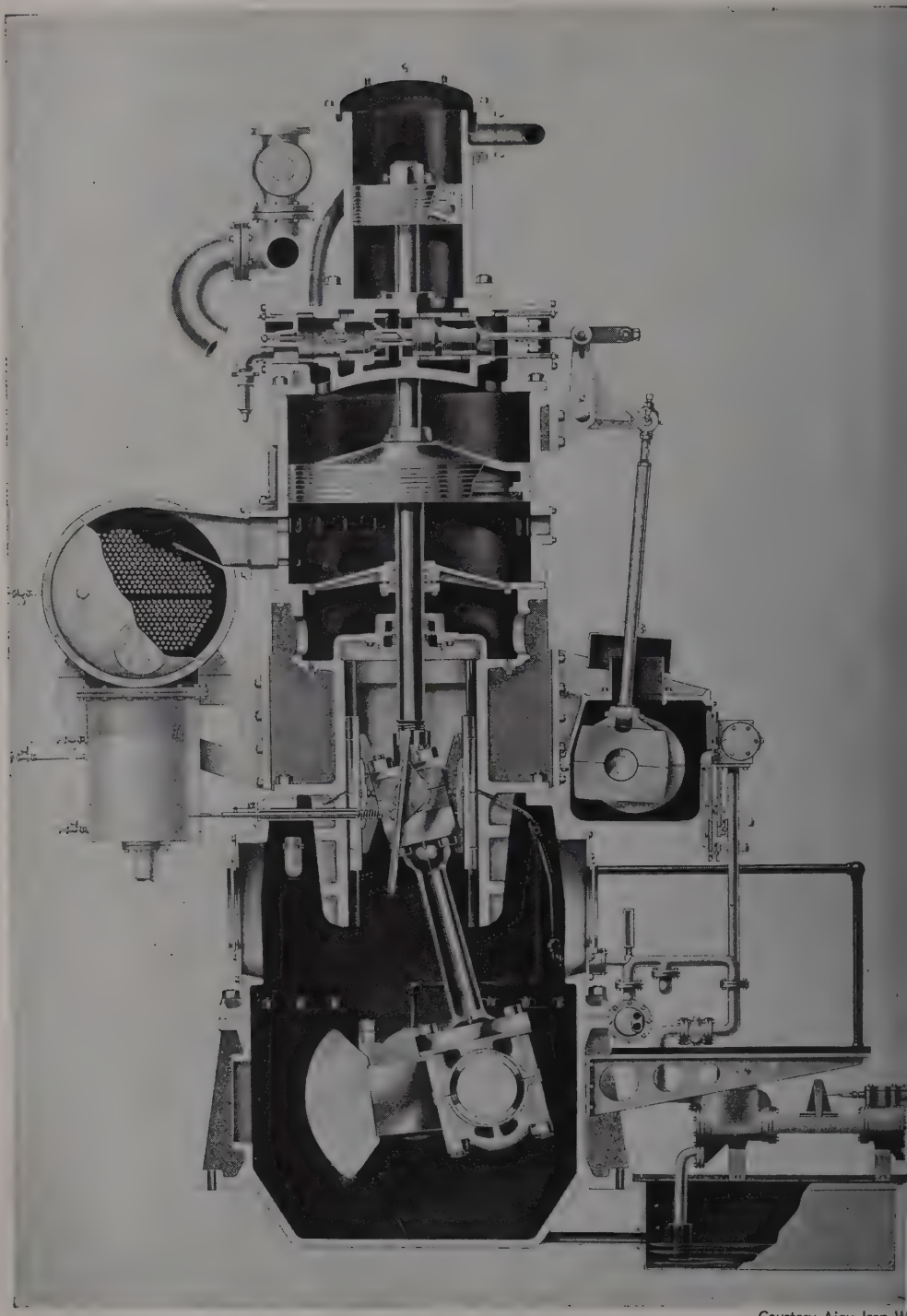
Courtesy Westinghouse Electric & Manufacturing Company

Fig. 4. 8,500-shaft horsepower geared-turbine propulsion unit used in Victory ships.



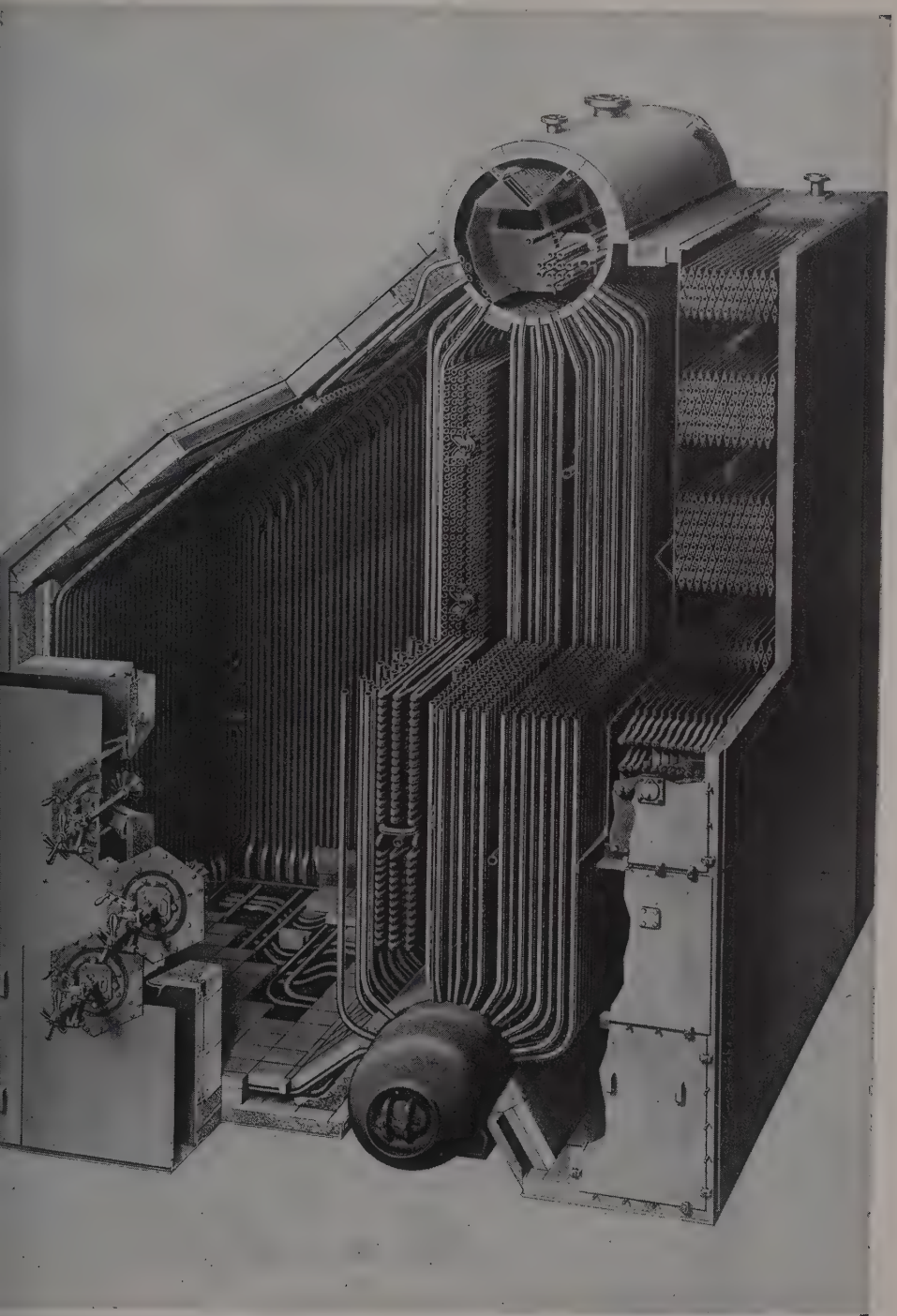
Courtesy Skinner Engine Company

Fig. 5. Three-cylinder uniflow marine engine



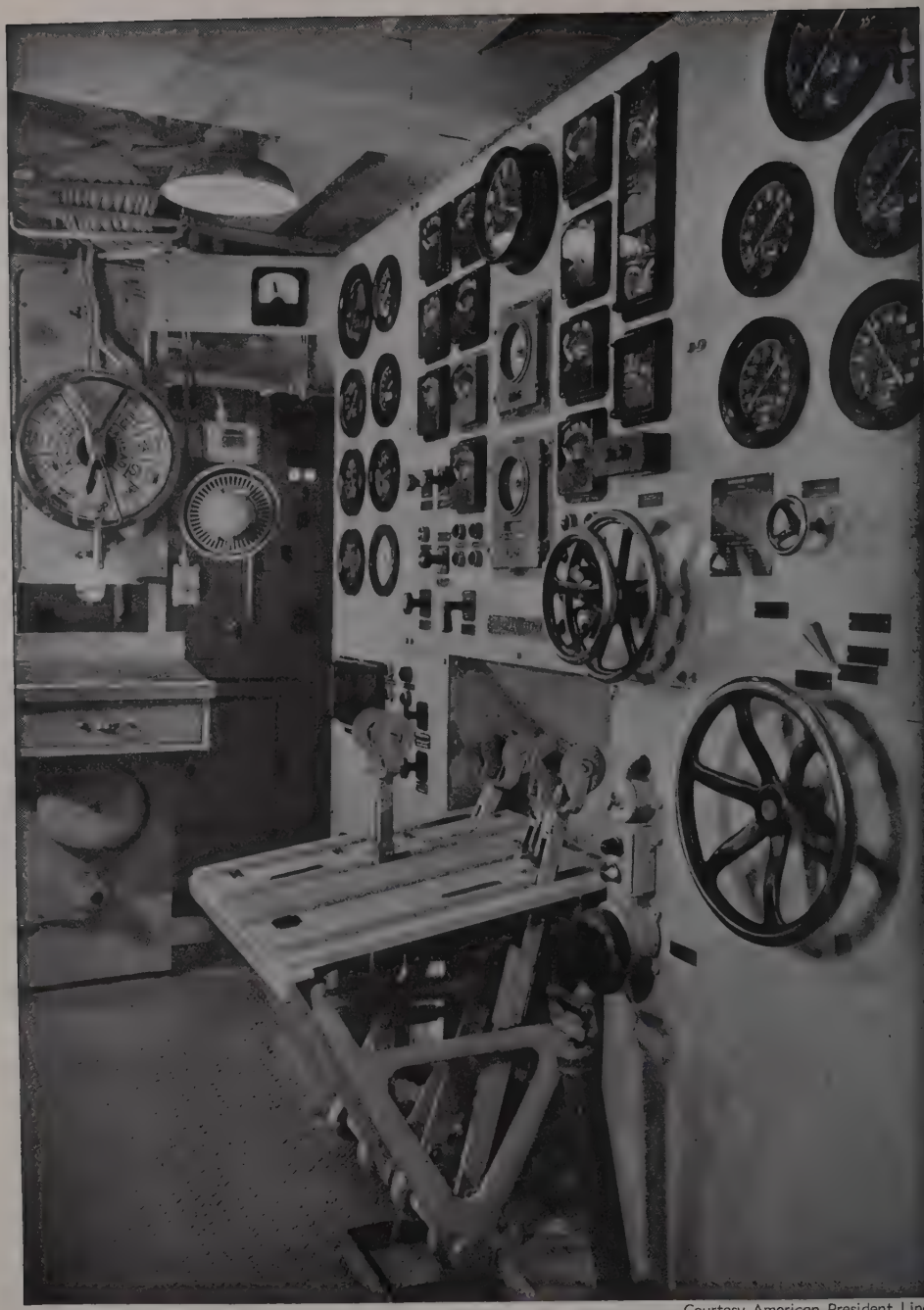
Courtesy Ajax Iron W

Fig. 6. Ajax marine engine.



Courtesy Combustion Engineering Company, Inc.

Fig. 7. Marine two-drum boiler as installed in the Maritime Commission's C-2 vessels.



Courtesy American President Lines

Main propulsion control panel in the main engine room of the S.S. *President Cleveland*.

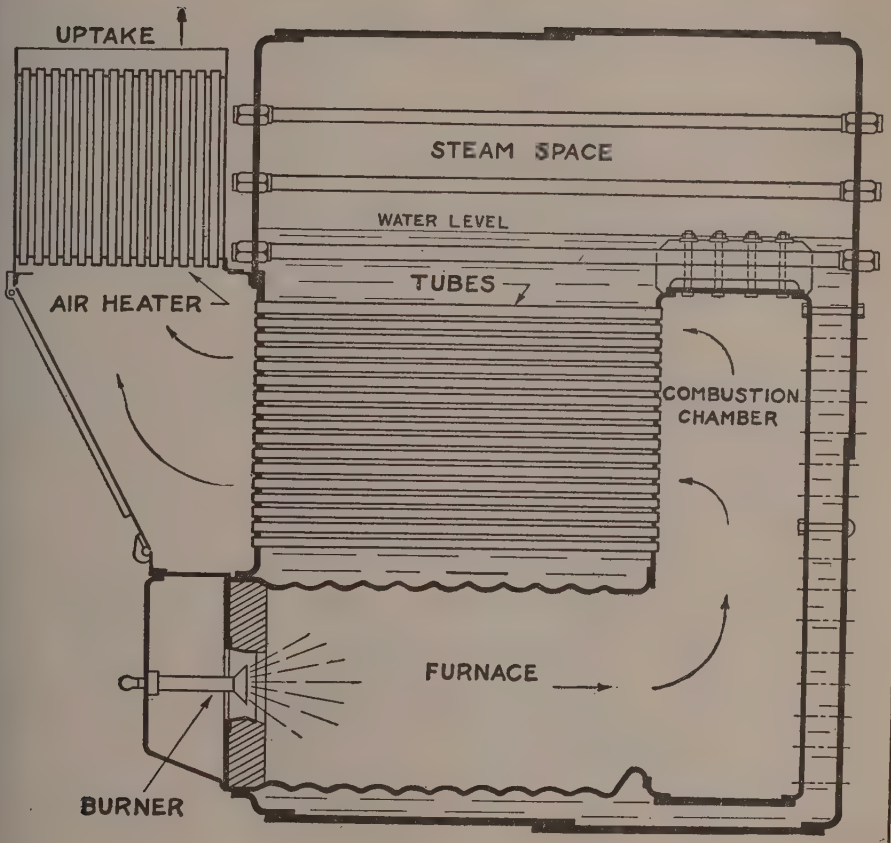


Fig. 8. Longitudinal Section of a Three-furnace Cylindrical, Return-tube (Scotch) Boiler.

between each engine and the gears so as to minimize the torque variations transmitted by the gear teeth. The two types of couplings used are the electromagnetic and the hydraulic.

(3) The *electric drive* is used primarily as a speed reducer. It permits the speed of the electric motor and propeller to be adjusted independently of the engine and generator speed. Electric energy used to drive the propulsion motor can be generated by any type of prime mover. However, steam turbines and internal combustion engines are the only engines used to any great extent in connection with electric drive. In ships of large powers alternating current is preferred to direct current on account of less weight and cost, and greater simplicity. The reduction in speed is obtained by designing a propulsion motor with more poles than the generator. Thus for alternating current the speed ratio between the generator and motor is fixed for any one pole arrangement. Although the Diesel engine has been used to some extent for alternating current electric propulsion the turboelectric plant is the outstanding example of this drive. On the other hand, direct current propulsion finds its greatest usefulness in Diesel-electric jobs.

Aside from the matter of speed reduction the electric drive has other desirable features. In either a-c or d-c jobs it gives full power astern without changing the normal ahead operation of the main engine. In the case of direct current it also gives an exceedingly fine control of power and speed. Also, the electric drive permits pilot house control of the propulsion motors. These last two features are particularly desirable for tugs and icebreakers.

Marine Boilers.—These are of two general types—*firetube* and *watertube*. The Scotch marine boiler, shown in Fig. 8, is the outstanding example of the firetube type. As the name implies, the hot products of combustion pass through the tubes. This type of steam generator is obsolete as far as new construction in the United States is concerned. However, many hundreds are in use in existing vessels. Contrary to this one principal type of firetube boiler, watertube boilers are manufactured in a variety of forms. In the past, each boiler manufacturer built a particular type which was referred to by its proprietary name, such as "Babcock & Wilcox." Since the various boiler companies now build all types, such designations are meaningless to one not already familiar with the boilers concerned. Fig. 9 is a diagrammatic sketch of a water-tube boiler showing the path of water and steam. It should be noted that there are three distinct sections of the boiler: (1) The *preheating section* generally referred to as an "economizer," because originally it was added to older designs in order to increase the economy of the boiler; (2) the *generator section* where the water vapor or steam is formed; (3) the *superheater* section where additional heat is added to the steam. The efficiency of a steam plant increases with increase in pressure and temperature of the steam. Therefore, boilers for modern steam plants must deliver steam at both high temperature and high pressure. Due to consideration of strength of materials the practical limits for a marine steam plant are 1,500 pounds per square inch and 950° F.

The obsolescence of the Scotch boiler is due mainly to its great weight and bulk, and the impracticability of building it for steam pressures higher than 220 pounds per square inch. However, the Scotch boiler does possess some advantages over the watertube such as its ability to use impure feedwater; also, its large volume of contained water makes it less sensitive to changes in rate of firing or feed control. The Scotch boiler is desirable in cases where weight, space and high thermal efficiency are not controlling factors.

Steam Turbines.—There are two basic types of steam turbines—*impulse* and *reaction*. In the impulse type the steam expands in stationary nozzles where the heat energy is converted to kinetic energy by virtue of the increase in velocity of the jet. The driving force is created by the impulse of the high velocity steam jet on the blades, similar to the action of a water wheel. In the reaction turbine the steam expands in the passages of the moving blades with a corresponding drop in pressure and increase in velocity. The reaction to the force required to accelerate the steam is the driving force on the blades. This is similar to the rocket effect of jet propulsion.

The characteristics of the two types of turbines are such that a greater change of energy occurs in a set of nozzles in an impulse turbine than in a blade row of a reaction turbine. Thus, impulse turbines are generally more compact than reaction turbines. All small turbines are of the impulse type, whereas large turbines may be either impulse or reaction, or a combination of both types. The combined turbine takes advantage of the fact that the impulse blades are more efficient at the high pressure, inlet end while the reaction blades are more efficient at the low-pressure end. In geared turbine drives the turbine is divided into two or sometimes three casings, which are actually separate turbines, through which the steam flows in series. This division of turbines reduces the load that any one reduction gear pinion must transmit. Also, the problems of thermal expansions and contractions are reduced by the smaller units.

Reversing turbines are required for direct or geared drives. The reversing turbine is a separate turbine mounted in the casing of the low-pressure turbine at the exhaust end. When the ship is going ahead the astern turbine runs idle opposite to its natural direction of rotation. The resulting drag on the ahead turbines is kept as small as possible by making the astern element compact without too much regard for its efficiency. When running astern the windage losses in the ahead turbines are considerable and the final power available for astern running is generally less than half the ahead power. However, this is generally sufficient. If for any reason full astern power is required from a turbine, the electric drive is advisable.

Reciprocating Steam Engine.—All modern reciprocating engines used for marine propulsion are of the multicylinder vertical inverted type. The primary difference in the various forms is one of valve action, that is, the manner in which the steam is controlled during the events of admission, expansion and exhaust. A secondary distinction relates to the different ways of arranging the cylinders and connecting the pistons to the crankshaft.

The *slide valve engine* is the most common type. The two-cylinder compound is used mainly in tugs with the triple expansion predominating in seagoing cargo vessels. The slide valve engine installed in Liberty ships has one slide valve per cylinder which controls admission and exhaust of steam at both top and bottom ends

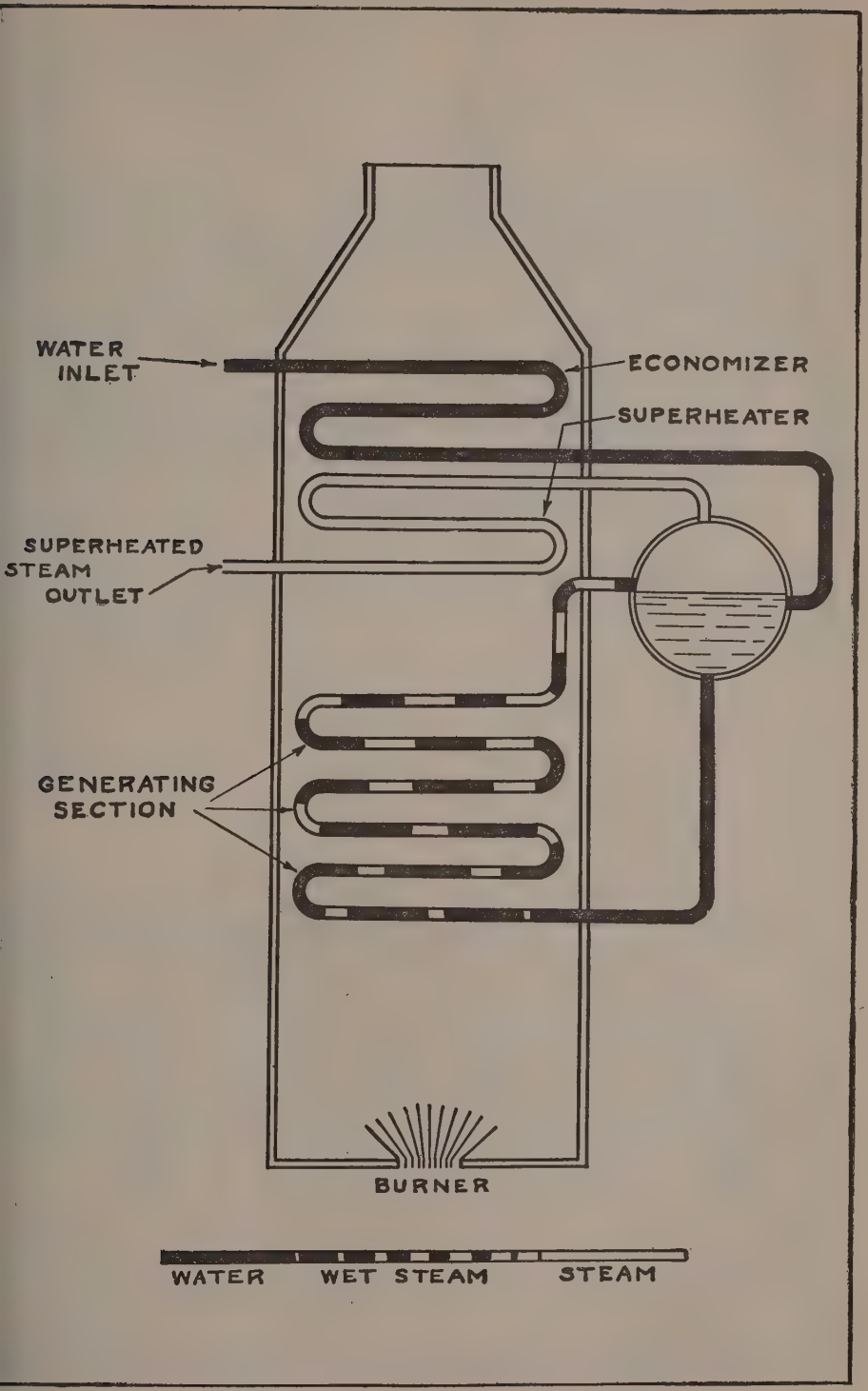


FIG. 9. Diagrammatic Representation of a Watertube Boiler.

Typical of all slide valve engines, it is simple and reliable but quite inefficient.

The *uniflow marine engine,* as built in the United States by the Skinner Engine Company, has a poppet valve at each end of the cylinder to control the admission of steam. The exhaust is controlled, as in all uniflow engines, by ports in the middle of the cylinder which are uncovered by the piston at the end of its stroke. The number of cylinders used ranges from 2 to 8. Each cylinder is independent in regard to steam flow; i.e., each cylinder receives a charge of steam at the beginning of the stroke and exhausts directly to the condenser. The poppet valves are operated by cams and can be controlled so as to give the much desired constant point of admission with variable cut-off.

Woolf Engine.—A development of the steam engine by Woolf in 1804 was a compound engine in which the high-pressure cylinder exhausted directly into the low-pressure cylinder. A recent revival of the Woolf principle occurs in the *Ajax engine.* The engine, as usually built, consists of 3 units on a 3-crank shaft. Each unit, is a steeple compound arrangement with the high-pressure cylinder on top of the low-pressure cylinder, both pistons being on the same rod. Each cylinder takes steam on one side of the piston only. The high-pressure takes steam on the bottom side and then on the down stroke exhausts directly to the top side of the low-pressure cylinder. The low-pressure cylinder is strictly single-acting uniflow and exhausts to a condenser attached to the side of the engine. One valve of the piston slide-valve type controls both admission to the high-pressure cylinder and the combined event of high-pressure exhaust and low-pressure admission.

The *Lentz engine* is a European development of the Woolf principle. It is built as a double compound engine having two high-pressure and two low-pressure cylinders. Each piston is on a separate crank with 180° crank angle between each high- and low-pressure cylinder. Thus the low-pressure cylinder of each unit is always moving opposite to its adjacent high-pressure cylinder. The steam to the double-acting pistons is controlled by poppet valves, six of which are required for each pair of cylinders. The only difference between the Lentz engine and an ordinary double-acting, poppet-valve counterflow is the manner in which the steam is exhausted directly from the high-pressure cylinder to the low-pressure instead of first being exhausted to a receiver and then being admitted to the low-pressure. This arrangement, however, gives a more efficient engine due to the elimination of the receiver and two valves between each pair of cylinders.

Reciprocating Engine Performance.—There is little difference in the relative heat efficiencies of the three engines just described; all of them are definitely superior to the standard slide valve engine. However, the attempt to increase the efficiency of any reciprocating engine by using higher-temperature steam aggravates the problem of lubricating the piston and cylinder walls. The serious aspect of the problem is not the actual providing of lubrication but the separation of the oil from the feedwater before it is returned to the boilers.

Warren Rotary Steam Engine.—Although this engine has no reciprocating parts, the driving torque is produced by direct steam pressure. The vanes on the rotor are virtually rotating pistons. Referring to Fig. 10 it will be noted that the steam is admitted from the center of the rotor to the spaces behind the vanes. By varying the opening of the port A any desired point of cut-off can be effected. Exhaust occurs when the vane uncovers the port "B." Steam is again admitted behind the vane when it has passed through the meshing space of the obturator. The cycle is similar to the uniflow engine with the compression event eliminated. The engine can be built with any desired number of stages having a total ratio of expansion greater than would be practicable in a reciprocating engine. The normal rotative speed of this type of engine is much less than that for a steam turbine. It can be coupled directly to electric generators and in case of a propulsion engine requires a geared speed reduction of only eight or ten to one for low propeller speeds and in many cases can be direct-connected. Although superheated steam can be used where high heat efficiency is desired, the engine is able to handle wet steam at the low-pressure end, and high ratios of expansion can be used without requiring highly superheated steam as in the case of a steam turbine. The chief advantage of this engine is the fact that it does not require internal lubrication and thus eliminates the problem of oil-contaminated feedwater which is common to all other pressure-type steam engines.

Combined Reciprocating Engines and Turbines.—Although some original designs have used reciprocating engines and turbines in combination, this arrangement is more common in conversion jobs where the power and efficiency of the propulsion plant have been increased by adding an exhaust turbine to the original reciprocating engine. The turbine must be connected through reduction gears to the propulsion shaft just aft of the main engine. In order to secure full benefit from the combination it is necessary to increase the original steam pressure and temperature and install a new condenser capable of producing a higher vacuum.

Diesel engines—of all general types are used aboard ship as either main engines or auxiliaries. For a more detailed discussion see INTERNAL COMBUSTION ENGINE; DIESEL ENGINE.

Thrust Bearing.—The interaction of the propeller and water produces a *thrust* on the propeller shaft. A special *thrust bearing* must be fitted in the shafting between the propeller and engine, or gears, so that this axial force which propels the vessel will be transmitted directly to the hull instead of to the propelling machinery. The modern type of thrust bearing consists of a collar on the shaft which bears against Babbitt-faced shoes secured to the casing of the bearing. The casing is bolted firmly to the hull. Since the shoes are on both the forward and after sides of the collar the propeller thrust will be transmitted to the hull whether going ahead or astern.

Propeller.—Although the form of a screw propeller is similar to the helicoidal screw thread, the action of an individual propeller blade can be considered as a rotating airfoil. The thrust produced by a marine propeller is directly comparable to the lift of an airplane wing. (See AERONAUTICS.) Propeller design is based on tests of scale models made either in open water or in closed variable pressure tunnels. In comparing the behavior of a model and the full size pro-

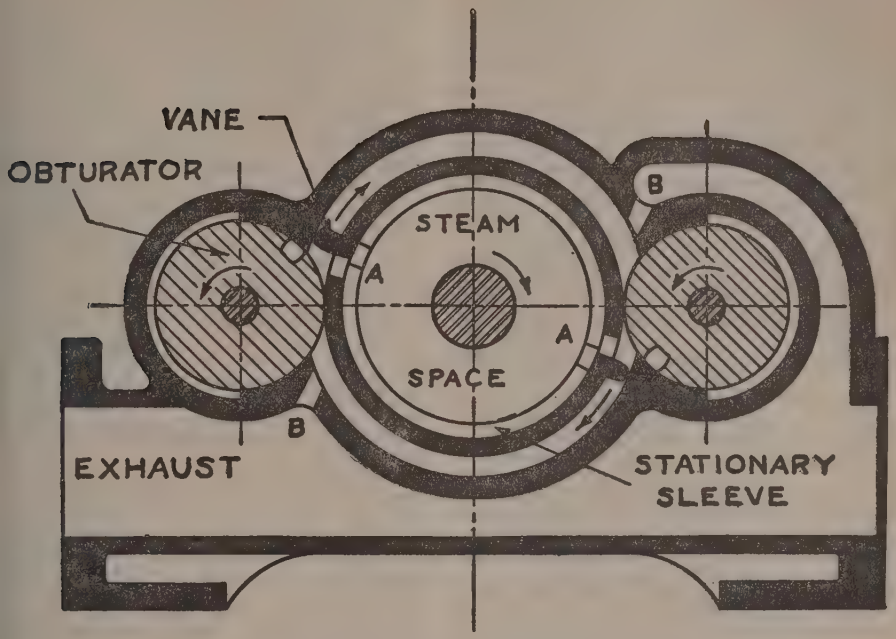


Fig. 10. Warren Rotary Steam Engine.

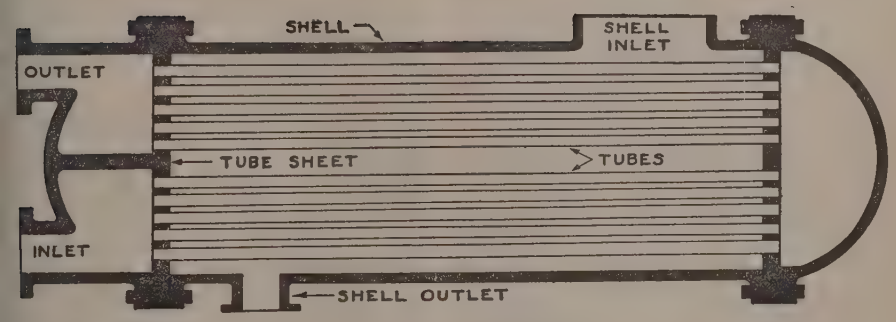


Fig. 11. Typical Heat Exchanger.

peller it is necessary to consider the effect of propeller size upon such quantities as thrust, power and torque. A study of dimensional analysis[1] reveals the conditions under which a model must be operated so that its performance can be used to predict full size performance. For instance, one of the conditions is that the ratio of the pressure acting on the model to the pressure acting on the full size must be the same as the ratio of their linear dimensions. That is, if the full size propeller has a diameter 20 times the diameter of the model, the pressure on the model must be one twentieth that on the full size. Since pressure acting on a ship's propeller is mainly atmospheric, it is necessary to operate the model in a partial vacuum to obtain comparable pressure conditions. Fortunately, this pressure relationship does not appreciably affect any of the propeller properties except cavitation (*cavitation* occurs when the flow of water to the propeller fails to follow the blade outline) and most testing can be conducted under atmospheric pressure.

Auxiliaries.—*Heat exchangers* include such items as condensers, evaporators, feedwater heaters, fuel oil heaters and lubricating oil coolers. Shell-and-tube construction, as illustrated in Fig. 11, is typical for all of these units. Of course, the shape, proportions and details of design will vary for each type of service, but all of them are based on the principle of transferring heat from one medium to another through the walls of the tubes. In the case of heat transfer between condensing steam and water more efficient transmission will be effected if the water is confined to the tubes so that the velocity of flow along the tube walls is uniform.

The *electric plant* aboard ship is becoming more important as the shipboard uses of electricity continue to expand. The first general use of electricity aboard ship at the beginning of the 20th century was confined to lighting. On small cargo vessels the "dynamo" would be shut down during the day and oil lamps would be used in the engine and fire rooms. On modern vessels electric power is as common as on shore with additional uses such as the gyrocompass, automatic steering and other navigational aids. In some vessels all auxiliaries and hull machinery are driven by electricity. Direct and alternating current are both used, with direct current predominating, except in later naval vessels. The electric generators for auxiliary use are generally driven by geared steam turbines or Diesel engines. Small size generators, particularly those in older ships where they are referred to as dynamos, are driven by single cylinder reciprocating steam engines.

Pumps.—The *pump* is probably the oldest piece of mechanical equipment in marine use. In the development of marine engineering many new types have been invented. The centrifugal and other rotary types are desirable on account of compactness, uniform flow and because they can be driven directly from the shaft of an electric motor or steam turbine. However, the reciprocating piston type pump driven by direct-acting steam pistons is still common. The efficiency of the piston pump is high, but the steam end of a direct-acting pump is very inefficient. The desirable features of the piston pump are retained in the *power pump* which gives an efficient drive by using a system of gears, crankshaft and connecting rod to connect an electric motor to the reciprocating pistons.

Fuels.—Oil is the supreme fuel for marine service. It is the only practicable fuel for internal combustion engines and is superior to coal for use in steam generators. For equal heat values the space required for oil is about 65 per cent of that required for coal. Also, oil can easily be stowed and removed, as required, from double bottoms and tanks located in remote parts of the ship, whereas coal must be bunkered reasonably close to the fireroom in space that is valuable for cargo or other purposes. Hand firing of coal requires considerable labor and is generally very inefficient. In the case of mechanical stokers and pulverized coal installations the labor involved will be about the same as that for oil burning, as far as the actual firing of the coal is concerned. However, there will be additional labor in trimming coal bunkers and feeding the hoppers of the pulverizers or stokers. In the matter of boiler design, oil firing imposes fewer restrictions on the size and shape of the boilers. This is a very important feature in the higher powered vessels.

For additional information on machinery used aboard ship see: ENGINE; PUMPS and PUMPING MACHINERY; STEAM ENGINE; TURBINE.

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MARINE INSECTS. Insects have not only invaded rivers and lakes, they have established themselves to some extent at least, along the margin of the sea. On a sunny day by the shore myriads of flies may be seen hovering over the seaweed cast up by the tide. These have been developed from grubs which live and feed in the decaying weed, and are able to bear immersion twice daily. Around the rock-pools many midges may be noticed. Their grubs feed on growing green seaweed, and spend their whole life in the salt water, breathing the dissolved air, as do their fresh-water relations, by means of gill-filaments, or simply through the surface of the skin. Many species of beetles inhabit the shore, and are submerged twice daily, when they lurk under stones or burrow into the sand; the hairy bodies are not easily wetted, and in one of the best-known marine beetles (*Aëpus*) there are paired air sacs in the hind-body which are believed to act as reservoirs for breathing while the tide is up. Several kinds of very small springtails may be seen on the surface of the rock-pools at low tide; probably when the water rises they retire into crevices of the rocks. They are covered with a very fine, dense pile, and it seems impossible to wet them.

The absence of wings is a common character

[1] "Dimensional Analysis of Model Propeller Tests" by Edgar Buckingham, *Journal of the American Society of Naval Engineers,* vol. XLVIII, No. 2, May 1936.

mong the seashore insects. The beetles of the enus *Aëpus* are wingless, and so is the small ug *Aëpophilus* often found in their company, s well as the female of the midge *Clunio,* whose iate, though winged, appears not to fly, but to se his wings as sails as he skims over the sur- ice of the rock-pools. "The tendency of insects n oceanic isles to lose their wings has often een noticed," says G. H. Carpenter, "and the loss f the power of flight explained as an advantage, nce insects which do not fly cannot be blown ut to sea. Possibly the absence of wings in so any seashore insects can be explained in like anner. Several genera of pond skaters have ne or two species which frequent the water of stuaries and harbors; these are in all cases ingless, though their fresh-water relations are, s a rule, winged."

The extreme of adaptation to marine life is nown by the bugs of the genus *Halobates,* also elonging to the family Hydrometridae, with ieir short anchorlike forelegs and their im- ensely long and slender middle and hind-legs, ie middle shin and foot being fringed with ng hairs. The elongate wingless fore-body of iese insects and the greatly reduced hind-body ive them a most peculiar and characteristic ppearance, and the dense pile wherewith they re clothed keeps them dry. They have been bserved gliding over the calm seas of the opics, often hundreds of miles from land, or inging to drifting substances whence they could ick food.

MARINE INSURANCE. See INSURANCE, ARINE.

MARINE SEDIMENTS, those laid down the ocean, in contrast to terrestrial deposits id down on land. They are usually character- ed by uniformity in thickness and character er rather large areas, and commonly contain ssils of animals known to live only in the sea. he common types are conglomerates, sandstones, ales and limestones. See also OCEAN, THE; ction on *Submarine Geology* in article on EOLOGY, and section on *Sedimentary Rocks* in rticle on ROCKS.

MARINER'S COMPASS. See COMPASS, ARINER'S.

MARINES IN FRANCE IN 1918—Bel- au Wood, Soissons, etc.—On May 31, 1918, e Second Division of the American Expedition- y Forces was selected to go to the relief of the rench Army retreating before the German ive. The Fifth and Sixth Regiments and the ixth Machine Gun Battalion of United States arines, forming the Fourth Brigade of the Sec- nd Division, commanded by Brigadier General mes G. Harbord, were in reserve in a rest ea at Montdidier, when the order to the front rrived. Reaching their destination in the early orning of June 1, they moved into line in pport of the French. It was the opening of e Battle of Chateau Thierry, and found the erman advance facing the Americans. Hill 165 as the enemy's objective, but the marines as xpert riflemen "calmly set their sights and med with the same precision that they had own upon the rifle ranges at Paris Island, are Island and Quantico." Their machine guns so took up the fire.. The artillery soon backed the riflemen and, with shrapnel, added to the killing power; the Germans ran to cover raked by the American fire. This day's battle halted the German drive on Paris. But the city of Chateau Thierry remained in the enemy's hands; its liberation involved prior capture of the Bois de Belleau which was very strongly fortified, as were the flanking villages of Bouresches and Torcy. On June 6 at 5 P.M. the marines, attack- ing with the bayonet, captured Bouresches and penetrated Belleau Wood. The Germans resisted fanatically, but the marines with their associated infantry brigade so exhausted the three enemy divisions (197th, 237th and 10th) that the 5th Guards, and then the 28th, had to be thrown in as reinforcements. Thus, five German divisions were consumed in a three-week conflict. The last enemy nests were captured on the 28th. In the Aisne-Marne campaign launched on July 18 the brigade fought again brilliantly near Soissons, then in the St. Mihiel campaign of mid-Septem- ber. Early in October they defeated the Ger- mans once again east of Reims. The brigade's total casualties amounted to nearly 400 officers and 12,000 enlisted men. Distinguished Service crosses were awarded to 644 of its members.

MARINETTE, măr-ĭ-nĕt', city, Wisconsin, Marinette County seat, altitude 595 feet, is lo- cated on Green Bay, at the mouth of the Me- nominee River, on the Chicago and North West- ern and the Chicago, Milwaukee and St. Paul railroads, opposite Menominee, Mich., with which it has car ferry service across Lake Michigan to Frankfort, Mich. Its manufactures include wood products, excelsior, gloves, pulp wood insulation, cardboard boxes. It has docks for small craft on the river, which flows through the center of the city, and a harbor for lake steamers. The city has a considerable lake traffic, and is a point of entry for the 37th customs district. The site of the first local sawmill is preserved as a monu- ment to the city's early days, and there is a monument to United States Senator Isaac Stephenson (1829–1918), pioneer lumberman. Marinette was settled in 1830 on the site of an Indian village, was named for Queen Marinette (Jacobs) of the Menominee tribe, the wife of a fur trader, and received its city charter in 1887. Government is by mayor and council. Pop. (1950) 14,178.

MARINUS I or **MARTIN II,** pope: r. 882–884. Of Roman birth he was ordained a deacon and sent on three embassies to Constan- tinople at one of which he presided as legate over the Eighth Ecumenical Council (869). He suc- ceeded John VIII who had made him bishop of Caere (Cerveteri) and treasurer of the Holy See. He absolved Formosus (q.v.) of all cen- sures but condemned Photius (q.v.). Because of friendship for Alfred of England he freed the headquarters of the English in Rome from all taxes.

MARINUS II or **MARTIN III,** pope: r. 942–946. A Roman cardinal, he was elected through the power of the prince, Alberic, and in- stituted reforms, aided monastic development, and helped the poor. He was impotent as a temporal ruler.

MARIO, Giovanni Matteo, MAR- CHESE DI CANDIA, dē kän'dyä, Italian tenor: b.

Cagliari, Sardinia, Oct. 17, 1810; d. Rome, Dec. 11, 1883. After serving in the Sardinian Army he went to Paris, where after two years of musical study he was appointed first tenor of the opera, changing his name at the same time from Di Candia to Mario. He made his debut Nov. 30, 1838 as Robert in *Robert the Devil,* and soon became the leading tenor of the world. Among his chief roles were Otello in Rossini's *Otello;* Almaviva in *Il Barbiere di Siviglia;* and Manrico in *Il Trovatore.* He married the famous singer, Giulia Grisi, in 1854, and together they made an operatic tour of the United States. In his later years, after his retirement from the stage in 1867, he lost his fortune through speculations, and in 1872 again made a concert tour of the United States.

MARIOLATRY. See Mary.

MARION, măr'ĭ-ŏn, **Francis,** American soldier: b. near Georgetown, S. C., in 1732; d. Pond Bluff, Feb. 26, 1795. He was the youngest in a family of six children. His grandfather, Benjamin Marion, was a Huguenot exiled from France in 1690. At 16 Francis showed his adventurous disposition by embarking on a small vessel bound for the West Indies. It was wrecked and he barely escaped death by starvation. He returned home and worked several years on a farm. In 1759–1761 he served in campaigns against the Cherokees. Thenceforth until 1775 he lived on his plantation at Pond Bluff in the parish of Saint John.

In 1775 Marion was elected member from Saint John in the South Carolina provincial congress, which adopted the bill of rights and voted money for raising troops. He was chosen captain (June 21, 1775) and took the field against the British and the Tories. He took part in the capture of Fort Johnson (Sept. 14, 1775), and because of his ability in organizing and discipline was promoted to major. He participated in the patriot victory (June 28, 1776) at Charleston, which gave the Southern States respite from active fighting for nearly three years. Appointed lieutenant-colonel, he led his regiment in the unsuccessful attack on Savannah (September 1779). In 1780 Marion, now a brigadier-general, was obliged to take refuge in forest and swamp. Beginning with a handful of men, less than 20, he gathered recruits, fearless riders and good marksmen, who formed the famed "Marion's brigade." At times they numbered several hundred. They came and went at their leader's bidding, providing their own equipment and rations. Part of the time they were at work on their farms, planting crops. These rough and ready troopers became the terror of the British regulars and the Tories, although in justice to Marion's men it should be said that they committed no acts of wanton cruelty and burned no buildings on Tory homesteads. The stories of his adventures read more like fiction than history. His scouts kept close watch of the enemy's movements, and detachments of the brigade struck blow after blow, surprising and capturing small parties of soldiers. At times they united with larger bodies of troops for important engagements. After a vain pursuit, Sir Banastre Tarleton named Marion the "Swamp Fox." Failing in his attempt against Georgetown (December 1780), he retired to Swan Island and prepared for a second attack (Jan. 13, 1781), which was also unsuccessful. Then he joined with Col. Henry Lee in reducing Fort Watson (April 1781). After raiding 200 miles of country he commanded the first line in the battle of Eutaw Springs and took many prisoners. For his gallantry in this engagement he received the thanks of Congress. From 1782 to 1790 Marion served in the State senate and was a member of the State Constitutional Convention in 1790. He opposed harsh treatment of the Tories and condemned the Confiscation Act of 1782. In 1784 he married a wealthy cousin, Mary Videau, who survived him with no children. He was a man of attractive personality. Of slight figure, he was capable of great endurance and accustomed to abstinence. As a leader he was admired and beloved. He justly ranks among the heroes of the American Revolution.

MARION, city, Illinois, Williamson County seat, altitude 419 feet, is located 45 miles south of Mt. Vernon, on the Illinois Central; Missouri Pacific; and Chicago and Eastern Illinois railroads. It has local and county airports. To the west is Crab Orchard Lake (25,000 acres) a federal project, a large industrial area, and national wild life refuge. A United States Veterans Hospital adjoins the city. Blasting powder, mine drills, batteries, stencil machines, electric capacitors, armatures, transformers, refrigerator parts, plastics, furniture, ice cream, and ice vending machines are manufactured. Robert G. Ingersoll and John A. Logan (qq.v.) lived in Marion. Pop. (1950) 10,459.

MARION, city, Indiana, Grant County seat, altitude 811 feet, is located 28 miles northwest of Muncie, on the Pennsylvania; Chesapeake and Ohio; New York Central; and Toledo, St. Louis and Western railroads. It has an accredited airport. It is an industrial city in a farm area, with gas and oil wells nearby. Among its manufactures are insulated wires and cables, bottles, radios and equipment, automobile accessories, shoes, and paper products. The city government is administered by a mayor, a council, and a board of public works. It is the seat of Marion College (coeducational). The first land entry in Marion was made in 1825. Grant County, organized in 1831, was incorporated in 1839. The city was incorporated in 1889. It was named in honor of Gen. Francis Marion (q.v.). Pop. (1950) 30,081.

MARION, city, Iowa, Linn County, altitude 848 feet; is located on Indian Creek; 6 miles northeast of Cedar Rapids; on the Chicago, Milwaukee, St. Paul and Pacific Railroad, of which it is a division point, with shops and yards. It is in a region producing general crops, cattle and hogs. Its fine shade trees have won for it the nickname of Grove City. Marion was once the county seat; Cedar Rapids now holds that position. A mill built in 1863 is still operating, and there are in the city chick hatcheries, an aluminum factory, and a factory making sack balers. Marion was settled in 1839, and was named in honor of Gen. Francis Marion. Pop. (1950) 5,916.

MARION, city, Ohio, and Marion County seat; altitude 986 feet; 46 miles north of Columbus; on the Erie; Cleveland, Cincinnati, Chicago, and St. Louis; and Chesapeake and Ohio

ailroads; with a municipal airport. In a farm egion it is a railroad and manufacturing center, amous since 1874 for its steam shovels, tractors, oad rollers, and farm implements. Railroad hops, foundries, and factories making steel aults, steel bodies, locks, ornamental glass, silk oods, dresses, cigars, dairy and soybean prodcts are here.

At the age of 19, Warren G. Harding (q.v.) ecame proprietor of the Marion *Star*. The ouse in which he campaigned for the presidency 1 1920 is preserved as Harding Museum; and a ile south is the handsome Harding Memorial.

An early settler, Jacob Foos, found a fine ater supply at this site. After two years as acob's Well, the place was named Marion in 822 and became county seat. Marion became city in 1890. Pop. (1950) 33,817.

MARION, town, South Carolina, and larion County seat; altitude 68 feet; 21 miles ast of Florence; on the Atlantic Coast Line ailroad. It is the business center for a cotton, bacco, and timber region; local industries proice cotton yarn, cottonseed oil, veneer, boxes, ment blocks, clothing, lumber, and brick.

Marion was settled in 1800 as Gilesboro; in 30 it was renamed Marion, honoring Francis arion, the "Swamp Fox" of the American evolution. It was incorporated as a city in 00. Pop. (1940) 5,746; (1950) 6,834.

MARION, town, Virginia, and Smyth County at; altitude 2,124 feet; in the Walker Mouns; on Holston River; 45 miles northeast of istol; on the Norfolk and Western Railroad. is in a cattle, corn, Burley tobacco, and lumber gion, with limestone and manganese deposits. arion has manufactures of furniture and tool ndles, baseball bats, brick, shirts and shorts, d silk hosiery.

Here are Marion College, a junior college for ls, and the Southwestern State Hospital for e insane. The hero of King's Mountain, Gen. illiam Campbell (q.v.), is buried here. Sherod Anderson is also buried here. His son, bert Anderson, is the editor of Marion's ekly paper.

First settled in 1750, Marion became a town 1832. Three miles north is Hungry Mother ate Park. Pop. (1950) 7,000.

MARION ISLAND, in the Indian Ocean, a dependency of the Union of South Africa. is 13 miles long and 8 miles wide.

MARIOTTE, mȧ-ryôt', **Edme,** French ysicist: b. probably in Dijon, ?1620; d. Paris, ance, May 12, 1684. He lived for the most rt at Dijon, and was made prior of Saintrtin-sous-Beaune. He became a member of Academy of Sciences upon its formation, and s one of the founders of experimental physics. is Mariotte," said Marie Jean de Caritat larquis de Condorcet), "who first in France roduced into physics a spirit of observation l of doubt." He discovered independently the known by his name, also discovered by bert Boyle (q.v.), and known as Boyle's Law.

MARIOTTE'S LAW, *in physics,* the prinle that the volume of a gas, under constant, t is, unchanging, temperature and pressure, ies inversely as the pressure. It is identical with Boyle's Law (q.v.), the latter name being applied to it in the United States and England, and the former in continental Europe.

MARIPOSA GROVE, a stand of big trees in Yosemite National Park, California. It contains about 465 trees of the *Sequoia gigantea,* some of which are thousands of years old. One of the largest specimens is the Grizzly Giant, with a main limb over six feet in diameter at 200 feet above the earth and a circumference of 96 feet. The tallest tree is 272 feet high, and several are over 250 feet. A roadway 9½ feet wide has been cut through the heart of one of the giants.

MARIPOSA LILY or **BUTTERFLY LILY,** popular names for various species of *Calochortus* of the family Liliaceae. The numerous species, all of which are natives of western United States and British Columbia, are characterized by coated corms; rather leafy, generally branched stems; and showy, six-segmented flowers. Almost all the species are in cultivation for ornament, some, natives of the Colorado Desert, being suited to arid conditions, others to fairly moist soils, still others to very cold localities, as species indigenous to the Sierra Nevada. All will stand extreme cold, but not alternate freezing and thawing, hence their failure under such conditions. The bulbs should be planted in late autumn in any kind of soil. After the tops have become yellow subsequent to flowering in the following year the bulbs should be taken up, divided, and kept dry until planting time.

MARIQUINA, mä-rê-kē'nä, town, Philippine Islands in the province of Rizal, Luzon, eight miles northeast of Manila. It is situated at the intersection of several main highways, has shoe and leather factories and medicinal iron springs. Pop. (1948) 23,353.

MARIS, mä'rĭs, **Jacob,** Dutch painter: b. The Hague, Aug. 25, 1837; d. Carlsbad, Austria, (now Czechoslovakia) Oct. 7, 1899. He began his art studies at the local academy, choosing landscape as a specialty. He studied also under Nicaise de Keyser, director of the Antwerp Academy. Going to Paris, he received instruction from Antoine Auguste Hébert; he came under the influence of the Barbizon school, and reached his full power as a painter of figures and landscape in combination. In 1871 he returned to his native town. His brush work and use of chiaroscuro are essentially French.

Among his numerous works are *View of a Town in Holland; View of Schiedam; On the Sea Shore; Mother and Children.*

MARIS, mä'rĭs, **Matthijs,** Dutch painter, brother of Jacob Maris (q.v.): b. The Hague, Holland, Aug. 17, 1839; d. London, England, Aug. 22, 1917. In his youth he traveled and worked with his elder brother; in 1855 they lived in Antwerp sharing quarters with a young student named Lawrence Alma-Tadema (q.v.); in 1860 the brothers studied and sketched in Germany and Switzerland; in 1870, in Paris, Matthijs was enrolled in the National Guard and performed military service during the siege. Shortly after he settled in London, where he remained till his death. He was a striking example of the so-called "artistic temperament"; he

painted what he liked and when he liked, with the result that his works are extremely scarce. His work is characterized by fine qualities of color and imagination. At sales his pictures brought very high prices; two of them fetched $33,075 in London in 1906; one produced $17,850.

Willem Maris, a younger brother, was also a painter of note (b. The Hague, Feb. 18, 1844; d. Amsterdam, Oct. 11, 1910). He received his training from his brothers and was the most truly Dutch in his artistic sympathies. A sunny optimism pervades his work, expressed in wide skies, brilliant sunshine and gay coloring.

MARITAIN, mȧ-rē-tăn′, **Jacques,** French philosopher: b. Paris, Nov. 18, 1882. Baptized in the Protestant faith, he first came, when a student at the Sorbonne, under the influence of the professor of biology, Félix Alexandre Le Dantec, and then was weaned away from determinism and crass materialism by the philosopher Henri Bergson. He became a Catholic in 1906, and, after one year at Heidelberg, gave himself to the study of Thomistic philosophy. He was professor of philosophy at the Institut Catholique, Paris, visiting professor at the Institute of Medieval Studies, Toronto and at several American universities. He was in the United States at the outbreak of World War II and was one of the first French abroad to join the de Gaulle movement, which paved the way for his appointment in 1945 as French ambassador to the Vatican. His books are devoted to a technical exposition of scholastic philosophy in its Thomistic form, and to an application of Thomistic principles to politics, art, education and religion.

His first work, *La Philosophie bergsonnienne* (1914), was a criticism of Henri Bergson's theory of intellectual intuition; in *Reflexions sur l'intelligence et sa vie propre* (1924), he challenged Maurice Blondel's apparent distrust of abstraction and speculation; in *Three Reformers: Luther, Descartes, Rousseau* (tr. 1929), he denounced the fountainhead of modern subjectivism. *The Degrees of Knowledge* (tr. 1937), which may be considered his main work, contrasts the modern mathematical approach to the study of nature with the ancient metaphysical approach. His *Preface to Metaphysics* (tr. 1939), comprises lectures on being and its transcendental properties viewed as the basic principle of speculative thinking. What may be called his political treatises—*Things that are not Caesar's* (tr. 1930), *Freedom in the Modern World* (tr. 1936), *True Humanism* (1938), to mention but a few —are inspired by the preoccupation of safeguarding the dignity and rights of man against the encroachments of the modern totalitarian conception of the state and breathe a fervent democratic spirit, while *Art and Scholasticism* (tr. 1930), *Prayer and Intelligence* (1928), and *Religion and Culture* (1930) as well as *Education at the Cross-Roads* (1943), are typical of the manner in which the author translates into life and action the fundamental tenets of his philosophy. *Ransoming the Time* (tr. 1941), a collection of diverse essays, deals with one essential theme: the reconciliation of human conflicts through Christian wisdom.

MARITIME ADMINISTRATION. See Commerce, Department of.

MARITIME LAW. Broadly speaking, the subject matter of any action over which Admiralty Court could take jurisdiction shou be considered a topic of the Maritime Law. this definition prize cases would be include but the right of capture and other belligere rights on the high seas in time of war, the i munities of neutral shipping and cargoes, co traband traffic, etc., more properly consider are topics of International Law (q.v.). Ho ever, overseas commerce being internatio there is little in the *lex maritima* which has n an international aspect. The maritime law Great Britain and the United States is rooted the usages and customs of merchant seafare shipmasters and seamen, which are of remo antiquity and have been preserved in the Co and Digest of Justinian and other compilatio hereafter mentioned. The oldest repository England of this law was the *Black Book the Admiralty,* written in Norman French a dating partly from the reigns of Edward and Richard II and partly from the reigns Henry IV, Henry V and Henry VI, "long fore any controversies arose between the A miralty and King's courts about foreign co tracts, whereof they had been in peaceable p session time out of minde" (Prynne's *Anim version on the Fourth Part of Coke's In tutes,* 1668). An early record of the admin tration of maritime law in England is found the Domesday of Ipswich, 17 Edward I (A 1289). The *Black Book* has disappeared an English manuscript, which was in the libra of the Coilege of Advocates at Doctors' Co mons until the dispersal of the college in 18 had in recent years done service for the l original. The substantive sea law of the *Bla Book* is contained mainly in a transcript the Laws of Oléron. This last-named compi tion, which takes its name from an island the west coast of France, near Rochefort, is e tant in several manuscripts. The oldest of th written in a mixture of old French and Gasc and now in the Guildhall at London, where was brought from the archives of Bordeau probably dates from the end of the 13th c tury. The compilation is much older, no doul for the Laws of Wisby, by which the mercha of the Hanse towns and other German, Scan navian and Russian trading communities on t Baltic and North Sea regulated their condu are mere condensations of the Laws of Olér —and the Hanseatic League was formed in 12

A more complete code of sea laws than eith of those mentioned is the *Consolato del Ma* of uncertain age and pedigree. Hugo Grot asserts that it was compiled at the order of t "ancient Kings of Arragon," whereas Domeni Alberto Azuni and others claim it to have be the work of Pisan lawyers. Both may be rig The *Consolato del Mare* was evidently not co piled at one sitting; its matter is drawn from ma sources, including the Roman *corpus juris* and t laws and customs of Italian, French and Spani marts of commerce. While not completed u til the 14th century, the extant form is apparen the resultant of accretions to a nucleus da ing back possibly to the 11th century. An how, a *lex maritima* had become genera recognized in Europe toward the end of t 12th century and its distinction from the co mon law of England, as asserted by Willia Prynne, who is quoted above, is testified to an early rescript of the *Black Book* providi

that "all those who doe sue any merchant, mariner or other person whatsoever at common law of the land for any thing of auntient right belonging to the maritime law . . . shall be fined to the king for his unlawful and vexatious suite." The extent to which the ancient compilations have maintained their authority may be estimated from the fact that a fragment of the law of Rhodes, embodied in the Digest of Justinian and transcribed into the Consolato, states as correctly as any recent textbook the modern law of jettison and general average, while the fabric *de nautico foenore* (Dig. 22, 2; Code 4, 33) gives the present rules on bottomry and respondentia with absolute exactness.

The principal topics of Maritime Law (see articles under separate titles) are: Affreightment, under which head may be included the law governing contracts of shipmasters to carry freight and their resulting responsibilities as common carriers; Barratry, a sea crime which is committed when a master or crew do any unlawful acts tending to their advantage and to the detriment of the owner of a vessel — mutiny is an extreme form of barratry; Bill of Lading (q.v.; also COMMERCIAL LAW and NEGOTIABLE INSTRUMENTS); Bottomry. a form of contract whereby, figuratively, the keel or bottom of a ship, but in reality the entire vessel, is hypothecated to secure the repayment of money loaned, or to pay for repairs done or materials or supplies furnished and necessary to enable the vessel to complete a voyage; Charter-party, a contract of affreightment whereby the owner agrees, not to carry a particular consignment, but to let the whole or part of his ship to a merchant or other person for a particular voyage; Collision, under which title the rules for the assessment and apportionment of damage resulting from careless navigation are collected; Demurrage, the money required to be paid by the charterer for a vessel in compensation to the owner for her detention beyond the time agreed to for the loading or unloading of a cargo; General Average may be defined as contributions to be made by all parties interested in a ship or her cargo to make up the losses arising in consequence of an extraordinary sacrifice — for example, the jettison of part of her cargo — as the means of preserving from destruction the vessel or the rest of the goods she carries; Marine Insurance (q.v.) is a comparatively recent development of maritime law; the first policies it is said were issued by the Florentine merchant princes of the house of Medici; Pilotage, the practice of the pilot's profession is governed by local usages peculiar to each port and by legislative acts, which, in the United States, may take the form of either Federal or State laws; Registry of vessels and the transfer of ownership or flag, practically all matters under this head being regulated by statute in each country; Salvage, a compensation due to a person through whose gratuitous exertions a vessel or its cargo had been rescued from the perils of the sea; Wharfingers, properly "wharfingers," the owners, occupiers or custodians of a wharf.

All contracts of a maritime character are cognizable by the maritime law and enforcible by the courts administering the same. In the enforcement of contractual obligations arising out of the relations between insurer and insured or shipper and carrier or owner and charterparty, the common-law courts as well as the courts of admiralty might take jurisdiction. But in a case of bottomry, collision, general average or salvage, where the common law of the land and the law of the sea widely diverge, the jurisdiction of the maritime tribunals is paramount. Obligations *ex delicto* are justiciable in courts of admiralty when the wrong was committed within their territorial jurisdiction. This jurisdiction extends to the high seas, the national territorial waters where the tide ebbs and flows and other navigable water connects with and leading to tidewater. In the United States admiralty jurisdiction may extend even to navigable waters disconnected from the sea and situated entirely within a single State. The Federal District Courts exclusively have original jurisdiction in admiralty cases. Under the maritime law no more than under the common law could there be a recovery of damages for death negligently caused. Such recovery is now permitted by statutory enactment; but the limitation of owner's liability to the value of the salvage from the wreck in which the death occurred and to the freight money earned makes the statutory relief granted practically valueless. The English law on the subject is more liberal, though, where a calamitous loss occurs and the claimants are many, the total amount of damages recoverable is too small to be compensatory in any proper sense. In fact, it is possible that the limitation by law and distribution by insurance of the risks incident to maritime commerce may have too thoroughly eliminated the motive of self-interest as a factor in the promotion of efficiency and safety. When a ship is lost its owner may make a profit, receiving more than its value from the insurer; similarly, the merchant may, and often does, get more from the underwriter than the value of a cargo lost; the underwriter averages his losses and, on the whole, makes a profit out of his business. The laws for the inspection of vessels, the licensing of masters and other officers, the rules of navigation and concerning lights and other signals and the statutes prescribing imprisonment and other heavy penalties for neglect to observe these laws and regulations or supply the minimum life-saving equipment do not seem to provide an incentive equal to that which would be provided by the risk of an uninsurable total loss or unlimited liability for carelessness in the operation of vessels. The statutes, moreover, have been proven deficient in many respects — for instance, it appeared from the inquiry into a recent celebrated case that the inspection of hulls did not include a test of stability.

The rights and duties of masters and seamen toward each other, the vessel owner, the shipper or receiver of cargo and passengers are in part regulated by usage. By far the larger part of this department of the maritime law however is statutory. The administration of ports, the issue of clearance and other papers and similar police regulations affecting shipping are, generally, in the form of prescriptions made by the highest legislative authority, though they may be the subjects of mere municipal ordinances. These regulations have become internationalized by commercial treaties on a basis

of reciprocity, foreign shipping at practically all the ports of the world sharing burdens and advantages equally with domestic vessels. Domestic regulations with respect to life-saving equipment also have international scope, because no foreign vessel can leave a port without clearance and ship's papers will not be granted until the local safety rules have been complied with. The International Marine Conference held at Washington in 1894 evolved a set of "Regulations for Preventing Collisions" and the first internationally uniform "Rule of the Road." Articles 15 and 16 of the convention agreed to this conference, prescribing a system of sound signals and "moderate" speed in fog or thick weather, were considered the most important and innovatory of the regulations then adopted; but shipmasters have continued to act on the principle, "when in a place of danger, get out as quickly as possible." The Seaman's Act of 1914 and the Safety at Sea Conference held in Berlin in the spring of the same year are indicative of progress, though under existing world conditions their effect has not been appreciable.

Proceedings in Admiralty Courts are quite informal. Usually they are *in rem*, that is to say, the ship or cargo or some part of either are proceeded against rather than the master or owner in person. The initiation of an action takes the form of posting a libel, i.e., attaching the same to the mast or some conspicuous place on the vessel, or to that part of the cargo against which a claim is made. The attachment of a libel creates a lien which can be discharged only by the entry of a bond, or the deposit in court of adequate security, or the payment of the claim. See DANISH SOUND DUES.

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STEPHEN PFEIL.

MARITZA, mä-rēt'sä, a river of Adrianople, the ancient Hebrus, rising as the Topolnitza, near the Bulgarian frontier, in the Balkan Mountains, and flowing through eastern Rumelia, southeast to Adrianople, where it bends to the southwest and falls into the Ægean Sea by the Gulf of Enos. It is over 300 miles long and navigable to Adrianople, about 100 miles from its mouth.

MARIUS, Gaius, Roman general: b. about 156 B.C., in Cereatæ, in the Volscian territory; d. Rome, 13 Jan. 86 B.C. He won his first military repute at Numantia in 134, beginning his rapid rise from the ranks; was made tribune of the people in 119; increased his political power by marrying Julius Cæsar's aunt; became prætor in 115; went to Spain in the next year, suppressing brigandage there; and in 109 accompanied Metallus to Africa. Two years later he was chosen consul, displaced his superior officer and made a brilliant campaign. His success was so great that he was elected consul four times in succession (104–101 B.C.)—a proceeding counter to law and entirely unparalleled—so as to meet the invasion of Italy by the Cimbri and Teutons. He defeated the latter tribe at Aquæ Sextiæ in 102, and the Cimbri at the Raudian Fields in 101. In 100 he was again elected consul. He made the fatal mistake of plunging into party politics, allied himself with the most disreputable leaders of the popular party, and, in his envy of the rising fame of the patrician Sulla (q.v.), attempted to remove him from his command in the Jugurthine War. Civil war broke out in 88. Sulla was victorious. Marius fled to Africa, whence he returned to Italy on the successful rising in Rome under Cinna. The first great proscription followed and many of Marius' opponents were killed. Marius was elected consul for the seventh time for 86 B.C., but died soon after he entered upon the office. Consult Beesly, 'Marius and Sulla' (1878).

MARIUS THE EPICUREAN, the chief work in fiction of Walter Pater. It is the story of a young Roman of the days of Marcus Aurelius, but in the problems and experiences of young Marius in ancient Rome, Pater has given also something of the problems and experiences of a young man at the end of the 19th century. In the days of Marcus Aurelius the ancient world was changing into the mediæval. Another such period was the Renaissance, in which the mediæval world was changing to the modern. In our days it may be civilization may be changing to something very different from the last few hundred years. Of the first of these great changes Pater wrote in 'Marius the Epicurean.' Of the second he began to give a picture in 'Gaston de Latour,' a later novel of which he wrote only the first part. To the last period, his own, Pater devoted critical rather than creative thought. 'Marius the Epicurean,' therefore, is deeply informed with ideas; in fact the very titlepage names "Sensations and Ideas." Pater became known first as a critic; in this novel he turned to express in the form of life the ideas which he had previously presented as matter of thought. A good many of Pater's ideas will be found in 'Marius': the fundamental conception of Epicureanism is a restatement of the theory of life which had already been presented in the conclusion of the Renaissance and had since been much and sometimes severely criticised. Flavian's plans for a career in literature have much in common with the ideas of the later essay on style. The work is characteristic of its author not only by its ideas, but by its general form. After this novel Pater published several shorter pieces which he called 'Imaginary Portraits.' In each of these he presented a figure which embodies some idea or position in the philosophy of art and life, sometimes an actual character like Watteau, sometimes an ideal figure like Sebastian von Storck. He subsequently wrote several other things of the same sort which is now generally thought of as very characteristic of his art and thought. 'Marius the Epicurean' is an earlier, longer and more fully developed imaginary portrait. Its interest is not in the

story, but in the idea, or in this case in the progress of the idea. Marius grows up in the old pagan world, comes to know all the cultivation and refinement of the ancient civilization, weighs the older philosophies of life and art and finally devotes himself to the new and growing religion of Christ. Like all of Pater's fiction the story is most sedulously careful of its surroundings and environment, and the pictures of life on the great old Roman family estate, the popular festival, the interview with the emperor, the lecture on rhetoric by Fronto are among his best known. In fiction in general there is an especial place for those books which present adventures and experiences of the soul rather than of the man as seen in the everyday world. There were a number of such at the end of the 19th century. Among the most famous of these studies of the religious life are 'John Inglesant' and 'Robert Elsmere.' 'Marius the Epicurean' is quite as interesting as either of these to those who follow the workings of the spirit, and quite as characteristic of the time which it presents and of the time in which it was written.

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MARIUT, mä-rē-oot', **Lake,** Egypt. See MAREOTIS.

MARIVAUX, Pierre Carlet de Chamblain de, pē-ār kär-lā dė shäm-blăn dė mä-rē-vō, French dramatist and novelist: b. Paris, 4 Feb. 1688; d. there, 12 Feb. 1763. He lost his patrimony in the Mississippi scheme, and also a young wife to whom he was deeply attached, and took up literature as a living. He was so successful that he became an Academician in 1742 or 1743. He wrote essays in periodical form, the 'Spectateur Français' having a hint of English influence in both matter and name. His novels, especially the unfinished 'Vie de Marianne' and 'Paysan parvenu,' were a protest against the literary morals of contemporary fiction. But he is best known for such plays as 'Les Jeux de l'Amour et du Hasard' (1730), 'Les Fausses Confidences' (1738), 'Le Legs' (1736) and 'La Mère confidente' (1735), which are marked by a total opposition to the style and manner of Molière, by much skill in intrigue and in portraying women and by the peculiarly artificial and elaborate style, which takes its name 'Marivaudage" from the author. Consult Savollée, 'Marivaux inconnu' (1880); Fleury, 'Marivaux et la Marivaudage' (1881); Gossot, 'Marivaux Moraliste' (1881); Larroument, 'Marivaux, sa Vie et ses Œuvres' (1894); Deschamps, 'Marivaux' (1897).

MARJORAM, a genus of annual or perennial herbs and a few shrubs (*Origanum*) of the family *Menthaceæ*. The species of which there are about 25 are mostly natives of the Mediterranean region and southwestern Asia. They have several-flowered whorls of labiate flowers arranged in spikes. Two species are widely cultivated in gardens for culinary purposes, being used fresh, dried or in decoction for flavoring soups, stews, dressings, sauces and salads. Common or pot marjoram (*O. vulgare*) is a hardy perennial with pink or purple flowers and highly aromatic leaves. It succeeds best upon warm garden soils well exposed to the sun, and may be propagated by seeds, divisions or cuttings. Sweet marjoram (*O. marjorana*) is also a perennial, but is tender and consequently treated as an annual, hence the popular name annual marjoram. It is usually raised from seeds sown in a hotbed or greenhouse and transplanted to ground like the above.

MARK. The original Jewish name of Mark was John (Acts xii, 12, 25; xv, 37), and it is not known when he was given or assumed the second, Latin, name by which he has always been known. Of his early life nothing is positively known. It cannot be said to be more than an attractive possibility that it was at the house of his mother, Mary, that Jesus met his disciples for their last supper, and that in consequence this upper room became the permanent meeting place of the Jerusalem disciples, and also that Mark was the youth who followed the crowd to the arrest of Jesus in Gethsemane. Peter later called him his "son" (1 Peter, v, 13), from which title it is commonly inferred that he began his Christian life under the influence of that apostle. The first distinct appearance of Mark in history is as an attendant of Paul and Barnabas, the latter being his cousin (Col. iv, 10, not "nephew," as the Greek word has been erroneously translated). The party went from Antioch to Cyprus and thence to Perga, on the mainland of Asia, where Mark deserted, returning to Jerusalem. Because he did this Paul refused to take him on his second missionary tour and a break with Barnabas resulted, after which Mark accompanied the latter to Cyprus again. A reconciliation with Paul must have later come about, since Mark is favorably spoken of in Paul's letters to the Colossians and to Philemon, as again still later in the second letter to Timothy. More uncertainty attaches to the mention of Mark in First Peter. Perhaps the most satisfactory conclusion is to take "Babylon" as designating Rome and for this and other reasons (see article PETER, EPISTLES OF) to give to this mention a still later date. On this view, after the death of Paul, Mark would have remained in Rome and have attached himself to Peter. This would be in harmony with the language of Papias who asserted a relation between the two. Any further details rest on more or less uncertain tradition. The reported connection of Mark with Alexandria is in no way improbable, but whether he was a martyr there or died a natural death is unknown. The tradition that he was connected with the church at Aquileia, which is the basis of the honor paid in Venice to his memory, is no more to be depended on. It may have been the result of personal reminiscence that the epithet κολοβοδάκτυλος was attached to him. This word means stunted or mutilated in the fingers ("stub-fingered" ?), but its application in Mark's case is nowhere defined, and many explanations have been proposed, such as, that his fingers were unnaturally short; or, as the Greek word would equally apply to toes, that they were shortened, perhaps causing lameness, or that he had mutilated himself to evade priestly service; or, finally, that the word is used figuratively to suggest the comparative brevity of his gospel and its failure to contain much that is found in Matthew and Luke. For the connection of Mark with the second Gospel and bibliography, see article MARK, GOSPEL ACCORDING TO.

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MARK, Edward Laurens, American anatomist: b. Hamlet, Chautauqua County, N. Y., 30 May 1847. In 1871 he was graduated at the University of Michigan, and in 1876 took the degree of D.Ph. at the University of Leipzig. Dr. Mark was instructor in mathematics at the University of Michigan in 1871–72 and in the following year was astronomer of the United States Northwest Boundary Survey. From 1877 to 1883 he was instructor in zoology, from 1883 to 1886 assistant professor and since 1885 Hersey professor of anatomy at Harvard University. In 1900–21 Dr. Mark also served as director of the Harvard Zoological Laboratory. Since 1903 he has been director of the Bermuda Biological Station for Research. He was United States delegate to the Fourth International Zoological Congress at Cambridge, England, in 1898. He has translated from the German, O. Hertwig's 'Text-Book of the Embryology of Man and Mammals' (1892); Korschelt und Heider's 'Text-Book of the Embryology of Invertebrates,' and published contributions to the *Bulletin of Comparative Zoology.* He edited contributions from the Zoological Laboratory, Harvard Museum of Comparative Zoology, 1884–1921. Consult Parker (ed), 'Mark Anniversary Volume' (New York 1904).

MARK, Gospel According to. Character and Purpose.— Of the four little books called «Gospels» the second is the briefest and simplest. In the most direct fashion possible salient events of the Galilean ministry of Jesus are set forth in the first two-thirds of the book, while the last third is mainly occupied with the events of the last week of Christ's life and of his death and resurrection, the second part being given with much more of detail than the first. The book might be analyzed as follows: Introductory, the ministry of John the Baptizer, the baptism and temptation of Jesus (i, 1–13). I. The early Galilean ministry of Jesus, marked both by wide attention and by increasing hostility which culminated in the charge that Jesus was in league with Satan, this part of Christ's work ending with the choice of the 12 apostles (i, 14–iii, 35). II. Later ministry in Galilee and its neighborhood, introducing parabolic teaching and consisting largely of the training of the 12 (iv, 1–x, 52). III. The entry into Jerusalem and the Jerusalem teaching, mainly controversial, in the Temple (xi, 1–xii, 44). IV. The Eschatological Discourse (xiii, 1–37). V. The closing scenes, anointing at Bethany, last supper, agony in Gethsemane, death and resurrection (xiii, 1–xvi, 20 (8?). No purpose appears except to bring the events recorded as clearly before the readers' minds as possible, so that they might know thus much, at least, of what Jesus did and said. The book manifestly is not a missionary tract with the intent to persuade the unconvinced, but rather one who is himself a disciple tells these things to his fellow-disciples for their instruction. It has often been overlooked that the author presents as himself accepting the stupendous claims of Jesus to be the supreme master of men and their destiny and his corresponding demands for their supreme allegiance. But while these are carefully and sympathetically recorded, the main impression gathered from this record of the ministry of Jesus is that of a mighty, unresting, triumphant worker, who yet evokes the intensest hostility of the religious leaders of his nation. But the primary purpose to be recognized throughout is narration.

Authorship and Sources.— No name has ever been connected with this book except that of Mark. Presumably because of its brevity which might seem perhaps to involve incompleteness, this Gospel was for a long time less quoted than Matthew or Luke. But as it was included in the 'Diatessaron' of Tatian it must have been in general acceptance for some time before the year 150; in fact, there is no reason to doubt that from the time of its composition wherever known it was accepted as authoritative. The earliest tradition which has come down to us, connecting itself with the name of Papias who was acquainted with a number of apostles and others who had seen Jesus, makes Mark the author of a narrative which embodied the reminiscences of Peter. The second Gospel answers well to this description. There are many touches which imply the remembrance of an eyewitness, such as that the grass was green (vi, 29); the look of Jesus (iii, 5); or his turning to look (v, 32). The tradition that this eyewitness was Peter is confirmed by the character of many details of events in which Peter had a share or in which he would be specially interested. It is not, however, to be thought that Peter was Mark's sole authority or even that the principal share of the book is due to him. It may well be held that the main source from which Mark drew his material was the common stock of apostolic reminiscence and preaching, what must at first have been an «oral gospel,» which presumably took a somewhat stereotyped form both in content and in language for catechetical purposes (Luke i, 4) and which may have been committed to writing before Mark used it. It has been held by some that Mark also shows knowledge of the «Logia» document (also called «Q,» see article GOSPELS), but in our ignorance of the scope of this document Mark's knowledge of it cannot safely be asserted.

Date and Place of Composition.— No date can be positively set for the composition of the Gospel according to Mark. It has been commonly dated immediately before the destruction of Jerusalem and thought to have been written at Rome. The latest conclusion of critics, notably of Harnack, based on his view of the early date of Luke's writings, sets the date decidedly before the year 60 and makes Jerusalem the place of original composition. There, or at Rome later, it might have been seen by Luke in its earliest form, while it is possible that additions were made to it before it was given to the world in its present form, which probably happened at Rome. (The «Latinisms» in its language are, however, no proof of relations to Rome, as they are merely such as had been everywhere in the empire adopted into the «Koine,» the common Greek of the time). It has been suggested that Mark's repeated revision of his original work resulted in what may be called three editions, the first, Palestinian and used by Luke, the second, made at Alexandria (with which city tradition associates Mark in his work), and used by the author of the first Gospel, the third, our present Gospel according to Mark, having been completed and given to the world at Rome. (See

rticle GOSPELS). Much of this theory, how-ver, is undemonstrable. But it seems safe to ssert that the substance of the book belongs ecidedly before the year 60 and was very ossibly composed in Palestine, while in its nal form it is connected with Rome.

Integrity.—It is the verdict of textual criti-ism that the last verses of the Gospel (16:9–0) were not a part of the original work. They re lacking in only two manuscripts, the Vatican nd the Sinaitic, but these are the most valued f all. A manuscript of the Old Latin replaces ese verses with another, shorter ending for ie genuineness of which no one contends, and our Greek uncials, one cursive, and also manu-cripts of early translations into Syriac and ther languages give both endings. An Arme-ian manuscript gives the name Aristion as the uthor of the verses in question. There is, urther, a notable lack of quotation of these erses by the Fathers, while several Fathers ssert that in their time they were not to be ound in the best copies of the Gospel. On he basis of the merely textual evidence, owever, the genuineness of these verses might e accepted, but there is general agreement mong scholars that the internal evidence is ecisive against their genuineness. The vocabu-ary, the style, the thought of these verses are ufficiently unlike the rest of the Gospel so that he great majority of competent critics hold that hey are not by Mark. Various explanations ave been proposed for the abrupt close of the riginal text at the end of the eighth verse, as hat the author might have been interrupted in ome way and never finished his book as he ntended, or that the last leaf was lost from he text which was the source of all our copies, nd that some one (Aristion?) later attempted o make good the loss, but while any of the roposed explanations may be possible, it can-ot be said that any of them are probable.

Authenticity and Value.—While, as has een said, for many centuries both Matthew nd Luke were more used and valued than Mark, this judgment has of late been reversed. As it is the oldest of the three Synoptics, or at ny rate preserves the original traditions of the Palestinian Church in their most primitive and unmodified form, it is of the highest value as record. This value is of course enhanced by he fact of Mark's association with so many of he early leaders of the Church, and still more y the contribution which Peter, in particular, s recognized to have made to the materials em-loyed. The modern critical estimate may be elatively unfair to the value of the other Synoptics, but is doubtless absolutely correct in ts high estimate of the authenticity and value f this Gospel.

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MARK, an old English term for a money of account, and in some other countries for a coin. The English mark originated in the 12th century and was valued at $3.33, and the Scottish mark, or merk, of the 19th century was $3.42. In the coinage of the German Empire the mark is a coin of nearly the same value as the English shilling. A mark banco used to be a money of account in Hamburg equal to 37 cents, nearly. The mark was also used as a weight in several parts of Europe, being divided into 24 carats.

MARK, Order of Saint, a Venetian order of knighthood. The doge, as well as the Senate, elected knights of Saint Mark, who enjoyed a pension. Foreigners also, particularly scholars, were elected. Saint Mark the Evangelist was the patron saint of the Venetian Republic.

MARK ANTONY. See ANTONIUS, MARCUS.

MARK TWAIN. See CLEMENS, SAMUEL LANGHORNE.

MARKED TREE, town, Arkansas, in Poinsett County, 40 miles northwest of Memphis, Tenn., on the Frisco Railroad. It is within a few miles of Saint Francis Lake and is located in a thriving lumber district. It contains lumber factories, a cotton compress, implement companies, and a de-linting plant. It has also a district high school and two banks. Pop. (1950) 2,878.

MARKETING. — Definition. — Marketing, as defined by the Committee on Definitions of the American Marketing Association, "includes those business activities involved in the flow of goods and services from production to consumption." Marketing, therefore, is made up on one hand of such physical activities as transporting, storing, and selling goods, and on the other hand of a series of decisions which must be reached by any organization undertaking any part of the process of moving goods from the producer to the user.

Growth of Marketing Methods.—The importance and complexity of marketing activities have increased steadily in the years since the Industrial Revolution. In a simple village economy, the shoemaker ordinarily purchased his leather and other materials from near-by producers and took orders from his neighbors for relatively simple footwear. The quality of his work was easily recognized, and protests against poor workmanship could be made easily and directly. The shoemaker himself had no difficulty in gauging in advance what kinds of shoes would be desired by his customers or the number of shoes he should make, nor did he have to entrust any part of his relationship with those customers to others.

As specialization in production has developed and the scale of manufacturing operations has increased, producers and their customers have become widely separated in space, in time, and in knowledge. The producer of automobiles in Detroit sells throughout the United States and, indeed, throughout the world. He produces not upon the order of a particular customer for a particular automobile but rather upon the basis of anticipated future sales to unknown customers. In this anticipation of future sales, he must in turn place orders for materials and component parts well in advance of his own production period. Finally, the increasing multiplicity of the

goods manufactured and used by the people of the United States, has led to a lack of intimate knowledge on the part of the buyers of the inherent qualities of those goods. Millions of people buy mechanical refrigerators and other household appliances without personal understanding of how the appliances function and without the ability to judge the workmanship.

As the scope of marketing activities has broadened, the amount of effort devoted to these functions measured in employment or in dollars, has naturally multiplied. Many estimates have been made as to the proportion of the consumer's dollar absorbed by production on one hand, and by marketing on the other. These estimates differ somewhat, but there is rather general agreement that marketing activities took more than half of the consumer's dollar in the years immediately preceding the Second World War. Figures for employment in retail trade, in wholesale trade, in transportation, in the sales departments of manufacturers and producers, in the facilitating activities of advertising agencies, publishing firms, and the like, lead to the conclusion that the steady increase in the proportion of our working population engaged in marketing activities prior to the war, had reached the point where they outnumbered those engaged in manufacturing or production.

Although the role of marketing activities has expanded substantially since the Industrial Revolution, literature on the subject has developed only within the last 30 to 40 years. Many publications devoted to various aspects of marketing have been developed and authoritative information has become available to those interested in the subject. During this period, courses in marketing, and in the various subdivisions thereof, have become common in the colleges and universities. Latterly, marketing research has developed as a highly specialized activity, in which thousands of individuals and hundreds of specialized firms are engaged.

Principal Subdivisions of Marketing

The early literature of marketing is full of discussions as to what should be considered marketing functions. There are such physical activities as transporting and storing merchandise. There are also the functions of making decisions on such questions as how the product should be designed; how it should be packed; what retail and wholesale channels should be used; whether advertising is advisable and, if so, how much and what kinds; what prices should be set, not only to final buyers but also to whatever intermediaries may be used; and what pricing policies should be observed in regard to such matters as quantity discounts, terms of sale, and the like.

Although there is as yet little agreement on what are properly to be included as marketing functions, it is very clear, from the standpoint of the individual businessman, that these and similar questions must be answered as part of the marketing task. As one convenient way of dealing with such questions, they may be grouped under the following heads: merchandising; channels of distribution; brand or trademark policy; sales promotion (including advertising and personal salesmanship); pricing and price policies; control of marketing operations.

Merchandising.—This term has many meanings. To some it is synonymous with marketing; to others it is synonymous with retailing. In the advertising world, many men use the phrase "merchandising the advertising to the salesmen" to mean "informing and making the salesmen enthusiastic about the advertising campaign being carried on by their employer." Others say "Merchandising is getting the goods onto the dealers' shelves; distribution is getting them off."

The meaning given to merchandising in this article is none of these, but rather "the adjustment of the merchandise produced or offered for sale to customer demand." Merchandising for the merchant means decisions and actions with regard to what goods and what quantities of them should be bought for resale. Merchandising for the manufacturer means selecting the product or products to be produced, deciding on size, appearance, form, and packaging, and determining the quantities to be produced during any given time. Thus, in manufacturing, merchandising activity can be regarded either as a part of production or as a part of marketing. It is the point at which the production department and the sales department most often come together. Effective merchandising, therefore, requires the closest coordination of those two departments.

The importance of advance knowledge as to the acceptance which will be accorded to a new product or to a redesigned version of an established product has given considerable impetus to a variety of methods of testing consumer reactions in advance of large-scale marketing efforts.

One vital factor in the merchandising task is that of coping with fashion. For some products, such as millinery and women's and misses dresses, the merchandising task is almost entirely that of gauging fashion trends, but even automobile designers carefully study trends in the popularity of colors. Fashion is not synonymous with style. Dr. Paul H. Nystrom defines style as "a characteristic or distinctive mode or method of expression, presentation, or conception in the field of art."[1] A style is, therefore, a more or less permanent phenomenon in contrast to a fashion, which is usually temporary. A style may or may not be a fashion at any given time; it becomes a fashion when it is generally accepted by the people. Queen Anne is a style of furniture, but it does not happen to be a fashion because it is no longer in widespread use. Any fashion has its beginning when a relatively few people are influenced by it, its culmination when large numbers of people follow it, and its decline when it is gradually abandoned by more and more of its followers. Many theories as to the psychological motivation for this fashion cycle have been formulated. Fashion, like the stock market, is essentially a manifestation of group psychology. Fundamentally, these matters are still little understood, but practical businessmen have developed methods for scrutinizing the trend of sales in their own establishments and elsewhere which somewhat reduce the hazards of handling fashion merchandise.

In the merchandising of all types of goods, whether fashion is a major element or not, experience has demonstrated the importance of paying close attention to the buying motives of the potential customers. To do this it is first necessary to determine who the potential customers for the particular product or service are. They may be a handful of large corporations

[1] *Economics of Fashion*, p. 3. (Ronald Press, New York 1928).

uying for use in their own manufacturing rocesses, or the general public buying to satisfy ome personal need or desire.

The distinction implied in the contrast between usiness buyers and the general public is the asis for a classification of goods and services, f great importance in marketing, as industrial oods or consumers' goods. The latter are ought by the public for the business of living. 'ood and clothing are typical of relatively per- hable consumers' goods, whereas washing ma- hines, automobiles, and dwellings are typical of o-called consumers' durable goods. Industrial oods, on the other hand, are bought by business rms for use in the production and marketing f their own output. Industrial goods range rom operating supplies, such as brooms and weeping compounds, to major machinery and quipment and even the factory building itself, nd from raw materials to fuel and power.

Channels of Distribution.—To the merchant, hether a wholesaler or a retailer, the decision s to what goods to buy for resale is a principal art of merchandising. To the merchant's sup- lier, the decision to sell to him is a part of ie supplier's selection of his channels of dis- ibution. The manufacturer of consumers' oods must decide in general what types of retail tores are the best for his product. Then he ust decide whether to have his own salesmen ell direct to these retailers or to sell to whole- alers for resale to the retailers. If he elects to ell through wholesalers, he must decide which ypes of wholesalers, and he must also choose hether to sell to them direct through his own alesmen or through such intermediaries as brok- rs and manufacturers' agents.

Similarly, the manufacturer of industrial oods faces the question whether to use such in- rmediaries as mill supply firms and manufac- irers' agents or, to utilize his own sales force, orking out of the main factory office or, out of ales branches strategically located throughout ie country.

Policies must be formulated not only as to ie types of intermediaries to be used but also s to their number. At one extreme is a policy f exclusive distribution, under which the retail r wholesale intermediary is the sole outlet for ie product or service in some particular terri- ory. Typical of this policy is the automobile ndustry, with each "franchised" dealer protected ithin a specified territory against the competi- on of other dealers. At the other extreme is a olicy of intensive distribution, characterized by forts to secure the maximum possible number outlets. Typical followers of this policy are ie major cigarette manufacturers, who want l the outlets they can get. Between these two xtremes are many policies which may be rouped under the term "selective." Under this pe of policy, certain chosen outlets are on the asis of criteria important to the manufacturer, ich as prestige in the community, size, ability provide installation or repair service, and the ce.

There are three major considerations to be ken into account in arriving at a policy in re- ard to the number of outlets to be sought: (1) e willingness of prospective buyers of the par- ular product to seek out a source of purchase; 2) the ability of the intermediary to contribute the effective promotion of the particular prod- t; (3) the intermediary's willingness to make such promotional efforts if the benefits from those efforts accrue largely to him.

In addition to deciding what policies to follow concerning the channels of distribution to be used, the marketer must exert much effort and show much ingenuity in putting the policies selected into effect. Much of the day-to-day work of marketing consists of seeking to make particular retail stores, or wholesale establishments, of the type selected, want to carry the product. Much of the sales promotion program must often be directed to this end. Advertising in trade and other publications, preparation of effective display and other material useful or appealing to the dealer, offering of attractive profit margins—all these are designed to supplement and reinforce the work of the salesman in inducing retailers, wholesalers, or other intermediaries to carry the product or line of products.

Brand Policy.[2]—A trademark is a distinctive word, emblem, symbol, or device, or a combination of these, used on goods actually sold in commerce to indicate or identify the manufacturer or seller of the goods.[3] In business terms a trademark is a short cut to the customers' memory. The picture of the little Dutch girl and the phrase "Old Dutch Cleanser" can be retained in the memory far more easily than could "cleanser produced by the Cudahy Packing Company." Through constant use on packages and in advertising, many trademarks have almost entirely eclipsed the name of the manufacturer. By actual test, dozens of persons know and use the trademarks "Vaseline" for every one who knows the Chesebrough Manufacturing Company, even though every jar describes "Vaseline" as the Chesebrough Manufacturing brand of petroleum jelly.

Because of their importance as a short cut to the customer's memory, well-established trademarks are considered to have substantial cash value. In transactions involving the sale of one business to another and in some court decisions, well-known trademarks have been valued at many millions of dollars. As might be expected a body of law and precedent has developed and is continuing to develop for the protection of property of such value. The basic principle is that ownership of a trademark is acquired by prior use (that is, the first actual user in commerce is the owner), and registration of trademarks by the United States Patent Office is provided for by the Act of March 19, 1920.[4]

Careful observance of the legal technicalities in the choice and development of a trademark is important. Of equal importance from a business standpoint is the selection of a trademark which will easily become a short cut to the customer's memory—one which lends itself readily to advertising and sales promotion and has pleasant rather than unpleasant connotations for the prospective customer.

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[2] A brand may include a brand name, a trademark, or both. The term "brand" is comprehensive, including practically all means of identification except perhaps the shape of the product and the package. The brand name is that part of the brand which may be vocalized. (Paraphrased from Committee on Definitions, American Marketing Association).

[3] *General Information About Protection of Trademarks*, pp. 1–4. (Government Printing Office, Washington 1944).

[4] For a full discussion of the legal aspects of trademarks, see *Unfair Competition*, by Zechariah Chafee, Jr., (The Harvard Law Review Association, Cambridge, Mass. 1940).

The addition of a new item to the line of a manufacturer often gives rise to the question: "Shall the new item carry the same trademark as the existing items?" The use of a so-called family brand assures the newcomer of benefits from some of the goodwill that may have developed. On the other hand, the promotional needs of the new item may be secured more adequately by a distinctive trademark. As an extreme illustration, the well-known trademark for Ivory soap was understandably not deemed suitable for the vegetable shortening Crisco, made by the same company.

The importance of the brand which has gained public acceptance or preference as a means of controlling sales, has led to the description of the widespread conflict between two opposing methods of marketing, as the "Battle of the Brands."

On the one side are manufacturers of merchandise carrying brands featured in extensive magazine, newspaper, and radio advertising, often national in scope, and relying relatively little on the promotional efforts of retailers and wholesalers. With this type of brand, the retailers and wholesalers are generally little more than necessary links in the chain for making goods physically available to prospective buyers. Whatever the personal preference of the retailer, he must carry the well-known brands of cigarettes, for example, if he is to do business in tobacco products; the development of demand by the manufacturers makes this certain.

On the other side are retailers and wholesalers with their own brands of merchandise, frequently produced by manufacturers to the retailer's specifications. Such brands are often called "private" brands, although they are more accurately described as "distributor's" brands. When the corner druggist has a particular formula for cough syrup or antimosquito lotion put up under his own brand name, he is following a distributor's brand policy in a small way. But the battle is really joined when large-scale retailers, such as the great food chains, the large mail order houses, or important department stores, seek to develop wide public acceptance for a great range of products under their own brand names. Because the responsibility for maintenance of quality and the development of public acceptance rests on the owner of the brand, in this case the large-scale retailer, the manufacturer is limited to producing to specifications at as low a manufacturing cost as possible. The retailer, through his contact with the market, therefore, often becomes the dominant enterprise in the chain of service bringing goods to prospective buyers.

Sales Promotion.—The principal methods of promoting the sale of a product, aside from the inherent qualities of the product itself and its price, are personal salesmanship and advertising.

A marketing organization handling consumer goods must decide whether it will use salesmen to sell to final consumers (e.g. the retail store salesman or the house-to-house canvasser for vacuum cleaners or hosiery), to retailers, or to wholesalers, with or without the assistance of so-called missionary salesmen,[5] or whether it will rely entirely on advertising. Similarly, a marketing organization handling industrial goods must decide whether its sales should be promoted by salesmen, or whether it can rely on catalogues and other forms of advertising.

The management of sales organizations is a field of major importance in itself. Sales management includes the selection of salesmen, their training to serve the particular needs of the firm by which they are employed, the working out of the best methods for determining their compensation, and the control of their activities. The control of salesmen's activities includes planning the number and location of customers to be solicited, possibly the laying out of the sequence in which customers are to be visited, the planning of the type of presentation to be made to prospective customers, and the appraisal of the performance of individual salesmen.

Advertising has been one of the most thoroughly studied aspects of marketing. Many types of advertising media have developed: newspapers; general circulation magazines; special circulation magazines, including so-called trade magazines, editorially devoted to the interests of particular trades or types of business executives (e.g. purchasing agents, power plant superintendents); radio broadcasting, both local and network; billboards along highways and city streets; car cards in public transportation systems; catalogues; direct mail advertising in many forms. The motion picture has been increasingly used as an advertising medium, often for use at large gatherings of prospective customers. Exhibits of various kinds at conventions and trade gatherings have long served the same purpose.

The marketing organization seeking an effective advertising program must give close attention to the selection of the medium or combination of media best adapted to the particular market to be sought, and the particular product to be promoted. Similarly, the construction of the advertising material to be used in these media requires careful attention to the determination of the buying motives which should be emphasized most strongly and to the most compelling ways of appealing to those buying motives. The need for specialized attention to these problems has been largely responsible for the growth of the many advertising agencies which perform these functions for their clients.

Not infrequently, the characteristics of the particular market for a particular product are such that expenditures for advertising are not likely to yield much return in sales. Sound judgment on this point by marketing organizations often has an important effect on the profit and loss statement.

Price Determination and Price Policies

The individual wheat farmer does not put a price on his crop. He is offered a price adjusted by conventional amounts from the current quotation on an organized exchange, and his decision is limited to whether he will hold or sell at that price. Only as large numbers of farmers, millers, and speculators change their decisions as to whether to hold, sell, or buy, does the price quotation change materially. Much current economic writing implies that earlier economists believed that such a condition prevailed throughout the business structure. This view may be an injustice to those earlier economists, but in any event, the plain fact is that most marketing of-

[5] Missionary salesmen, known as "detail men" in some industries, call on customers to encourage the placing of orders. In the dental trade, for example, manufacturers employ "detail men" to call on dentists to encourage them to place orders for the manufacturers' products with dental supply houses.

anizations do face the problem of putting a rice on their product, and not merely the ques-on of manufacturing or not manufacturing at n established market price. The greater the egree to which the product is differentiated rom other products, the more attention can be ntered on factors other than the prices of mpetitive products. Conversely, the more the roduct resembles competitive products in ap-earance and performance, the more competitive rices will govern price policies. Since one of ne outstanding features of our industrial de-elopment has been the widespread differentia-on of products, thus greatly widening the range f the consumers' choice, it follows that the prob-m of setting prices has tended to become more, ather than less, important to marketing manage-ents.

In the typical situation, the pricing problem ncludes the establishment not only of prices to ttract buyers, but also of prices to whatever uccessive tiers of intermediaries are included n the marketing program. It may also involve ecisions as to whether special discounts are to e offered for purchases in relatively large uantities. The pricing problem often includes ne decision as to whether all customers, or all ustomers of a particular type or class, are to be uoted the same price, or whether individual alesmen or higher officials are to be permitted o lower prices for especially vigorous bargainers, r to recognize circumstances which result in articularly low costs to the seller. Finally, the ricing problem includes decisions as to terms of ale and delivery.

The Marketing Program.—Recognition of ne interrelationship of the several subdivisions f marketing described above has led experienced arketing executives to think and act in terms f a co-ordinated marketing program. Decisions n the channels to be used bear directly on the ricing problem; decisions on price are tied in-eparably to the problem of the selection of hannels; and both in turn directly influence de-isions in regard to methods of sales promotion. uccessful marketing results from the effective arrying out of a well co-ordinated marketing rogram, in which every element supports every ther element.

Marketing Institutions

The principal source of quantitative statistical nformation concerning marketing institutions is ow the census of the United States. The first ich census of marketing institutions was the ensus of distribution of 1929. A second enu-eration was the census of American business of 933; a third, the census of business of 1935. The ost recent was a part of the regular 16th census f the United States in 1940, covering the census f business for the year 1939.

Basically, marketing institutions may be di-ided into retail institutions, wholesale institu-ons, and producers' marketing departments or gencies.

Retail Trade.—In 1939 there were 1,770,355 etail stores of all types in the United States. his number represented an increase from 1,587,-18 in 1935 and 1,476,365 in 1929. Retail trade emains perhaps the greatest single stronghold f the individual small businessman. There were ,613,673 active proprietors of unincorporated usinesses in the retail field in 1939. The ,770,355 different retail stores had sales slightly in excess of $42,000,000,000 in the same year. They employed 4,600,217 employees (not including the active proprietors of unincorporated businesses mentioned above), and their payrolls totaled approximately $4,500,000,000.

Retail stores may be classified in a number of different ways: as to the types of goods sold; as to whether or not they are operated as single stores, or as parts of a corporate chain, or as voluntary associations; as to whether they do principally a cash or credit business; as to their general level of prices and quality of merchandise carried, and the like.

Numerically, the food group bulks largest when retail stores are classified according to the type of goods sold. Roughly, a third of all retail stores are in this group. When eating and drinking places to the number of more than 300,000 are added, nearly half the retail stores of the country purvey food in one form or another. On the average, however, stores in the food group are smaller, measured by dollar sales, than other stores, and therefore dollar volume of food sales (excluding sales of eating and drinking places) represented only about one quarter of the total retail sales in 1939.

Filling stations, of which there were 241,258 in 1939, ranked next to food stores in number and had sales of $2,833,495,000. Department stores, which appear as a subdivision of the general merchandise group, numbered only 4,074 but had sales of $3,974,998,000. By definition, the department store is one which carries a relatively wide range of merchandise and has a departmentalized form of organization. The census does not classify stores with sales of less than $100,000 annually as department stores. Some department stores have sales well above $50,000,000 per year.

Retail stores may also be classified according to whether they are owned and operated by chain store organizations, by individual proprietors, or whether they are members of voluntary chains or co-operative associations. The corporate retail chain has reached its greatest development in the variety and grocery fields, although it is also important in the drug, clothing, and filling station business. Chains of the type of F. W. Woolworth Company, S. S. Kresge Corporation, W. T. Grant Company, and many others do a very high proportion of the total business in the variety field. In the food trade, the Great Atlantic & Pacific Tea Company, Safeway Stores Corporation, Kroger Grocery and Baking Company, and First National Stores Incorporated, carry on approximately 40 per cent of the nation's retail food business.

To meet the competition of big chain enterprises, a large number of individual stores have linked themselves with wholesalers in so-called voluntary chains which use a common name, sell many items under a common trademark, and follow a number of uniform management practices. This type of enterprise has grown to considerable importance in the food field and is found occasionally among automotive supply stores.

Wholsale Trade.—The census classifies all wholesale establishments into six major types of operation groups: (1) service and limited function wholesalers; (2) manufacturers' sales branches (with stocks); (3) manufacturers' sales offices (without stocks); (4) petroleum bulk stations and terminals; (5) agents and brokers; (6) assemblers (mainly farm products). These

major classifications may be broken down in more detail. The first category of service and limited function wholesalers, which included 101,627 firms out of a total of 200,573 wholesale establishments in 1939, was made up of the following:

Wholesale merchants	91,323
Voluntary group wholesalers	703
Converters (textile)	631
Export merchants	586
Importers	2,158
Industrial distributors	1,471
Cash-and-carry wholesalers	1,198
Drop shippers and desk jobbers	937
Wagon distributors	2,398
Retail—co-operative warehouses	222

For the most part, wholesale merchants buy goods outright from manufacturers and suppliers and resell them to retailers or other outlets, usually granting credit and extending delivery service. Such firms may carry a broad line of merchandise or a relatively specialized and narrow line. In contrast to the services offered by wholesale merchants, the cash-and-carry wholesalers, as the name implies, require their customers to transport the merchandise themselves and to pay cash for it. Drop shippers never take possession of merchandise, but simply secure orders which the manufacturer or supplier fill direct to the customer.

Manufacturers' sales branches (with stocks), of which there were 12,977 in 1939, and manufacturers' sales offices (without stocks), of which there were 5,119 in 1939, perform different parts of the wholesale function. Sales branches or offices may be established by manufacturers for the purpose of sale or resale to wholesalers, or for sale to retailers, or for sale to final buyers, either individual consumers or industrial enterprises.

The general category of agents and brokers, of which there were 20,903 in 1939 includes the following types:

Auction companies	649
Brokers (merchandise)	4,710
Commission merchants	2,758
Export agents	654
Import agents	394
Manufacturers' agents (with stocks)	1,907
Manufacturers' agents (without stocks)	7,871
Selling agents	1,487
Other agents	473

These various categories reflect differences in the arrangements between manufacturers and agents or in the method of operation of wholesale enterprises. A common characteristic which distinguishes this group from the service and limited function wholesalers is that they do not buy and resell for their own account but serve as selling or buying representatives, usually on a commission basis.

Assemblers (mainly farm products), of which there were 29,122 in 1939, include: assemblers; commission buyers; co-operative marketing associations; co-operative sales agents; cream stations; country grain elevators; and packers and shippers.

The census of business shows in great detail the extent to which each of these types of wholesale institutions is important for different industries and for different types of products. Every producer or manufacturer finds that one of his chief problems is to decide which of these wholesale institutions or what combination of wholesale institutions will serve him best. The great divergence in methods of operation is partly a reflection of the differences among the markets to be served and partly a reflection of individual decisions by many different business managements.

In addition to the types of marketing institutions already described, there are also the marketing departments of manufacturers or producers, which are not included among the manufacturers' sales branches. Many manufacturers notably those with limited geographical coverage or those who sell to a few large customers, have no need for sales branches and operate entirely from the factory or central office.

In addition, there are a great many marketing institutions which might be described as facilitating organizations. Advertising agencies which prepare and supervise advertising programs for their clients are prominent among these. There are also a growing number of specialized marketing research organizations which undertake to secure facts, by survey or otherwise, as to the size and character of the market for a particular product, the best type of outlets to be used, and other factors affecting marketing decisions. In a very real sense, magazines, newspapers, and radio stations are also facilitating marketing institutions because of their importance in sales promotion activities.

Integration of Marketing Functions

When a single enterprise carries out all of the activities involved in moving goods to final buyers, it may be described as having integrated all of the marketing functions. An example of thoroughgoing integration, not only of marketing activities but also of production activities, is found in the petroleum industry. Many of the concerns in the petroleum industry own oil wells, pipelines and other transport facilities for moving crude oil to refineries, refineries themselves, tankers or other transportation equipment for moving the refined product to market, and wholesale and retail marketing facilities. As another example, some manufacturers of men's clothing own and operate chains of retail stores to sell their products, and the products of other manufacturers to men.

The integration of marketing functions may be complete or partial. Grocery chains, for instance, often perform what may be described as both wholesale and retail functions. They maintain large warehouses to which goods are shipped direct from manufacturers or processors in very large quantities. These large quantities are broken down at the chain warehouses into smaller quantities and shipped to the individual retail stores, usually by truck. In other words, there has been partial integration of the marketing functions but not the complete integration which would have developed if the same interests owned both the manufacturing and the chain store organization.

A different type of partial integration is found when a manufacturer or producer sets up his own sales branches with stocks of merchandise and sells from these branches to retailers. In this case, the integration has extended through the wholesale functions but has not included the retail functions. The working out of integration to the most effective degree, taking into account not only internal costs but also sales promotion factors, is an outstanding marketing problem.

New Combinations of Merchandise.—Another important problem which concerns many types of marketing institutions is the working out of new combinations of merchandise to be carried. A special aspect of merchandising activity, as described above, has featured extensive experimentation in the combinations of merchandise carried by particular kinds of wholesale or retail institutions. A notable illustration is the development of modern drugstores, many of which, starting with a relatively clear-cut line of pharmaceuticals, have expanded to include a wide range of toys, household appliances, cosmetics, tobacco products, and even some types of clothing. Most drugstores are much like old-fashioned general stores or modern department stores. In the grocery chains, there was much discussion during the 1920's about the addition of meats and fresh fruits and vegetables to the line; this development is now firmly established. Filling-station chains, several of which are operated by large tire manufacturers, are tending to broaden their lines markedly, almost to the point of becoming small department stores.

During the last two or three decades there have been, however, some developments in the opposite direction—toward narrower specialization. In the shoe trade, for instance, some concerns have specialized not only in men's shoes or even in men's shoes at a single price. Perhaps the extreme in such specialization was the opening in a large city of a store devoted entirely to the sale of men's neckties.

The Automobile and Marketing.—During the years following the First World War, one of the most powerful influences for change in retail trade practices was the increasing use of the automobile. To this cause can be traced the rising importance of large trade centers and the decline in the trade of smaller communities in rural areas—and also the movement of retail trade to outlying sections of larger cities where parking space is available. With the location of the new stores of the two major mail-order companies (Sears Roebuck & Company, Montgomery Ward & Company) in outlying sections, as compared to downtown shopping areas, and the development of large food stores, commonly called supermarkets, wherever parking space can be found, it seems highly probable retail trade has not yet felt the full effects of the increased mobility of customers resulting from the use of the automobile.

Marketing Costs.—As already noted, marketing costs represent somewhat more than half, perhaps between 54 per cent and 59 per cent, of the total cost of producing and distributing goods. Increasing perception of this fact has caused considerable concern about the problem of high distribution costs. Two observations in regard to this problem are worth citing: (1) Distribution costs have in part replaced production costs. Economies flowing from large-scale manufacture, and from the technical developments that it has been possible to utilize in large-scale operations, have greatly lowered the costs of producing goods; but at the same time increased marketing costs have resulted from the attempt to dispose of larger outputs in wider markets. (2) The high cost of distribution, as Professor F. W. Taussig once remarked, is to a considerable extent the price of consumer freedom—freedom to make choices from a great variety of goods, both in and out of season, freedom to gratify whims; freedom to return merchandise merely because of a change of mind; freedom to enjoy all kinds of collateral services, including credit, delivery, mail orders, telephone orders, demonstrations, lectures, fashion shows, and so on."[6]

These observations do not, of course, imply that intensive efforts should not be made by business management and by public authorities to reduce marketing costs. Indeed, the large proportion of total costs devoted to marketing represents an opportunity and a challenge, since the general potential standard of living can be greatly affected by efforts in this direction. Overall estimates of aggregate marketing costs do not serve particularly well for this purpose. What is needed is detailed information as to the costs incurred by particular types of marketing institutions.

The study of marketing costs really began some 30 years ago when the Harvard Bureau of Business Research, a division of the Harvard Graduate School of Business Administration, published its first study of the operating costs of shoe retailers. Since that time, the Harvard bureau and many other educational and trade institutions have published typical figures for operating costs of many retail and wholesale trades. The census of business has provided additional information, and there are few wholesale and retail trades for which at least some information about typical operating costs is not available. A compendium of such studies, not only for the United States but for European countries, has been published by members of the faculty of the Harvard Graduate School of Business Administration.

Published material on marketing costs of manufacturers, by contrast, is very scanty and is largely limited to a study in 1933 by the Association of National Advertisers,[7] a study by the Twentieth Century Fund entitled *Does Distribution Cost Too Much?*[8] and a study of some 15 industries by the Federal Trade Commission.[9]

Marketing Research.—There has been a notable increase in interest in marketing research. In a sense, any effort to secure facts or to correlate known facts in an orderly fashion in order to provide a rational basis for marketing decisions is marketing research. Over the years most successful enterprises have, therefore, been engaged in marketing research. Business firms, advertising agencies and publishers, and specialized marketing research organizations have also been developing a considerable body of specialized techniques which warrant particular attention.

As has been noted already, the marketing of most consumer goods is characterized by far-flung markets, with producer and consumer

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[6] McNair, Malcolm P., Teele, Stanley, F., Mulhearn, Frances G., (with the collaboration of Dr. Julius Hirsch) *Distribution Costs, An International Digest*, p. 2 (Graduate School of Business Administration, George F. Baker Foundation, Harvard University, Boston 1941).

[7] *An Analysis of Distribution Costs of 312 Manufacturers*, Association of National Advertisers, Inc. (in collaboration with the National Association of Cost Accountants, New York 1933).

[8] *Does Distribution Cost Too Much?* Twentieth Century Fund (New York 1939).

[9] *Report of the Federal Trade Commission on Distribution Methods and Costs*, United States Federal Trade Commission (United States Government Printing Office. Washington, D.C. 1944)

widely separated as to time and place. Some manufacturers of industrial goods and a few small manufacturers of highly specialized consumer goods have such a small number of potential customers that information about these potential customers may be secured by a direct, complete canvass or census. But for mose sellers the number of potential customers renders it physically and financially impossible to make a complete canvass. Under these conditions, the techniques of "sampling" become important. Essentially, the use of "sampling" rests on the proposition that results obtained from studying a properly selected sample will be representative of the whole.

An important question in radio advertising is the number of listeners for particular programs. A method has been devised whereby a careful, calculated sample of people in certain cities is telephoned and asked what program is being heard. From these replies the relative popularity of different programs is calculated. Critics of this method point out that the sample is composed only of people in cities and only of those in the income group who have telephones. If this is the total group with which the marketer is concerned, the kind of sample is adequate; if, on the other hand, the marketer is interested in a cross section of the entire population, there are very important segments unrepresented in such a sample. To meet this difficulty a device has been developed which is attached to the radio and records on a tape the exact times the radio is turned on and the stations to which it is tuned. The user of this device seeks to have it attached to radios in homes which are carefully selected to be fully representative of the entire population, taking into account such factors as geographical distribution, racial characteristics, income levels, and urban and rural differences.

The question of the popularity of particular radio broadcasts is illustrative of problems calling for continuing information. The readership of magazines (circulation is not a complete nor accurate measure of the number of actual readers) and the movement of particular brands of goods through grocery and drugstores are other illustrations of questions which receive continuing study by one means or another.

More often a marketer needs facts to help reach a specific nonrecurring decision. The problem may be the desirability of a particular change in a package, the use of a specific kind of advertisement or other promotional piece, or the determination of the size and character of a market, either nationally or in some smaller regional unit.

For securing information on these and a host of other questions many techniques have been developed and are used. One technique is direct observation. Observers, for instance, are stationed in liquor stores to hear and record just what happens during a transaction. How does the customer ask for merchandise? In how many instances does he ask for a specific brand of merchandise? How often does he mention price first? How often is he influenced by large special displays? The salesman, knowing of the observer's presence, may not act naturally, but the behavior of the customer is likely to be significant.

A second frequently used technique is the interview. Interviews are held in homes, on subways or other public transportation, in offices, and indeed wherever people can be induced to talk. Usually the interviewer is guided by a carefully prepared questionnaire or series of questions which is designed to bring out the information desired and to guard against false or mistaken answers.

Both the preceding methods are expensive, since they require the time of an observer or interviewer for each observation or reply. Their high cost is a major factor which has lead to the very great use of mail questionnaires. Such questionnaires have become a popular butt for jokes, and in some instances they have been so poorly constructed or handled that the results have little or no validity. A great deal of experience on the construction of questionnaires has now been accumulated, however, and it should be possible to avoid the most egregious errors. Even after careful attention to the advance construction of questionnaires, experienced marketers conduct small-scale trial runs before using a particular questionnaire on a broad scale.

The careful planning of a survey in advance, including the exact definition of the information (facts or opinions) to be sought, the determination of the methods to be used in securing information, and the handling of mass data after it has been secured, is an essential to effective and low-cost marketing research. Much refinement of techniques is now in progress and those refinements will make possible more precise measurements, but the best techniques are of little value if the basic planning in terms of objectives is not carefully and skillfully done.

The Government and Marketing

As an important part of business as a whole, marketing is, of course, affected by all federal and state legislation which deals with business activities. The present tax structure, for insurance, affects marketing decisions as much as it effects decisions about production. There are, however, a number of important pieces of legislation which are primarily concerned with marketing activities. Among these may be mentioned the Pure Food and Drug Act as amended, the Federal Trade Commission Act establishing the principal federal agency which regulates marketing activities, and the statutes providing for the registration of trademarks. Important basic state legislation includes the uniform sales acts and many laws designed to prevent fraud and misrepresentation in sales transactions.

During the last decade there has been a considerable legislative movement related to the regulation of prices. These legislative enactments are sometimes lumped together under the heading "Fair Trade Legislation." The Clayton Act, passed many years ago in conjunction with the Federal Trade Commission Act, made a start toward limiting pricing freedom by forbidding discrimination among different localities designed to eliminate competition. In the middle 1930's this limitation was extended by the so-called Robinson-Patman Act, which provided, "That it shall be unlawful for any person engaged in commerce, in the course of such commerce, either directly or indirectly to discriminate in price between purchasers of commodities of like grade and quality. . . ." This act includes a series of specific exceptions to the basic rule against discrimination, the most important of which is, "That nothing herein contained shall prevent differentials which make only due allowance for

ifferences in the cost of manufacture, sale, or elivery resulting from the differing methods or uantities in which such commodities are to such urchasers sold or delivered. . . ."[10]

A second major piece of legislation limiting ricing freedom was the Miller-Tydings Act hich permitted the states to enact legislation roviding for resale price maintenance. Under uch state enactments, manufacturers are permitted to require wholesalers and retailers to esell their merchandise at or above prices stipuated by the manufacturer. State legislation of his nature has been generally adopted, and resale rice maintenance contracts have been widely mployed, especially by manufacturers of drugs, oods, and alcoholic beverages.

A companion approach to the control of selling prices is typified by the California Unfair Practices Act, which prohibits sales below cost. A number of states have adopted this type of egislation and have defined cost variously, several setting a percentage above the price paid y the retailers or wholesalers to cover the distributors' operating costs.

During the Second World War, the federal overnment's control of marketing was very xtensive, not only through the prohibition f production of certain goods, but also through ationing and direct price control. Under these onditions, marketing managements have often ad to be guided much more by government egulations than by an analysis of business circumstances.

Bibliography.—The reader seeking more detailed information on marketing will find that he literature numbers hundreds of volumes nd that dozens of magazines are constantly ublishing articles on the subject. From these any sources, a few have been selected. They re classified below as to whether they are oncerned with marketing generally or some nportant subdivision of the subject. In addion, a few of the current magazines are listed:

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MARKETS AND RURAL ORGANIZATIONS, Office of. See AGRICULTURE, DEPARTMENT OF.

MARKHAM, märk'ăm, **Albert Hastings,** English admiral and Arctic explorer, cousin of Sir Clements Markham (q.v.): b. Bagnères, Nov. 11, 1841. He entered the navy in 1855, saw active service in the China seas for several years, took part in the Polar expeditions of Adams (1873) and of Nares (1875), and in the latter expedition attained what was then the farthest north, 83° 20′ 26″. With Sir Henry Gorn-Booth he attempted to reach Franz Joseph Land in 1879, but was unsuccessful; in the next year Markham explored the Galapagos Islands. Rear admiral in 1892 and second in command of the Mediterranean Fleet in 1893, he was made a vice admiral, and later admiral. His last command was at Nore. He retired in 1906. He wrote *The Cruise of the Rosaria Amongst the New Hebrides* (1873); *The Great Frozen Sea* (1878); *The Voyages and Works of John Davis* (1884); *A Polar Reconnaissance* (1879); and *Life of Sir John Franklin* (1891). He died Oct. 28, 1918.

MARKHAM, Sir Clements Robert, English geographer and traveler: b. Stillingfleet, Yorkshire, July 20, 1830; d. Jan. 30, 1916. He was educated at Westminster School, entered the navy in 1844, accompanied the Franklin Search Expedition of 1850 and then retired from the service. He traveled in Peru in 1852–54 and 1860–61, the second journey being undertaken to get cinchona seeds for planting in India, an experiment described in his *Peruvian Bark; Cinchona Culture in British India, 1860–1880* (1880). After spending 1865–66 in Ceylon and India, he became assistant secretary in the India Office from 1867–77, and curator of its geographical department in 1868. From 1858–87 he was secretary of the Hakluyt Society, of which he became president in 1890. From 1863–88 he was secretary of the Royal Geographical Society, and in 1893 became its president. His more important works, several of which were translated into German, are *Cuzco and Lima* (1856); *Travels in Peru and India* (1862); *The Arctic Navy List* (1875); *Lives* of Columbus, John Davis, Richard Hakluyt, Lord Fairfax, Major Rennell and Sir Leopold McClintock; *Quichua Dictionary* (1908); *The Incas of Peru* (1910). He rendered distinguished service to the history of geography and discovery by editorial work for the Hakluyt and other societies. He was created Knight Commander of the Bath in 1896.

MARKHAM, Edwin, American poet: b. Oregon City, Oreg., April 23, 1852. He spent his

[10] An act to amend section 2 of the act entitled "An act to supplement existing laws against unlawful restraints and monopolies, and for other purposes," approved Oct. 15, 1914, as amended (U.S.C., title 15, sec. 13), and for other purposes.

boyhood on a ranch in central California, herding cattle and sheep, and later graduated from the California State Normal School at San José and from Santa Rosa College. He studied law, but did not practice; subsequently took up educational work and was superintendent and head master of schools in California and principal of the Observation School of the University of California in Oakland. He had for some time been an occasional contributor to some of the leading American magazines, but first gained wide reputation through the publication of his poem, *The Man with the Hoe,* suggested to him by Millet's picture of the same name. This first appeared in the San Francisco *Examiner* and was later published in a collection entitled *The Man with the Hoe and Other Poems* (1899). This poem, which had a wide influence and caused much discussion, is intended by the author not merely as a picture of the peasant but as "a symbol of the toiler brutalized through long ages of industrial oppression." His other publications include *Lincoln and Other Poems* (1901); *The Poetry of Jesus* (1914); *California the Wonderful* (1914); *The Children in Bondage* (1915); *Remarkable Writings of Thomas Lake Harris,* 5 vols. (1918); *Gates of Paradise* (1920); *The Ballad of the Gallows Bird.* Died S. I., New York, March 7, 1940.

MARKHAM, Gervase (or **Jervis**), English poet and writer: b. 1568?; d. London, Feb. 3, 1637. A soldier of fortune in the Low Countries and later a captain under the earl of Essex in Ireland, Markham is remembered as a writer on horse-breeding, agriculture and forestry. He is said to have imported the first Arab into England for stud purposes. His *Poem of Poems* or *Syon's Muse* (1595) was dedicated to Sir Philip Sidney's daughter. He collaborated in writing two plays, and was the author of *A Discourse on Horsemanshippe* (1593), as well as numerous works on husbandry.

MARKHAM, William, English colonial governor in America: b. England, about 1635; d. Philadelphia, June 12, 1704. When William Penn obtained a charter for Pennsylvania, he made Markham, a first cousin of his, his deputy. Markham had all rights granted to Penn save that of convoking a legislative assembly. On Aug. 3, 1681 he established a council, later chose the site for Philadelphia and conferred with Lord Baltimore as to the Maryland-Pennsylvania boundary. Penn himself arrived on Oct. 27, 1682, and Markham, whose commission accordingly lapsed, was elected to the council. In 1684–99 he was secretary to the province, in 1686 became land commissioner and in 1689 an auditor of accounts. When in 1691 the territory now constituting the State of Delaware was detached from the province, he was appointed its deputy governor, and in 1694–99, as lieutenant governor, administered both this territory and the province.

MARKHOR, mär'kôr or -koor, a remarkable goat (*Capra falconeri*) of the mountains of Afghanistan and northwestern India, where it keeps among the highest wooded valleys, ascending and descending only as compelled to do so by the seasonal changes in the depth of the snow. It is of large size, standing about three feet tall at the shoulders, and is reddish-brown in summer and light gray in winter. "The magnificent beard, extending in the adult males on to the chest and shoulders, and sometimes reaching nearly to the knees, is black in front and gray behind; in the young bucks and the does at all ages it is confined to the chin." The horns are very different from those of other goats, rising straight up from the forehead, spreading sideways, so as to form a V when seen from in front, and spirally twisted. Specimens have measured 50 inches along the spiral keel. Several distinct local varieties of markhor are known to the Himalayan hunters, who regard this animal as one of the most excellent objects of sport in that region of prime game animals. "Unlike the ibex, which keeps to the rugged crags and steep ravines above the limits of the forest, the markhor delights in rocky forests, and although it occasionally comes out into the open glades, it seeks concealment as much as possible." Hence its hunting calls for the greatest skill as well as endurance. This goat is often captured, tamed and crossed with domestic goats; and it is believed to have had some influence in originating the Angora breed. Consult Lydekker, *Wild Oxen, Sheep and Goats of All Lands* (1898).

MARKIEWICZ, Countess, Irish artist and revolutionist: b. Lissadel, Sligo, Ireland, about 1868. A daughter of the late Sir Henry Gore-Booth, closely connected with a number of English titled families, she has been described by the Dublin bourgeoisie as the stormy petrel of Dublin life. Her husband, a Pole, was employed in the Russian consular service, and both had been prominent figures in the social life of Dublin. Before the countess became involved with the Sinn Fein Party she had made a name both as an artist and an actress, and she had frequently acted in her husband's plays at the Abbey Theatre. As a young girl the countess, then Miss Constance Gore-Booth, was presented at court and spent several seasons in London, after which she went to Paris as an art student. She came into prominence during the election in Northwest Manchester in 1908 as an opponent of Mr. Churchill. The Licensing Bill was then the issue and she went to Manchester to plead the cause of the barmaids. Her sister, Miss Eva Gore-Booth (q.v.), a leading English suffragette, was then the secretary of the Barmaids' Political Defence League. In 1911 the countess was charged in Dublin with assaulting a policeman at the breaking-up of a Socialist meeting. During the labor troubles in Dublin in 1912 she came into conflict with the police on several occasions. On the memorable Sunday at the end of August 1912 when Larkin's dramatic arrest was the prelude to wild disorder in O'Connell Street, she and her husband came upon the scene when the excitement was at its height, and as Larkin was being escorted to the police station by a body of police with drawn batons. The countess stood up on the car she was driving and led the cheers of the mob for the captured labor leader. For many months afterward, when a large section of the Dublin working classes was in dire poverty caused by the protracted strikes, the countess was a constant attendant at Liberty Hall, the headquarters of the Transport Workers' Union. Here she was engaged in preparing and distributing meals to

the impoverished wives and families of the strikers. A few weeks before the abortive revolution in April 1916 her house was raided by the police, who found a printing plant there and many documents. At the outbreak of the revolt she apparently accompanied the party who captured Saint Stephen's Green, and when the troops got the upper hand she retired with her detachment into the Royal College of Surgeons, one of the principal buildings on the green. Eventually she hoisted the «white flag» and intimated that she would surrender at noon. At the appointed hour the countess marched out of the college, followed by 120 rebels walking two abreast. She was dressed entirely in green, with green tunic, green hat with green feather, green putties and green shoes. She marched to where the opposing force was waiting and, going to the officer in command, saluted, kissed her revolver and handed it over with her bandolier, and announced that she was ready. The men were disarmed and marched off under armed escort to the castle. For complicity in the uprising the countess was sentenced to death by a court-martial, the sentence being afterward commuted to imprisonment for life. She was liberated with the other Irish prisoners in June 1917. She continued her activity in the Sinn Fein party, however, and at the general elections held in December in 1918 she was elected to Parliament, the first woman to be so honored, but she declined to serve. Thereafter she was a leader in Irish Republican circles, opposed to the Free State. She died at Dublin, 15 July 1927.

MARKING-NUT, an East Indian tree (*Semecarpus anacardium*) of the cashew family, having a fruit the receptacle of which is roasted and eaten. The black juice of the unripe fruit serves with quicklime to make an indelible marking-ink.

MARKINGS OF ANIMALS. See Coloration, Protective.

MARKLE, John, American coal operator: b. Hazelton, Pa., 15 Dec. 1858. He was graduated in the mining engineering department of Lafayette College in 1880 and in the same year was appointed general superintendent of mines of G. B. Markle and Company, his father's firm. Upon his father's death he succeeded him and was president of the G. B. Markle Company, successor to G. B. Markle and Company, and one of the largest of the «independent» companies in the anthracite coal industry and also president and chief engineer of the Jeddo Tunnel Company. He was one of the leading figures and represented the independent operators in the negotations with President Roosevelt and in the inquiry by the President's commission in connection with the anthracite coal strike of 1902. Mr. Markle was a director of the Industrial Finance Corporation, the Morris Plan Company of New York, member of the American Institute of Mining Engineers, the New York Chamber of Commerce and Franklin Institute, Philadelphia, and a trustee of Lafayette College. He died 10 July 1933.

MARKOE, Thomas Masters, American surgeon: b. Philadelphia, Pa., 1819; d. 1901. In 1836 he was graduated at Princeton and in 1841 at the New York College of Physicians and Surgeons. He was appointed to the chair of anatomy in Castleton Medical College, Vermont; in 1852–54 was professor of pathological anatomy at the medical department of the University of the City of New York. He was appointed adjunct professor of surgery at the New York College of Physicians and Surgeons in 1860; became full professor 10 years later and in 1879 was appointed to the chair of the principles of surgery. He published 'Treatise on Diseases of the Bone' (1872).

MARKS' MILLS, Engagement at. On 23 April 1864, a train of 240 wagons, escorted by 1,200 infantry, 400 cavalry and five guns, all under command of Lieut.-Col. F. M. Drake, 77th Ohio Infantry, left Camden, Ark., for Pine Bluff, to get supplies for General Steele's army, then co-operating with Banks' Red River expedition. At 10 A.M. of the 25th, when at Marks' Mills, on the Camden and Pine Bluff road, about eight miles beyond Saline River, Drake was attacked, front and rear, by General Fagan's force of 3,000 men — cavalry, mounted infantry and two batteries — and after a hard fight of more than three hours, during which Drake was severely wounded and had lost 250 in killed and wounded, the entire train, guns and the greater part of the cavalry and infantry were captured. About 300 escaped and made their way to Little Rock and Pine Bluff. Incomplete Confederate returns show a loss of 41 killed, 108 wounded and 144 missing. Fagan's entire loss was about 420. When Steele heard of the disaster he immediately abandoned the idea of joining Banks, left Camden on the night of the 26th for Little Rock, was followed by Sterling Price, had a rear-guard fight at Jenkins' Ferry on the 30th and continued his retreat to Little Rock. Consult 'Official Records' (Vol. XXXIV).

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MARL, a mixture of carbonate of lime and clay in various proportions. If the lime predominate the marl is called calcareous; clay marl, or argillaceous marl, has a larger proportion of clay. As marl is hard or not it is called indurated or earthy. Even the more solid marls crumble soon on exposure to the atmosphere, and form a paste if dipped in water; they effervesce in acids, because of the presence of carbonate of lime. Marl occurs in masses and beds, is associated with chalk, gypsum, sand, clay or compact limestone and contains important fossil remains. To the presence of carbonate of lime in its composition, marl owes its use in the manufacture of Portland cement and as a fertilizer. Many natural mixtures used as manures are called marls, such as the New Jersey green sand-marls, which contain as their principal constituents clay and greensand and usually only 1 or 2 per cent of carbonate of lime. The latter use of the word is scarcely justifiable, especially as it is sometimes applied, notably in England, to substances containing no lime at all. Marl is accumulating at the present time in many lakes in the glaciated areas of our Northern States, in part as a result of the grinding up of small shells, in part as a result of the activity of algæ known as chara, which cause the deposition of lime carbonate. Marl may sometimes be a direct chemical precipitate. See Mineral Production of the United States.

MARLATT, Charles Lester, American entomologist: b. Atchison, Kans., Sept. 26, 1863. He was educated at Kansas State College of Agriculture and Applied Science, receiving his B.S. degree in 1884 and his M.S. in 1886, and taught there for two years. From 1889 to 1894 he was assistant entomologist, from 1894 to 1922 first assistant and assistant chief entomologist, from 1922 to 1927 associate chief, and from 1927 to 1933 chief, of the Bureau of Entomology of the United States Department of Agriculture. Marlatt directed efforts to secure a federal law to prevent the importation of infested and diseased plants, which resulted in the passage of the Plant Quarantine Act of Aug. 20, 1912.

MARLBORO, märl'bûr-ō, unincorporated village, New York, situated in Ulster County, at an altitude of 180 feet, on the west bank of the Hudson River and the New York Central Railroad, 8 miles north of Newburgh. In a fruit-growing and dairying region, it has canneries, dairies, and factories producing builders' supplies. Marlboro was the home of Frederic W. Goudy (q.v.), type designer. Pop. (1950) 1,709.

MARLBOROUGH, märl'bŭ-rŭ, 1st Duke of (John Churchill), English soldier and statesman: b. Ashe House, near Musbury, Devonshire, 1650; d. near Windsor, June 16, 1722. He attended St. Paul's School from 1663 to 1665, when he became page to the duke of York (later James II). Commissioned an ensign in 1667, he saw service at Tangier, and in 1672 was promoted to the rank of captain. In that year he accompanied the duke of Monmouth to Flanders in the expedition to assist the French against the Dutch. He distinguished himself at the siege of Maastricht in 1673, and in the following year was commissioned colonel by Louis XIV. Returning to England, he was married to Sarah Jennings, attendant of Princess (later Queen) Anne, early in 1678, and was commissioned colonel of a foot regiment. He accompanied the duke of York to the Netherlands in 1679, and later that year to Scotland. In 1682, he was created Baron Churchill of Aymouth. In the following year his wife was appointed lady in waiting to Princess Anne, with whom she became intimate. On the accession of James II in 1685, he was sent on a mission to Louis XIV and soon after his return was created Baron Churchill of Sandridge. He helped to suppress Monmouth's rebellion and was raised to the rank of major general.

He was in touch with William of Orange as early as 1687, and he joined him in the following year. Early in 1689, William appointed him a member of the Privy Council and raised him to the earldom of Marlborough. He served in Ireland in 1690, reducing Cork, Kinsale, and other towns. Suspected of intrigue with the Jacobites, he was dismissed from his positions in 1692 and committed for a short time to the Tower of London. By 1698, however, he was restored to favor at court and was appointed governor to the young duke of Gloucester and member of the Privy Council. In 1701, William appointed him commander in chief of the English forces in the Netherlands and ambassador plenipotentiary at The Hague.

On the accession of Queen Anne in 1702, Marlborough was appointed captain general of the forces in England and master general of ordnance. He was sent to The Hague as ambassador extraordinary and arranged for English support of the Dutch in the War of the Spanish Succession. In command of a mixed force of English, Dutch, and Germans, he drove the French from Upper Gelderland and took Kaiserwerth, Venlo, and Liége. For his services he was created marquis of Blandford and duke of Marlborough. He returned to the Continent in 1703, campaigned successfully in the Rhineland, but was unable to take Antwerp because of the lack of Dutch support. In the following year he stormed the French and Bavarian lines at Donauwörth and, with Prince Eugene of Savoy, won the great victory of Blenheim (August 13). Parliament showed its gratitude by passing an act enabling the queen to award him the manor of Woodstock, and Blenheim Palace was built for him at her expense. He was victorious over the French at Ramillies in 1706, and at Oudenarde, with Prince Eugene, in 1708. In the following year he defeated the duc de Villar at Malplaquet, though at a cost ill repaid by the capture of Mons. Meanwhile, his popularity at court had declined and a new ministry, hostile to him, had taken office. He was accused of using public funds for private purposes and dismissed from his command in 1711. He went in disgust to the Netherlands in 1712, but returned to England in 1714, on the death of Queen Anne, and shortly thereafter was reappointed captain general and master of ordnance.

Consult Murray, George, ed., *Letters and Despatches of Marlborough,* 5 vols. (London 1845); Coxe, William, *Memoirs of the Duke of Marlborough,* rev. ed. (London 1847–48); Churchill, W. L. S., *Marlborough, His Life and Times,* 6 vols. (New York 1933–38); Ashley, M. P., *Marlborough* (London 1939).

MARLBOROUGH, municipal borough, England, situated in Wiltshire, in the Kennet River valley, 75 miles west of London. It serves as the trading center for the surrounding dairying and sheep-raising region. The borough is the seat of Marlborough College, a public school founded in 1843. Thomas Cardinal Wolsey is said to have been ordained at St. Peter's Church here in 1498. Pop. (1951) 4,556.

MARLBOROUGH, märl'bûr-ō, city, Massachusetts, situated in Middlesex County, at an altitude of 375 feet, on the Boston and Maine and the New York, New Haven and Hartford railroads, 15 miles east-northeast of Worcester. An industrial city, it produces shoes and slippers, paper goods, metal products, boxes, and miners' lamps. It has a public library, a museum of natural history, and a general hospital. In the building used as the headquarters of the American Legion is the John Brown Bell, taken from the engine house at Harpers Ferry in 1861 by Union soldiers from Marlborough.

Marlborough occupies the site of an Indian settlement. The first white settlers arrived in 1657, and three years later a town was incorporated and named for Marlborough, England. It was attacked by the Indians in 1676, in King Philip's War, while the townspeople were at church. Marlborough was incorporated as a city in 1890. It is governed by a mayor and council. Pop. (1950) 15,756.

MARLBOROUGH, provincial district, New Zealand, situated in the northeastern part of South Island. Its extreme length is 130 miles,

breadth 60 miles; area, 4,220 square miles. The coast is deeply indented by bays and natural harbors, from which the hills rise abruptly, clothed with magnificent forests. The district is generally hilly or mountainous, with splendid scenery. The amount of arable land is restricted; in the south are the Wairau plains, one of the finest sheep tracts in New Zealand. Mining is carried on, gold, copper, and coal being found. Blenheim, the capital, is connected by rail with the seaport of Picton on Queen Charlotte Sound, an inlet off Cook Strait. Pop. (1945) 20,737.

MARLIN, mär'lĭn, city, Texas, seat of Falls County, located near the Brazos River at an altitude of 383 feet, 20 miles south-southeast of Waco, on the Southern Pacific and the Missouri Pacific railroads. It is situated in an agricultural region in which cotton is the principal product, and the ginning and compressing of cotton is the city's leading industry. Cottonseed oil is produced and shipped. Other shipments are mineral crystals, dressed poultry, and creamery products. With three hot-water artesian wells having remarkable curative properties, Marlin stands high as a health resort, and is visited by persons from all parts of the country. There are two general hospitals and a veterans hospital here. The city has good schools, a public library, and a courthouse. Government is by mayor and council. Pop. (1950) 7,099.

MARLINESPIKE, mär'lĭn-spīk, **MARLINSPIKE,** or **MARLINGSPIKE,** an iron pin tapering to a point, and principally used by sailors to separate the strands of a rope in splicing or knotting. The name is often applied to the jaeger because of the bird's long middle tail feathers.

MARLITT, E. See JOHN, EUGENIE.

MARLOW, mär'lō, city, Oklahoma, in Stephens County, on a tributary of the Washita River, 26 miles east of Lawton, served by the Chicago, Rock Island, and Pacific Railroad. Corn and watermelons are raised in the county, and there are cotton gins in the city. Pop. (1950) 3,399.

MARLOWE, Christopher, English poet and dramatist: b. Canterbury 1564; d. Deptford, June 1, 1593. In 1584 he took the A.B. degree at Corpus Christi College, Cambridge, and in 1587 the degree of M.A. Perhaps in the same year, the first part of his *Tamburlaine* was acted in London; and the rest of his life was spent in active connection with the theaters. His life seems to have been somewhat dissipated and the daring of his theological opinions gave color to an accusation of atheism. In 1593 he was killed in a tavern broil by Ingram Frisar, and was buried at St. Nicholas, Deptford.

Numerous plays have been assigned to Marlowe, including a share in the three parts of *Henry VI;* and he may very likely have had some part in others besides the following, which can with certainty be ascribed to him: *The Tragedy of Dido,* of uncertain date of acting, finished by Thomas Nash, printed 1594; *Tamburlaine the Great* (two parts), acted 1587–1588, printed 1590; *Tragedy of Dr. Faustus,* acted 1588–1589, entered at Stationer's Hall 1601; *The Jew of Malta,* acted after 1588, entered 1594, printed 1633; *Edward II,* acted 1591, printed 1593; *The Massacre of Paris,* acted 1593, printed about 1600. His *Hero and Leander* was completed after his death by George Chapman and published in 1598. Marlowe's plays attained a sudden and great popularity and his poetic reputation is testified to by numerous tributes from his contemporaries. Marlowe's dramatic activity came at a time of great emotional stir and stress. In England the ideas and ideals of the Renaissance and the Reformation had finally gained the ascendency over those of the Middle Ages. The struggle with Spain, which was just ending in the destruction of the Armada, had brought a triumphant consciousness of national greatness. From this newly-discovered England as well as from the newly-discovered America and the rediscovered world of Greece and Rome, came countless incentives for multiform activities. The drama had already become in some measure an expression of this national activity, but it still awaited the services of great literary genius. After two generations of precarious struggle, the professional companies had become firmly established in the public theaters and it was already plain that the main development of the drama was henceforth to be popular and professional rather than scholarly and amateur. In comedy, indeed, the plays of John Lyly and George Peele had already supplied refinement and a literary flavor, but in the popular drama in the main, and in tragedy in particular, there was neither refinement nor poetry.

Marlowe created English tragedy anew. He threw aside Senecan traditions and devoted himself to meeting the demands of the London theaters, but the prologue to his first play was a declaration of reform, announcing the adoption of blank verse, heroic themes and "high astounding terms." His themes were novel, and his treatment of them seems to have been dictated by a conception of tragedy formed independently of his predecessors—the heroic struggle of a great personality doomed to inevitable defeat. *Tamburlaine* is hardly a tragedy at all but rather a chronicle of the hero's greatness; but in *Dr. Faustus* and *The Jew of Malta,* heroes with ambitions as boundless and passionate as Tamburlaine's are overwhelmed in the end by the limitations that forever bound human aspiration. These plays mark the formation of the Marlowean type of tragedy, often imitated and long influential in the English drama. A protagonist distinguished by great passions and many crimes absorbs the interest of a series of scenes, brutal and sensational, full of violent action, ranting declamation, bloodshed, and villainy affording opportunity for elaborate theatrical spectacles and adorned by passages of profound intellectual suggestiveness and extraordinary beauty of diction and melody. *Edward II,* the most mature of his plays, illustrates these characteristics and also testifies to his growing power both as a playwright and as a poet. The characterization is less melodramatic, more varied and more human than in the earlier plays; the structure more coherent and organized; the style less bombastic, more even and more dramatic. Shakespeare, who clearly imitated Marlowe in *Richard III* and produced *Richard II* in rivalry of *Edward II* did not in these two plays surely surpass his master.

Marlowe's faults and deficiencies are apparent and they cannot all be credited to the

immaturity and experimental nature of his art. The banalities that mar his noblest scenes and the absurdities that appear in every phase of his work, theatrical, dramatic or poetic, would doubtless have disappeared in the rapid development of dramatic art which the next 30 years witnessed. But there are no indications that, had Marlowe's life been prolonged, he would ever have excelled in humor or the individualization of character. His achievement is, nevertheless, among the most remarkable and enduring of the Elizabethan era. His poetry remains forever impressive with its fine impetuosity, its splendors of diction and melody. His tragedies, of immense influence on the theater of his day, continue to rank among the greatest of English literature in their expression of passionate ambition and aspiration. He was the first great English dramatist, and he prepared the way for Shakespeare. See also JEW OF MALTA, THE.

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Bibliography.—The best collected editions of his works are by Alexander Dyce (1858, 1865, and 1876), and by A. H. Bullen, 3 vols. (1885). Also consult Ward, A. W., *History of Dramatic Literature*, vol. 1 (London 1887); Ingram, J. H., *Christopher Marlowe and His Associates* (New York 1904); Bakeless, J., *Tragicall History of Christopher Marlowe*, 2 vols. (Cambridge, Mass., 1942); Kocher, P. H., *Christopher Marlowe* (Chapel Hill, N. C., 1946); Ellis, Havelock, ed., *Christopher Marlowe*, with introduction by J. A. Symonds (reissue, New York, 1948).

Marlowe's life has been the theme of two modern tragedies: Richard H. Horne's *Death of Marlowe* (1837); and W. L. Courtney's *Kit Marlowe* (1890).

MARLOWE, Julia (real name SARAH FRANCES FROST), American actress: b. Caldbeck, Cumberlandshire, Eng., Aug. 17, 1866; d. New York, N. Y., Nov. 12, 1950. She came to the United States in 1871. In 1878 she joined the Juvenile Opera Company, which presented *H.M.S. Pinafore, The Chimes of Normandy* and other light operas, in which she was known as Fanny Brough. Subsequently she took a child's part in *Rip Van Winkle*. She then retired, studied in New York for three years and then made her metropolitan debut as Parthenia in *Ingomar*. Her later roles include Viola in *Twelfth Night;* Rosalind in *As You Like It;* Highland Mary in *For Bonnie Prince Charlie* (1897); Barbara Frietchie in the play of that name by Clyde Fitch (1899), and Charlotte Oliver in *The Cavalier* (1903). Other plays in which she took the title roles are *Colinet and When Knighthood Was in Flower*. On May 28, 1894 she was married to Robert Taber, who had been her leading man in her first appearance in *Romeo and Juliet* in 1888. They starred together for a season, but owing to a disagreement were later separated, and in 1900 Mrs. Taber secured a divorce. In 1904 she joined Edward Hugh Sothern, and for several years they were joint stars in Shakespearean roles. In 1911 they married, and in 1924 she retired from the stage. Their presentations of Shakespearean plays are reckoned as some of the best ever given in the United States. She received honorary degrees from George Washington University and Columbia University.

MARMADUKE, John Sappington, American Confederate soldier: b. Saline County, Mo., March 14, 1833; d. Jefferson City, Mo., Dec. 28, 1887. He studied at Yale and Harvard and graduated from West Point in 1857, and served in the United States Army in the West. At the outbreak of the Civil War he entered the service of the Confederate States and rose to the rank of major general. In 1864 he was captured and was not released until after the close of the war, when he went abroad for a time, and on his return engaged in business and also in journalism. He was editor of the St. Louis *Journal of Agriculture* (1871–1874); and he served on the Missouri Railway Commission (1880–1885). He was defeated for the governorship of Missouri in 1880, but in 1884 was elected and served until his death.

MARMALADE, a jellied or gelatinous preparation made from quinces, peaches, apricots or oranges and portions of their rinds, with a mixture of sugar and spice. It is made like the ordinary jams, poured out warm into pots or jars and sold as a confection. The marmalade tree (*Tucuma mammosa*) is of the star-apple family, producing a large egg-shaped drupe, tasting like marmalade.

MARMARA, mär'mȧ-rȧ, **Sea of** (Turkish MARMARA DENIZI; ancient PROPONTIS), an inland sea, lying between southeastern Europe and the westernmost part of Asia, communicating with the Mediterranean by the narrow strait called the Dardanelles, and with the Black Sea by the Bosporus. Length from Gallipoli to the head of the Gulf of Izmit, 172 miles; greatest breadth, which is near the center, about 45 miles; average depth over 600 feet; maximum depth, 4,000 feet. The largest of several islands is Marmara, famous for its quarries of marble and alabaster, situated near its western end; at the eastern end, on the Asiatic coast, and not far from Constantinople, is a group called the Princes Islands. A current sets from the Black Sea into the Sea of Marmara, which in turn runs into the archipelago. The tides are hardly perceptible and the navigation is easy.

MARMETTE, Joseph Etienne Eugene, Canadian author: b. St. Thomas de Montmagny, Quebec, Oct. 25, 1844; d. Ottawa, May 7, 1895. After receiving a good general education he determined to devote himself to literature. He wrote several historical novels dealing with the main events in French-Canadian history. These include *Charles et Eva* (1866); *François de Bienville* (1870); *L'Intendant Bigot* (1872); *Le Chevalier de Mornac* (1873); *Le Tomahawk et l'épée* (1877); *A Travers la vie* (1895).

MARMIER, mȧr-myā', **Xavier,** French author: b. Pontarlier, Doubs, June 24, 1809; d. Paris, Oct. 11, 1892. He engaged in journalism and later traveled extensively in Switzerland, Holland, Germany, Russia, Algeria, America and the East. In 1835 he accompanied the scientific voyage of the *Research* to the Arctic regions and then acquired a wide knowledge of the Scandinavian and Finnish languages and customs. In 1839 he became professor of foreign literature at Rennes and in 1841 occupied a position under the minister of public instruction. In 1846 he was appointed curator at the Bibliothèque Sainte-Geneviève in Paris, in 1870 was elected a member of the Academy; and in 1884 was made administrator. Among his publications are *Histoire de l'Islande* (1838); *Langue et Littérature Islandaises* (1838); *Histoire de la littérature en Danemark et en Suède* (1839); *Lettres sur la Rus-*

sie, la Finlande et la Pologne (1843); *Lettres sur l'Amérique* (1852); *Voyage en Suisse* (1861); *Voyages et Littérature* (1888), and the novels *Les fiancés du Spitzberg* (1858); *Gazida* (1860).

MARMION, A TALE OF FLODDEN FIELD, a poem in six cantos by Sir Walter Scott, published in 1808, is the second of his metrical romances, and the first—after the preliminary experiment of the *Lay of the Last Minstrel*—in which he developed the full possibilities of the form. Because of the success of the earlier poem, he was offered £1,000 for this one before he had begun to write it—a circumstance which enabled Byron to barb his satire with the taunt:

"And think'st thou, Scott! by vain conceit perchance,
On public taste to foist thy stale romance,
Though Murray with his Miller may combine
To yield thy muse just half a crown per line?"

Like most of Scott's fiction, in prose or verse, the story of *Marmion* is based on the fundamental impulse to revivify the past, especially in connection with the historic associations of picturesque scenes. Hence he weaves a romance about persons, some historic and some imaginative, but always with an eye toward the climax, the account of the Battle of Flodden Field. It is significant, too, that the famous scene describing the quarrel between Marmion and Douglas (canto vi) was an afterthought, due to a suggestion from one of Scott's friends that he should plan Marmion's journey from England to Edinburgh so as to introduce the Douglas castle of Tantallon. Critical opinions have varied concerning the romantic plot of this poem, and Scott himself spoke severely of his having based it in part on the crime of forgery, characteristic "of a commercial rather than a proud and warlike age." But there can be no difference of view as to the splendid movement and glow of the more stirring scenes of the story—those of the kind in which Scott's genius was always at its best—especially the account of the Battle of Flodden, culminating in the death of Marmion. The work also contains some interesting personal poetry, in the epistles, addressed to different friends, which Scott prefixed to the several cantos, and (in canto v) one of his most popular narrative ballads, *Lochinvar*.

RAYMOND M. ALDEN.

MARMOL, mär'môl, **José,** Argentine author: b. Buenos Aires, Dec. 5, 1818; d. there, Aug. 12, 1871. He was a pronounced Democrat, was banished by Juan Manuel de Rosas, led the opposition against that dictator and on its successful termination became senator and librarian of Buenos Aires. A fervent orator, Marmol is better known as the author of *La Amalia* (1855), a historical novel dealing with Rosas' dictatorship, of the popular patriotic poem *El 25 de Mayo de 1843*, and of the dramas *El poeta* (1842); *El Peregrino* (1846) and *El Cruzado* (1851). *La Amalia* has long been familiar to European readers through French and German translations. An English translation of this work was published in New York in 1919.

MARMONT, mär-môn', **Auguste Frédéric Louis Viesse de,** DUC DE RAGUSE, marshal of France: b. Châtillon-sur-Seine, France, July 20, 1774; d. Venice, March 2, 1852. He entered the army as a lieutenant of infantry in his 15th year. In 1792 he changed to the artillery, and at Toulon became acquainted with Bonaparte, who chose him for his aide-de-camp. For several years after 1805 he was military and civil governor of Dalmatia, where he initiated important public works. Being called to aid in the Austrian campaign in 1809 he assisted so efficiently that Napoleon made him a marshal and governor general of the Illyrian provinces. He was again called upon in the Spanish campaign of 1811, was severely wounded at Salamanca, and was laid up for some time. In the campaign of 1813 he held the command of an army corps in Germany, and fought in the battles of Lützen, Bautzen and Dresden. In 1814 he fought a final battle under the walls of Paris, but opposition appearing fruitless surrendered to the Allies. This proceeding was one main cause of Napoleon's immediate abdication, and brought Marmont into favor with the Bourbons. After the Restoration, Louis XVIII made him a peer of France, but he was compelled to withdraw from Paris by the revolution of 1830, and his name was struck off the army list.

MARMONTEL, mär-môn-tĕl', **Jean François,** French writer: b. Bort, Limousin, France, July 11, 1723; d. Abbeville, Eure, Dec. 31, 1799. He was educated for the church, but turned to letters, and became a journalist and dramatist at Paris. In 1758–1759 he edited *Le Mercure*, and in 1763 was elected to the Academy. He wrote tragedies, including *Denys le Tyran* (1748) and *Aristomène* (1749); *Contes Moraux* (1761), and the works of fiction *Bélisaire* (1767) and *Les Incas* (1778). His *Poétique Française* (1763) and *Eléments de Littérature* (1787) have perhaps a more permanent worth. A collected edition of his writings appeared in 1786–1787. In 1771 he was appointed historiographer of France, and in 1783 was made secretary of the French Academy.

MARMOSET, the common name applied to a group of extremely small American monkeys constituting the family Callithricidae (Hapalidae) which differ from the related family Cebidae in the absence of the third molar tooth, leaving 32 instead of 36 teeth, and in having sharp curved claws on all the digits except the very short great toe which bears a flat nail. Their hands lack the dexterity possessed by other monkeys. The two families are united in a superfamily Ceboidea. Marmosets have soft silky fur, long nonprehensile tails, and are often described as squirrellike in appearance. The numerous species are grouped in two genera, *Callithrix* (*Hapale*), the true marmosets, and *Leontocebus* (*Midas*), the tamarins, which have longer canine teeth. Marmosets inhabit the forests of tropical South America, and one species, Geoffroy's tamarin, is found in Panama and Costa Rica. All are strictly arboreal, associate in small groups, and feed on fruits, insects, spiders and birds' eggs. The gestation period is about 150 days (S. Zuckerman), remarkably long for such small mammals. Unlike other monkeys they commonly bear two and sometimes three young at a birth. Marmosets are readily tamed and are greatly favored as pets, though in intelligence they are greatly inferior to the cebid monkeys. Some zoologists consider the marmosets the most primitive of all American monkeys, while others regard them as an adaptively specialized dwarf branch of the Ceboidea. See also MONKEYS; PRIMATES.

MARMOT, a large ground squirrel of the genus *Marmota* (*Arctomys*), having terrestrial habits, coarse fur, no cheek-pouches, short limbs and powerful digging claws. In size it varies from about 15 to 25 inches in length, the tail adding from 3 to 12 inches. Several species inhabit the northern parts of the world, in southerly climates keeping themselves mostly upon mountain heights, but farther north inhabiting lower levels, preferring open or thinly wooded plains. All dig and dwell in burrows, some species gathering into extensive colonies, the hillocks about the mouths of the burrows forming communities similar to the "towns" of the prairie dogs; while other species dwell in families far apart from one another. They feed upon herbage and grow very fat in the autumn preparatory to hibernation during the cold months, when their dormancy is complete. Their underground sleeping-chambers are warmly furnished with dry leaves and hay. The European marmot (*M. marmota*) is found plentifully in the Alpine range, equals a rabbit in size and is light brown in color. It lives immediately below the snow line, and subsists on vegetables, insects and roots. It comes forth from its burrow during the month of April, and is said to be readily tamed. The bobac, another European species (*M. bobak*), inhabits Poland, Russia and all northern Asia. A third species is found in the Himalayan ranges; and a fourth (*M. caudatus*), the largest and handsomest of the family, dwells in the valleys of their southerly slopes. These little animals are of great value to the wandering natives of northern and central Asia, who utilize both their skins and flesh. America has two marmots, one of which is the siffleur or whistler of the tops of the northern Rocky Mountains, and the other the familiar Eastern woodchuck. The former takes its name from the loud eerie whistle with which it wakes the echoes of the crags about the lone pastures above timber line, where it makes its home; it was of great service to the mountain Indians. Other species or varieties occur in the southern mountains of the Western states. The woodchuck or ground hog (*M. monax*), is a heavy, broad-headed, grizzled animal of the woods and fields, yellowish to whitish gray in color, blackish on the back and crown and chestnut on the belly; with the feet and tail brownish black. It abounds throughout the whole country east of the dry plains, and flourishes in spite of civilization, as the farmers' meadows and gardens supply it with an increased supply of good food, and mankind thins out its worst enemies, such as wildcats, foxes, weasels, the larger serpents and birds of prey; none of these save the first is much to be feared by the full-grown woodchucks, but may kill many of the young. As a result the animals have become unpleasantly numerous in some districts of the Eastern states, where their depredations upon gardens and certain plantations, as of lettuce, carrots, and celery, are often serious.

MARNE, märn, river, France, the chief affluent of the Seine, rising in the plateau of Langres, flowing northwest past Châlons to Épernay, thence westward, joining the Seine at Charenton-le-Pont, four miles above Paris. Its length is 325 miles, 220 of which are navigable. It is connected by canals with the Rhine, the Aisne and the Seine. The Marne was the crucial fighting line of the western front during World War I. The river was reached by the American forces in August 1944, during World War II.

MARNIAN EPOCH, name given to the period known in France as the Gallic, in England the late Celtic and in Switzerland as La Tène. It extends from about 500 B.C. to the conquest of Gaul by Julius Caesar. It is named Marnian from the French department of the Marne where the richest deposits of the period have been found.

MARNIX mär'nĭks, **Philipp von,** Baron Saint-Aldegonde, Flemish statesman and writer: b. Brussels, Belgium, 1538; d. Leyden, Dec. 15, 1598. He studied at the universities of Paris, Louvain, Dôle, and Pavia. While in Italy he became a strict Calvinist, and in 1566 he wrote a defense of the iconoclasts. He later was forced to flee to Bremen and East Friesland. In 1571 he took up residence in the home of William of Orange, and thereafter performed many missions for William, until he was captured by the Spanish (1573), and held prisoner for a year. In 1578 he was ambassador to the Diet of Worms. In 1585 he retired from political life after Antwerp, of which he had been burgomaster, capitulated to Alessandro Farnese. His most renowned work was *Tableau des différends de la religion* (1598). He also wrote the Flemish national song *Wilhelmuslied* and translated the Psalms of David.

MAROC. See Morocco.

MARONITES, măr'ō-nīts, a sect of Eastern Christians, whose origin was a consequence of the Monothelite controversy. In the 7th century the opinion that Christ, though He united in Himself the divine and human natures, had but one will arose among the Eastern nations. But when their last patron, the Emperor Philippicus, was deposed and exiled in 713, the Monothelites were condemned and banished by his successor, Anastasius II. The remnant of this party survived in the Maronites (so named from their founder, Maron)—a society of monks in Syria, about Mt. Lebanon, which is mentioned as early as the 6th century. Another monk, John Maro, or Maron also preached Monothelitism there in the 7th century. Regarded as rebels by the Melchites (q.v.), or Christians who adhered to the opinions of the emperor, they became, in that district of Lebanon which is now called Kisrawan, a warlike mountain people, who defended their political as well as their religious independence boldly against the Mohammedans, and who even under the Turkish government resisted the payment of a tribute, like the Druses. The political constitution of the Maronites is that of a military commonwealth. Governed by their ancient customary rights, defended from external attacks, they support themselves among the mountains by husbandry and the produce of their vineyards and mulberry trees. The revenues of all their orders of ecclesiastics are very small, but a common spirit unites them, and in simplicity of manners, temperance and hospitality they resemble the ancient Arabians. Revenge for murder is permitted among them, and as a sign of nobility they wear the green turban. Their church constitution resembles very much that of the old Greek Church. Since the 12th century they have several times accepted papal supremacy and the Roman Catholic

Church, without giving up their own peculiarities. At last Clement XII induced them to accept the decrees of the Council of Trent at a synod held in 1736 at their convent of Marhanna. After this synod their priests still retained the right to marry, after the manner of the Greek Church; and they continued to administer the sacrament under both forms. The use of the Arabic language was preserved in the church service. Mass was read only in the ancient Syriac. Their head is called the patriarch of Antioch, although his residence is in the monastery of Kanobin, upon Mount Lebanon; and he gives an account every 10 years to the pope of the condition of the Maronite Church. Under him are the bishops and other clergymen, who form seven degrees of rank. In Kesrouan are over 200 Maronite convents and nunneries, containing in all from 20,000 to 25,000 members who profess the rule of Saint Anthony and devote themselves to agriculture and gardening. Since 1584 there has been a Maronite college established at Rome for the education and training of their clergy. The Maronites supposed to number about 300,000, and these are distributed into 150 parishes throughout Syria, Palestine, Egypt and Cyprus. In consequence of recurrent sanguinary conflicts between Maronites and Druses, in 1861 under pressure of the Powers Lebanon was organized into an autonomous sanjak ruled by a Christian governor appointed by and directly responsible to the Porte. During the First World War thousands of Maronites were killed by the Turks. Governed by their emirs and enjoying a certain amount of independence they form a little nation within the framework of the Republic of Lebanon (q.v.), which, as part of France's Syrian mandate, remained under French jurisdiction until France withdrew her occupation army, Sept. 1, 1946. Consult Bliss, F. J., *Religions of Modern Syria and Palestine* (1912). See DRUSES.

MAROONS, the name given to runaway Negro slaves in Jamaica and in some parts of South America. The name seems to be equivalent to mountaineers, being derived from Spanish, *cimarron,* a fugitive Negro or maroon, from *cima* (same as French *cime*), a summit or hilltop. In many cases runaway Negroes, taking to the forests and mountains, rendered themselves formidable to the colonists and sustained a long and brave resistance against the whites. When Jamaica was conquered by the English in 1655 about 1,500 slaves retreated to the mountains. They continued to harass the island till 1795, when they were finally reduced by the aid of bloodhounds. Some of them were removed to Nova Scotia, and afterward to Sierra Leone.

MAROQUIN, măr-ō-kēn'. See MOROCCO (leather).

MAROS, mo'rosh, river of Rumania. It rises in eastern Transylvania and flows westward for about 550 miles, joining the Theiss at Szegedin and flowing into the Danube. Its watershed is about 30,000 square miles. It is navigable to Karlsburg, about 300 miles.

MAROT, mà-rō', **Clément,** French poet: b. Cahors, Quercy, winter of 1495–97; d. Turin, 1544. His father was *escripvain* or historiographer to Anne of Brittany. He went to Paris in 1506, was educated at the university there and studied for the bar. Through his father's interest, he entered the service of Francis I; and in 1519 was attached to the suite of Margaret d' Angoulême, the king's sister. In the battle of Pavia he was wounded and taken prisoner, but on his return to Paris became a member of the royal household. Imprisoned once as a Protestant heretic, and coming again into serious risk, he fled to Navarre and to Italy; returning, he had to flee finally in 1543. Being as much a freethinker as a Calvinist, he found no shelter in Geneva, whither first he betook himself, and went to Turin, where he died. His early poems are stiff; his later ones are almost unsurpassed for ease and grace, in which qualities his only rival is La Fontaine. He wrote many rondeaux, epigrams, epistles and ballads; also the poem *L'Enfer.* His famous translation of the Psalms in poetry—superior to the inadequate French prose translation of the Scriptures at that time —is said to have promoted the cause of the Reformers and was sung at the court and was widely popular in the country. Consult Morley, Henry, *Clement Marot, and other Studies* (London 1871); Tilley, A. A. *Literature of the French Renaissance,* vol. I (New York 1904).

MAROZIA, mà-rō'zhĭ-à, a 10th century Roman lady of infamous reputation, known for her influence in Rome and at the papal court. She was a daughter of the equally infamous Theodora, wife of the consul Theophylact, and was first married to Alberic; and after his death to Guido of Tuscany; and after the latter's death, to Hugo, King of Italy. Through the power of her family, and by her marital alliances, she exercised absolute control over Rome for several years. She deposed Pope John X in 928 and may have caused his death. Later she bestowed the papacy on her son, John XI, who was said to have been the offspring of her guilty love with Pope Sergius III. She styled herself "Senatrix" of all the Romans and "Patricia." In 932, shortly after her third marriage, she and her husband were imprisoned by her son, Alberic II. Her husband escaped, but nothing is known of her fate. See Gregorovius' *History of the City of Rome in the Middle Ages.*

MARQUAND, mär-kwänd', **Allan,** American archaeologist: b. New York, Dec. 10, 1853; d. there Sept. 24, 1924. In 1874 he was graduated at Princeton University and studied subsequently at the universities of Berlin and Johns Hopkins. In 1881–83 he was engaged as tutor and lecturer and from 1883 to 1905 was professor of archaeology and the history of art at Princeton. After 1905 he was professor of art and archaeology at the same institution. From 1890–1921 Dr. Marquand also was director of the Princeton Museum of Historic Art, and 1896-97 was professor of archaeology at the American School of Classical Studies, Rome. After 1885 he was associate editor of the *American Journal of Archaeology.* Dr. Marquand published *Greek Architecture* (1909); *Della Robbias in America* (1912); *Luca Della Robbia* (1914); *Andrea della Robbia,* 2 vols. (1922); joint author of *History of Sculpture* (1896–99), and archaeological articles in various journals.

MARQUAND, Henry Gurdon, American banker and philanthropist: b. New York, April 11, 1819; d. Feb. 26, 1902. He was educated in Pittsfield, Mass., and for 20 years was in the real estate business, afterward becoming a banker and acquiring an interest in various

railways and other commercial enterprises. He was a generous patron of the Metropolitan Museum of Art, to which he gave valuable paintings, and among his other gifts are a pavilion to Bellevue Hospital, New York City, and a gymnasium and a chapel to Princeton University.

MARQUAND, John Phillips, American novelist: b. Wilmington, Del., Nov. 10, 1893. He is a descendant of distinguished New England families that include Governors Joseph and Thomas Dudley (qq.v.) of Massachusetts and Margaret Fuller, the transcendentalist. He grew up in New York City and Rye, N. Y., and attended high school in Newburyport, Mass. After being graduated from Harvard University in 1915, he wrote for the Boston *Evening Transcript.* During World War I, he was an artillery officer in France and then returned to New York as a writer on the *Tribune* and later for an advertising agency.

In 1920 Marquand began writing fiction professionally, publishing his novels in *The Ladies Home Journal* and *The Saturday Evening Post.* The novel which first brought him distinction in American letters was *The Late George Apley* (1937) which won the Pulitzer Prize for fiction in 1938. By that novel, as well as *Wickford Point* (1939) and *H. M. Pulham, Esquire* (1941), he became well known as an interpreter of Boston and New England characters. He depicts them as sheltered, unhappy people, unable to break the strict moral code of family tradition.

His later novels shifted from New England settings but in essence continued to remain as modern novels of manners. World War II played an important part in *So Little Time* (1943), *Repent in Haste* (1945), and *B. F.'s Daughter* (1946). Marquand's subsequent novels included *Point of No Return* (1949), a satire of postwar New York bankers which re-examined the conflict between spiritual and materialistic values, and *Melville Goodwin, U.S.A.* (1951), a portrait of life among the army high brass which was accepted by some critics as a defense of the professional soldier. See also LATE GEORGE APLEY, THE; NOVEL—*Modern* (American).

MARQUESAS ISLANDS, mär-kā'sàs, or **MARQUEZAS,** French Oceania, a group in the South Pacific about 740 miles northeast of Tahiti and 2,000 miles south-southeast of Honolulu. The 13 islands have an aggregate area of 480 square miles. Most important of the islands are Nuku Hiva, Ua Pu, and Ua Huka, in the center; Hiva Oa, Tahuata, and Fatu Hiva, in the southeast; and Eïao and Hatutu, in the northwest. Atuana (Atuona), a village on the south coast of Hiva Oa, is the seat of administration. The original administrative headquarters was at Taiohae, a village on the south coast of Nuku Hiva. All the islands, which have a volcanic origin, are wild and rugged in appearance; there are steep cliffs on the east coasts, the rocks being fretted into fantastic shapes. Mountains are found in the interior of the islands; the highest point, on Hiva Oa, attains an elevation of 4,134 feet. The fertile valleys are copiously watered by mountain streams, where a luxuriant vegetation, hundreds of varieties of flowers, bamboo, palms, and some timber trees grow. The climate is humid but healthy, with cool nights and frequent breezes. The Marquesans are of the purest Polynesian type, light skinned and with regular features and fine stature. Formerly ritualistic cannibals, they still give evidence of a pugnacious and untamed temperament. They cultivate such food crops as plantains, bread fruit, yams, and corn, grow a small amount of cotton, and trade in cottonseed and copra. The Marquesas were discovered about 1595 by the Spanish mariner Alvaro de Mendaña de Neyra, who named them for the wife of the marquis of Mendoza, his patron. They were rediscovered in 1774 by Captain (James) Cook, and in 1791 Étienne Marchand planted the French flag on the islands. In 1791, also, Capt. Joseph Ingraham (1762–1800), of the United States, sighted Nuku Hiva and seven islets around it, naming them the Washington Islands. On Nov. 19, 1813, David Porter (1780–1843) claimed Nuku Hiva for the United States, naming it Madison's Island, but the annexation was never ratified. In 1842 France formally took possession, but the colony then established on Nuku Hiva was abandoned in 1859. It was not until after 1870 that French administration of the Marquesas was reinstituted. Pop. (1946) 2,988. See also FRENCH OCEANIA.

Consult Robson, R. W., *Pacific Islands Handbook* (New York 1946); Robson, N., *French Oceania* (Sydney, Australia 1951).

MARQUET, mär-kĕ', **(Pierre-) Albert,** French painter: b. Bordeaux, March 27, 1875; d. Paris, June 14, 1947. He studied at the École des Arts Decoratifs and the École des Beaux Arts, becoming an admirer of the works of Claude Monet, Vincent van Gogh, and Paul Cézanne. In his landscapes, for which he was best known, the subject was reduced to its essential detail and the bold, free use of colored masses was substituted for the tiny vibrating brush strokes of the impressionists. His views of Paris, particularly of Notre Dame and of aspects of the Seine painted from his studio window on the Quai des Grands-Augustins, established his reputation. Seaports had a particular attraction for him. He painted at Le Havre, Naples, Hamburg, Honfleur, Rouen, Rotterdam, Marseille, North Africa, and elsewhere. His work is represented in Paris at the Louvre and Luxembourg museums, and in several other European cities.

MARQUETRY, mär'kĕ-trĭ (French, *marqueterie*), mosaic or ornamental wood, metal or ivory inlaid in furniture, and smaller articles. In Venice, in the 15th century, caskets were inlaid with geometrical shapes of wood and ivory, and the Italian "intarsia" work of the 16th century was at first geometrical, and later developed into pictorial design. By the end of the 17th century marquetry in a number of intricate designs was being applied to Continental furniture. The English furniture makers of the 18th century employed it freely. See also BUHLWORK; INLAYING; PARQUETRY.

MARQUETTE, mär-kĕt', **Jacques** (known as PÈRE MARQUETTE), Jesuit missionary and explorer in America: b. Laon, France, June 1, 1637; d. near present Ludington, Mich., May 18, 1675. Sent to New France in 1666, he was appointed missionary to the Ottawas and established a mission at Sault Sainte Marie, Lake Superior, in 1668, another at La Pointe de Saint Esprit, Chequamegon Bay (1669), then the St. Ignace on Mackinac (1671). It is plain—putting aside

all imputed motives,— that Jesuits like Jogues, Albourg, Druillettes and a hundred others did not lead lives of unspeakable deprivations and amazing self-sacrifice merely for temporal gain for their Society or their country. When it is known that they were French, it is at once known that they were patriots. And if the Jesuits opposed the mercantile designs of the supporter of La Salle, it must be admitted, in the light of after events, that they were safeguarding the interests of their charges. The fate of Jogues and of René Goupil did not deter men like Marquette. It only made them more anxious to teach Christianity or to die. Marquette, like all the missionary priests of his Society, held that it was his duty to contribute to the knowledge of the world. Whether it was the analysis of a dialect or the bending of a river, the Jesuit made each his duty, always remembering the motto of his Society, "To the greater glory of God." Marquette had kept in mind all the talk about the great river and the natives that dwelt upon its banks. He was sent, he believed, as one who must teach all nations, and he did not disdain any knowledge that might help him to this, valuing the knowledge itself, for every Jesuit was a student both of nature and of books. Louis Joliet had started to become a Jesuit, but had, instead, become a fur trader. When he was commissioned by the governor of New France, to look for the great stream that, it was rumored, opened into the Pacific, Father Marquette, who earnestly desired it, was sent by his superiors to accompany him. On 8 Dec. 1672 Joliet reached Saint Ignace under his own authorization from De Frontenac and one from Father Marquette's provincial, to claim for God and the king all the land and water they could find.

When the ice broke, on 17 May 1673, Marquette and Joliet set forth. Father Pierson took Father Marquette's place at the mission. Father Marquette was something of a surveyor, and his maps are yet in evidence and very valuable. Two birch canoes that could only hug the shore and not dare the open lakes, and seven men,— five *voyageurs* — made up the expedition. Their stores were barely sufficient, their scientific instruments were, as one can easily imagine, inadequate. They were hopeful, hardy and they knew every mood of the treacherous lakes and the meanings of all the changes in the weather. Marquette had acquired the quick eye and ear of the Indian, and his mind was supple and well-trained; Joliet was not far behind him in wood and water craft. Still, they followed dim rumors. The most interesting of Marquette's reports is that of the second halt at the Indian village of Mascouten, on Lake Winnebago. They had reached the "jumping off" place. Their first halt was at De Pere, the Mission Saint Francis Xavier, to which Father Marquette had been recently assigned. They reached Lake Winnebago by way of the Fox River. From Green Bay,— the Mission Saint Francis,— they went to Lake Winnebago, and, from thence, accompanied by the Indian guides, they ascended the upper Fox River and entered the Wisconsin, on 10 June 1673. After seven days of hard paddling, they entered the Mississippi on 17 June. The report of this expedition on which we must rely for information is Marquette's,— Joliet's having been lost in the upsetting of his canoe at the La Chine Rapids, near Montreal. It is included in the 'Jesuit Relations,' and quoted by John Gilmary Shea, Sparks, Parkman, Thwaites, Hedges, and all who have written of the early days of the Northwest. Dr. Shea, in his 'Discovery and Exploration of the Mississippi Valley,' estimates the distance traveled by Marquette and Joliet from Saint Ignace to Green Bay (Mission Saint Francis Xavier), at 218 miles. General Wood, inspector-general United States army, makes the whole distance traveled 2,549 miles, but he omits the distance from Saint Ignace to Green Bay. Marquette and Joliet explored the Mississippi for 300 miles in solitude. Marquette describes the river at its junction with the Missouri as turbulent in the extreme. Marquette was pleased by the treatment received at the first village of Illinois Indians. They met Indians who showed some traces of civilization, and at the mouth of the Arkansas, they met with great kindness from the Indians. From the Illinois — believing the route to be shorter — they went, it is asserted, to a point near Chicago. By portage, at Sturgeon Bay, they saved time and strength, and from the Green Bay into the Fox River, they reached the Mission Saint Francis — having spent, from the beginning of their ascent of the newly-discovered river, on 17 July, about two months — four months, in all, of almost incessant hardship since they began their voyage on 17 May 1673. Further journeying was out of the question. Marquette and Joliet had not much strength left. A journey of nearly 3,000 miles, in birch canoes, had told on them, hardy as they were. Marquette spent 13 months at De Pere, endeavoring to regain his health. He knew well the stupendous importance of what he had done for France and for the world; but his business was with souls. While Joliet went to Montreal to report, Marquette started to found a new mission in Illinois. He left the Mission Saint Francis on 25 Oct. 1674, with 10 canoes; he arrived at the Chicago River, 4 December. The description of the carrying of the canoes through the forests gives a glimpse of the difficulties the missionary expected to encounter. The inundations of 30 March 1675 destroyed their hovel. At Kaskasian Marquette's heart was filled with gratitude by the kindness he received. His desire for exploration led him, while using his strength in ministering to the Indians, to explore Lake Michigan farther. He grew weaker, and turned to the north. Through the river — now Pere Marquette — he made his homeward way. On Saturday, 18 May 1675, he died. The Ottawa — under that name were included the tribes under the Jesuits in the Lake regions — had among them several Hiskakons, to whom Marquette had been much devoted. These, going northward in the spring, raised his body, reverently prepared it according to the mode of their tribe, took it to the Mission Saint Ignace, where Fathers Nource and Pierson awaited it. On Tuesday, 9 June 1676, Marquette was buried in the centre of the chapel of Saint Ignace, a building which was destroyed by fire in 1706. In September 1877, Father Edward Jacker, pastor of Saint Ignace, discovered the grave and remains of the great and good explorer, and they rest under a monument erected by the citizens of Saint Ignace in 1882. Consult

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MARQUETTE, mär-kĕt', Mich., city, resort and Marquette County seat; altitude 602 feet; on the south shore of Lake Superior in the Upper Peninsula; between the Carp River on the east and Dead River on the north; 15 miles east of Ishpeming; 180 miles north of Green Bay, Wis.; on the Duluth, South Shore and Atlantic, and Lake Superior and Ishpeming railroads; with freight steamship service to lake ports. It has a fine harbor with a breakwater 4,500 feet long, and excellent facilities for loading steamers with the iron ore shipped from here in large quantities. Two great docks have storage capacity of 50,000 tons each, and are equipped with ore mixing compartments. Near the city are trap rock quarries. The chief industrial establishments are railroad shops, foundries, saw and planing mills, woodenware factories, plants for producing chemical byproducts of wood, and manufacture of machine parts and mining equipment. The Northern Michigan College of Education, established in 1899, is here. The State House of Correction and Branch Prison (founded 1885) has an unusual arts and crafts department. The Peter White Public Library, built in 1904 and named for the city's most noted pioneer, also houses the museum and library of the County Historical Society. Presque Isle Park, which was presented to the city by the Federal Government, includes Granite Point where the American flag was first raised in 1820 by Governor Lewis Cass. The French explorers found copper in this region in the 17th century. Silver and lead were mined on Presque Isle Peninsula in 1845. Iron ore was discovered in the Marquette area in 1830, 1841, and 1844, and mining began in 1846. Ore was first transported by sleigh, later by mule cars over a plank road and finally, in 1857, by rail. In 1950 production reached a peak of over eight million tons. The first permanent settlement at this point was made about 1849 and called Worcester, after the Massachusetts city. In 1850 the city was renamed after Père Marquette (q.v.), the 17th century French Jesuit missionary to the Indians, whose explorations helped to open the Northwest Territory to settlement. It was incorporated as a village in 1859. Destroyed by fire in 1868, it was rebuilt and incorporated as a city in 1871. Diversified industries and summer tourist trade have helped to maintain the industrial stability of the city. Pop. (1940) 15,928; (1950) 17,202.

MARQUETTE RANGE. See IRON—*Iron Ore Districts of the United States.*

MARQUETTE UNIVERSITY, Milwaukee, Wis., comprises the following schools and colleges: College of Liberal Arts; College of Business Administration; College of Engineering; College of Journalism; College of Nursing; School of Speech; Dental School; Law School; School of Medicine; Graduate School, and Summer School.

This Roman Catholic university, which is conducted by members of the Jesuit Order, offers 19 kinds of baccalaureate degrees, four master's degrees, the M.D., the D.D.S., the J.D., and the Ph.D.; also diplomas in Dental Hygiene and in Nursing, and a certificate in Public Health Nursing. The library comprises, besides departmental collections, the libraries of the several schools and colleges. Students have access to the Milwaukee Public Library and to the city's Public Museum, one of the largest and most complete in the United States, containing hundreds of thousands of zoological, botanical, mineralogical, and other specimens, both institutions being located within two city blocks of the University. The history of Marquette University begins with the arrival of Jesuit fathers in 1855, who two years later opened Saint Aloysius Academy. In 1864 a new building known as Saint Gall's Academy was erected. In the same year a charter for Marquette College was obtained. In 1906 it celebrated its silver jubilee with the erection of a new building called Johnston Hall. An amended charter creating Marquette University was obtained in 1907. The Jesuit administrative officers and teachers serve the university without salary or other recompense beyond personal support. Administration Hall was erected in 1938 through the gift of an anonymous donor. It houses the general administrative offices. The Marquette University High School at Milwaukee is also conducted by members of the Jesuit Order.

MARQUEZ, José Arnaldo, hō'sā' ar-nal'do mär-kās', Peruvian poet: b. Peru, about 1825; d. Lima, Jan. 15, 1881. For participation in civil wars he was several times banished in the earlier part of his career and he lived variously in Chile, Cuba and the United States. Among modern Peruvian poets Márquez takes high rank. He published *Lost Notes* (1862); *Flor de Abel,* etc., and in prose *El Perú y la España moderna,* and *Recuerdos de un viage à los Estados Unidos de América.* He lost his life in the defense of Lima against the Chileans.

MARQUEZ, Esteban, Spanish painter: b. Estremadura, c. 1650; d. Seville, 1720. Portraitist and founder of the Seville academy, he was a good colorist, Murillo style.

MARQUEZ, Leonardo, Mexican soldier: b. Mexico, about 1820; d. Havana, July 4, 1913. After serving against the United States in the Mexican War (1846–1848), Márquez supported the second dictatorship (1853–1855) of Antonio López de Santa Anna, under which he held important army posts. He fought against Benito Juárez in the War of the Reform (1857–1860), during which he received the name "tiger of Tucubaya" from his execution there of a number of prisoners on April 11, 1859, although he alleged the express order of Gen. Miguel Miramón as an explanation. Márquez supported the French intervention in 1862, and Maximilian's empire (1864–1867). He was made a division commander in October 1866. Upon the withdrawal of French troops in the following March, Márquez attempted to form a Mexican army to support the empire, being sent by Maximilian to Mexico City to raise troops for the relief of the emperor beseiged at Querétaro. That city, however, was captured by Juárez' troops on May 14, 1867, and Mexico City on June 21, two days after Maximilian's execution. Márquez escaped to Havana. He was specifically exempted from the amnesty of 1870.

MARQUEZAS ISLANDS. See MARQUESAS ISLANDS.

MARQUIS, mär'kwis, or **MARQUESS** (Italian, *marchese;* French, *marquis;* German, *markgraf*), a title of honor next in dignity to that of duke. Marquises were not known in England till King Richard II, in the year 1385, created his great favorite, Robert Vere, the Earl of Oxford, Marquis of Dublin. In 1397 the same king raised John de Beaufort, Earl of Somerset, to the rank of marquis, a dignity which he afterward refused to bear from its being an innovation. The title fell into disuse until the reign of Edward VI, who created the marquisate of Winchester in 1551. The title given a marquis in the style of the heralds is *most noble and potent prince.*

MARQUIS, Thomas Guthrie, Canadian author: b. Chatham, New Brunswick, 1864. He received his education at Queen's University, Kingston; was made English master at the Stratford High School and subsequently at the Kingston Collegiate Institute. Later he became principal of the Collegiate Institute at Brockville. After 1901 he devoted his entire time to literature. In 1905 he was chief editorial writer on the Ottawa *Free Press.* Subsequently he edited 'Canada and its Provinces' (22 vols., 1914–15). He also published 'Stories of New France' (1890); 'Stories from Canadian History' (1893); 'Marguerite de Roberval: A Romance of the Days of Jacques Cartier' (1899); 'Canada's Sons on Kopje and Veldt' (1900); 'Life of Lord Roberts' (1901); 'President of the United States' (1903); 'Brock: The Hero of Upper Canada' (1912); 'The War-Chief of the Ottawas' (1914); 'The Jesuits Missions' (1915). He edited the Canadian biographical collection entitled, 'The Builders of Canada' (1903). D. 1 April 1936.

MARRAKESH. See MOROCCO.

MARRELLA, a genus of fossil Crustacea found in the Cambrian shales of British Columbia.

MARRIAGE, History of (Latin, *marito,* from *maritus,* husband, from *mas,* a male). In the natural history sense marriage may be defined as a more or less durable union between male and female lasting till after the birth and rearing of offspring. In the ethical and legal sense marriage is a union between man and woman living in complete community of life for the establishment of a family. See article on the FAMILY, HISTORY OF.

The Origin and Social Function of Marriage.— In the natural history sense of the word marriage may be said to exist among many of the animals below man. Pair marriage is common among the birds and some of the higher mammals. It especially characterizes the anthropoid apes, the pair marriage of the chimpanzee being monogamous and durable, probably not unlike that of primitive man. The origin of marriage is therefore to be sought in the family, rather than the origin of the family in marriage. See article on family above referred to.

The function of marriage in human society is twofold: (1) to regulate the relations between the sexes and (2) to determine the relation of the child to the community. This latter function is often overlooked, but is quite as important in any scientific consideration of marriage as the former.

Practically all forms of marriage may be found among human beings if we consider all peoples and all historical ages, although the primitive or original form of marriage seems to have been that of a simple, pairing monogamy, similar to the pair marriage which is common among the higher animals. The reasons for rejecting the hypothesis of a primitive state of promiscuity have already been given in the article on the family just cited. Whether such a form as communal or group marriage (limited promiscuity) has ever existed among any people has been much debated by anthropologists and sociologists. The nearest approach to this form of marriage is found in certain aboriginal Australian tribes, where a man who takes a wife from a certain group has sexual access to all the other women of that group, though he lives with only one of them. A similar form is to be seen in the Punaluan family of the Polynesians, the marriage of a group of brothers with a group of sisters, though this form was rare even among the Polynesians. Most anthropologists and sociologists believe that such forms of group marriage were not primitive, but were relatively late historical developments. Setting these aside as exceptional forms, the main types of marriage in the human species may be grouped under the heads of polygyny, polyandry and monogamy.

Polygyny (Greek, "many wives").—A common form of marriage in barbarism and lower civilization is the union of one man with several women, scientifically known as polygyny, but popularly called polygamy. It is possible that this form of marriage existed to some extent in primitive times, as the gorilla among anthropoid apes is said to practise it. In general, however, it presupposes a considerable accumulation of wealth and is therefore among strictly savage peoples very rarely practised. As a human institution it received its chief development in the period of barbarism, and seems to have been an accompaniment of the development of dominantly militant life and of slavery in that period of human culture. Among people who practise polygyny, therefore, the practice is largely confined to the wealthy and ruling classes, as only these can afford the luxury of having more than one wife. In polygynous countries of the present rarely over 5 per cent of the families are of polygynous type. Owing to the fact that the number of males and females in any given population under normal conditions is relatively equal even in polygynous lands, the mass of the families are necessarily monogamic.

The causes of polygyny are complex. Beside the animal instincts of the male we must place especially the military honor of wife capture and the economic value of women (or wives) as laborers. In barbarism the outward and visible sign of a man's wealth and power is frequently the number of his wives. A contributory cause among some peoples is the high valuation set upon children, especially under the patriarchal system (q.v.). This seems to have been the main cause in the case of the Hebrew patriarchs.

The practice of polygyny has been widespread among practically all peoples from the

stage of barbarism up, though limited to the prosperous and well-to-do. Where it failed of legal sanction it frequently existed in the more or less illegal form of concubinage. It is not surprising, on this account, that in many cases it has received the explicit sanction of religion as in the cases of Mohammedanism and Mormonism. But among all peoples it has tended to die out with the coming of higher civilization, for the reason that it obviously involves the subjection and degradation of woman, the lack of paternal care of the children and the placing of a premium upon the more brutal instincts of human nature, especially in the male.

Polyandry (Greek, "many husbands").—The union of one woman with several men is a rare form of marriage found at present practically only in Tibet and among some of the mountain tribes of India, though within historic times it existed in Arabia. Apparently polyandry has never been a wide-spread form of marriage in the human species, as the instinctive jealousy of the male works against it; and there is no reason for supposing, as McLennan supposed, that primitively it was universal. On the contrary, it seems to exist only under such economic and social conditions as might lead to the suppression of male jealousy. Thus the difficulty of one man supporting a family has in the barren regions of Tibet led to the toleration of polyandry. In the same region there seems to be a scarcity of women, which also favors the practice of polyandry.

The most common form of polyandry is the fraternal or Tibetan form, in which a group of brothers have a common wife, the oldest brother being the head of the household and the putative father of all the children. Among the Nairs of India, however, a non-fraternal form of polyandry exists.

Monogamy (Greek, "single marriage").—Polygyny and polyandry, as we have seen, have always been exceptional forms of marriage. The prevalent form of marriage among all peoples and in all ages has been some form of monogamy, the union of one man and one woman. This has been so largely by biological necessity, as under normal conditions the number of males and females in any given population is relatively equal. The instincts of man have also to some extent favored monogamy, especially the instinct of sex jealousy. Economic conditions also have rarely made it possible for a man to support more than one wife and her children. Besides such biological and economic reasons for the existence of monogamy, however, it has manifest social superiorities to any other form of marriage. It is much more favorable to superior care and upbringing of children, as under monogamy both husband and wife commonly unite in the care of the child. It develops affections and emotions of a more altruistic type, and it makes the bonds of the family life more definite and strong. For these reasons monogamy favors the development of higher types of morality and of civilization generally. Its association with higher types of civilization is, therefore, not an accident. At its best, the monogamic family presents such superior unity and harmony that it is best fitted of all the forms of marriage to work in harmony with higher civilization.

The Marriage Ceremony.—Among all peoples, savage as well as civilized, legal marriage is usually accompanied by some form of ceremony which expresses the sanction of the group upon the union. This ceremony is usually of a magical or religious character though in a few peoples it is apparently purely social. Betrothal is also, among the more advanced peoples, frequently an occasion for some sort of religious or social ceremony.

The Freedom of Choice in Marriage.—Westermarck presents considerable evidence to show that among primitive peoples marriage was originally based on the mutual attraction and consent of the parties. Almost always the male is the wooer. The female accepts or rejects her lover, and thus plays the decisive rôle in sex selection. The same phenomena of courtship also appear very generally among the animals. There is no reason for supposing that different conditions existed among primitive men. The common practices of wife capture and wife purchase must be regarded as exceptional conditions developed in later stages of civilization. Marriage thus began in free choice, but among many peoples passed through stages of wife capture, and of wife purchase under the dominance of family or tribal interests, becoming only gradually in modern times again a matter of free individual choice.

Marriage by Capture and by Purchase.—Among predatory and warlike tribes marriage by capture is often common; indeed, on account of the social and military honor attached to wife capture, it sometimes comes to be the favorite form of marriage. We know of no people, however, among whom wives are regularly captured outside the tribe. Manifestly such a social state would be practically impossible, even though wife capture was socially favored.

Much more common than wife capture, but at a much later stage of cultural development was wife purchase. This stage comes in particularly in early barbarism with the development of slavery and the idea of property in persons; and among most peoples it has survived until higher civilization has been developed. It was particularly instrumental in developing polygyny and the patriarchal form of the family. Many survivals of wife purchase exist among even relatively highly civilized peoples.

Child Marriage.—Another result of wife capture and wife purchase among some peoples was the practice which we know as "child marriage," that is, the uniting in formal marriage of children under 15 years of age, usually the marriage of a girl under 15 with a much older man. As a custom, child marriage is not unknown among warlike savage and barbarous tribes. It developed, especially in India, however, under the influence of the caste system and the custom of wife purchase. More than one-half of the total female population of British India are married before 15 years of age, sometimes while they are mere infants. In the western provinces of India the girl remains at home with her parents until sexual maturity is reached; but in Bengal, girls commence their married life at the age of nine years. The British government has made ineffectual attempts to check child marriage, but the practice continues, as it is supported by the higher as well as by the lower Hindu castes.

Exogamy and Endogamy.—Among practically all peoples, custom forbids the marriage of very near kin. A limited number of tribes among savage and barbarous peoples do not forbid the marriage of brothers and sisters, but all view with social disapproval sexual relations between parents and children. Indeed, the larger number of uncivilized peoples not only condemn sexual relations between blood relatives, but forbid marriages between members of the same clan, or totem group. As clans may be metronymic or patronymic, this restriction prevents marriage between maternal or paternal relatives as the case may be, even to the most remote degrees of kinship, but makes it possible for a man to marry a near relative in a clan to which he does not belong, on the ground that no kinship tie exists between them. This custom forbidding marriage within the clan is known as "exogamy." It is nearly always correlated with "endogamy," as respects the tribe.* Thus in the clan or totemic stage of social organization, in which most of the North American Indians were at the time of their discovery, a man must take a wife outside of his clan or totem-kin group, but usually must marry within his tribe or related tribes.

The causes of such customs of exogamy and endogamy have been much debated. McLennan held that exogamy was the outgrowth of the custom of female infanticide, but there is little or no evidence in support of such a theory. Westermarck's explanation is that exogamy arises from the extension to the whole clan of the natural instinct of aversion to incest. It may be pointed out, however, that exogamy and endogamy are not customs peculiar to uncivilized peoples. Similar rules are found regarding forbidden degrees of relationship among civilized peoples. While there is possibly a natural aversion to incest, there is even more pronouncedly instinctive attraction between persons of the opposite sex who are relatively strange and unfamiliar. This leads naturally among all peoples to marrying outside of the close social group; and among the uncivilized all members of a clan are regarded practically the same as very near relatives. The main difference in the practice of exogamy among the uncivilized and among the civilized is that in the clan stage of social organization it is not blood relationship in our sense which counts, but the type of social organization itself.

Marriage Among the European Peoples.—Among the early Aryan peoples of Europe marriage was universally regarded, so far as we can discover, as a religious bond, since their family life was based upon ancestor worship. This early Aryan view of marriage gave way in later Rome to the view that marriage was a private contract, to be made and dissolved by the parties at their pleasure. The early Christian Church combatted this view of the marriage relation and sought to restore the view that marriage was a religious bond, which it finally did by making marriage one of the sacraments of the Church. It was forced, however, to still recognize that consent or contract was the essential means of entering the marriage relation. "Consent marriages" continued to be recognized, therefore, though they could not be broken except through the authority of the Church. The Protestant reformers put forth the idea that marriage was a civil relation, rather than a religious bond or sacrament, to be created by the state and broken by the state. In reaction to this view the Roman Catholic Council of Trent in 1563 declared that a valid marriage could only be created by the Church and only annulled by the Church. This still remains the Roman Catholic view of marriage. The later Roman view that marriage is a private contract, to be created and broken by individuals as any other contract, has shown a tendency to revive in modern nations among many elements of their population. The present problem of the family, therefore, centres about the question of divorce and the toleration of other forms of marriage than that of permanent monogamy. (See article on FAMILY, HISTORY OF). The last three theories mentioned are evidently held alongside of one another by different elements in the populations of modern nations. Which of these competing theories of marriage will become established in the moral standards of the future it is too early yet to say.

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MARRIAGE, The Law of. When the cave man wanted a mate he took her, and he was not very particular where he got her. His next neighbor's cave, indeed, would be the most convenient and likely place. It was a mere question of brute strength; the man of greater physical power had his way. As social evolution progressed and families were established and organized into clans, the man who preferred to gain a wife by capture had to go further afield. To have forcibly taken a woman of an allied family, or from an affiliated clan, would have brought down upon the offender the vengeance of an entire community and, against this, individual force could not prevail. Wife capture had to be practised against hostile tribes, from whose vengeance the robber would be protected by the whole of his own community. The Roman legend of the rape of the Sabine women points to a time when wife capture from unrelated and, therefore, enemy communities was a common practice. Probably robber-marriages persisted, to some extent, even in the home circle, so to speak. Among a number of semi-barbarous nations marriages still take the outward form of abductions. Before the leveling influences of Russian civilization had almost completely obliterated their tribal customs, wife captures were regularly staged by the Kirghis of the steppes. The bride, mounted on a swift horse and carrying her dowry, rode furiously out of her father's camp and the bridegroom gave chase. He was expected to catch her before dark, and he always did — that was part of the comedy. The whole performance was *camouflage* for the pur-

*The tribe being a group of related clans speaking the same language.

pose of covering up the real transaction, which was nothing else than a bargain and sale. Marriage by purchase was evolved, almost inevitably, from marriage by capture; the prospective husband paid a price to the family of the prospective wife for the privilege of carrying her off. Sometimes the abduction preceded the payment of the purchase price, the latter being disguised as a fine subsequently amerced to atone the "offense." In some instances, as under the early Roman law, the woman was adopted; she came under the fatherly power of the husband and, theoretically, became his daughter. In other times and places marriage was frankly a sale. In all cases the wife became the property of her husband and, at the worst, she was his drudge or slave. The tutelage, which was exercised over a woman throughout her life (even after her marriage) by the males of the family in which she was born, was intended to be protective of her honor and that of her family, as well as of her share of the patrimony of family property. An instance in point is the Levitical law, which permitted the father of a bride, put aside by her husband on charge of unchastity, to proceed against the accuser, and, the accusation being disproved, compelled the offender to expiate the wrong by keeping the woman as his wife all the days of his life. The actual condition of the wife was not as hard as might be implied from her legal status, or lack of legal status. The injunction to obey the father is coupled with the injunction to honor the mother. In the great Oriental monarchies of antiquity marriages were undisguisedly commercial transactions; the bought wife of a citizen of Babylon, however, was the manager of her husband's house and she was habitually consulted in serious matters of business. She was conferred with even in affairs of state if her husband happened to be a public official. A free woman, though married, might occupy a public position and hold separate property. Primitive communities do not clearly distinguish between custom and law or religion and morals; but in course of time a strictly religious form of marriage might be substituted for contractual marriage in any given community. The contractual or purchase marriage itself has a tendency to become symbolical and dramatic. The pledge given by the wooer to bind the bargain might originally have been a cow (domestic animals were real money, cattle or chattels and *pecunias* were words of identical meaning). This was later on represented by a gift to the bride — a bracelet, jewel or other token. The "giving in marriage," i.e., the consummation of the sale of the woman, would be accompanied by conventional words and gestures, dancing and music. Sometimes a wooer made payment in personal services, as Jacob tended father Laban's sheep seven years for Rachel; and in this, as in other cases without number, the marriage was a matter of mutual inclination. The bride usually received from her father a dowry or *dos,* which passed to the husband and remained under his control during the continuance of the conjugal relation. Among the Jews and Oriental nations in general marriages were terminable by divorce at the will of the husband. Among the Romans they were terminable at the will of the wife's father or by mutual consent of the parties. In either case the bride's dowry was returned. The re marriage of widows was not forbidden, bu was disfavored. Under the Babylonian law th consent of the courts had to be obtained an provision made for the care of the childre and household of the deceased husband. Monog amy and polygamy often existed side by side even in highly developed human societies. O the two great cultural races, the Semites hav given distinct legal sanction to plurality o wives. Polygamy was practised by the He brews in the patriarchial stage, though th practice fell into abeyance in later times Aryan institutions seem to be based on monog amous marriages. For obvious reasons monog amy must be the usual state in all communities whatever may be the law. Relatively few mem bers of a community have the power to gai or the ability to maintain more than one wife While a man individually might capture a woman of a hostile tribe and make her hi lawful wife, captives of war became slaves Among Oriental nations the children born t free men of their slave women or "hand maid ens" were considered legitimate and free Among the theoretically monogamous Aryan the opposite was the prevalent rule.

The marriage by appropriation and the result ing guardianship — or, more plainly speaking ownership — of the wife by the husband, doe not comport with the sociological thesis tha the institution of the patriarchate was precede by the matriarchate as a form of family organ ization. The practice of polyandry is rare even among savages, and where it is observe among people of culturally higher stage it in dicates degeneracy more probably than primi tiveness. In Tibet polyandry is evidently a outgrowth of the group marriage — the mar riage of all the daughters of one family a a group with all the sons of another family The plural husbands of polyandrous Tibetan women are invariably brothers. A rather fre quent form of primitive marriage is that when the husband is adopted into the tribe of th wife. That in such case the patriarchal au thority would be less pronounced than other wise is not evident, however. The male adopte into a tribe would assume the tribal name an be on the same footing with the males bor therein. Within a clan blood kinship is trace through females; but it is not necessary to pre sume the matriarchate as an antecedent socia order to account for this. The maternity of child is determinable with so much greater certi tude than its paternity that the tracing of kin ship through the mother would commend itsel for its convenience. Moreover, in those clan where this method of reckoning is customar the family and tribal organization is invariabl patriarchal. Practically without exception th nations which have become the leaders in cul ture have erected their social structure on basis of monandrous marriages and agnati kinship. The wife is taken into the husband' *gens,* clan or house, and her children becom members thereof and are given the famil name of their father. In the matter of inherit ances cognizance was usually taken only of rela tionship in the male line. A daughter migh inherit from her father, but if she died befor he did her children would take nothing b

representation; hence the importance of the *dos* or marriage settlement. By neither the Roman nor Teutonic rule of consanguinity was a man's sister's husband of kin to him and the suggestion of a prohibited degree of relationship between himself and a deceased wife's sister would have sounded queer to Cæsar or Cicero. The Levitical law took more account of blood relationship through females and made even a man's stepmother his cognate in blood. Stepbrothers and stepsisters could not intermarry, though they had no parent in common. It also forbade marital communion between certain other persons whose affinity was merely legal — as between a man and his uncle's widow or with his daughter-in-law. It forbade marriages of near relations to the third degree of blood kinship on either the maternal or paternal side — and this rule has prevailed throughout the Christian world. According to the Levitical law a man should not bring his sister-in-law into his house as a rival to his wife, but there was no prohibition with a deceased wife's sister and a man was expected to be a husband to the childless widow of his brother.

In the earlier period of their history the Romans recognized three kinds of formal marriage. The religious form, *confarreatio,* or "marriage with the bread-offering," had to be solemnized by the Pontifex Maximus in the presence of 10 witnesses and was reserved to themselves by the old patrician families. Among the plebians espousals took the form of a purchase, *coemptio,* which is defined by Gaius as a mutual mock sale of the parties, whereby the wife was freed from *tutela legitima* and *sacris familiæ* — tutelage to her male relatives and contributions for the maintenance of certain religious rites in her husband's household. The third form, *usus,* though held in little respect in the earlier period, ultimately became prevalent in all social ranks. Either by confarreation or coemption the woman given in marriage passed *in manum viri,* literally into the hands of the man, her husband, who acquired rights over the person and property of his wife greater, on the whole, than have been, or are, conferred by any modern system of law. He controlled her *dos* and other possessions absolutely during his life and continued his wardship after his death through guardians appointed in his will. The *usus* ripened into a perfect matrimonial bond only by prescription and after continued cohabitation for an entire year. In the meanwhile the husband's marital despotism was in abeyance. By simply absenting herself from the matrimonial domicile for one day in each year the *usus* wife could indefinitely postpone and defeat the acquirement of tutelary and possessory rights by the husband. On the other hand, the later law reduced the tutelage of the male in over the women of their family to a mere formality. By contracting a usus marriage, therefore, the women of Rome were enabled to evade both the paternal and matrimonial tyranny, under which they had been placed by the earlier law. In fact, at the most splendid period of Roman greatness married women enjoyed a freedom with respect to their persons and property such as they have not enjoyed anywhere since then. Most important of all was the establishment of the principle that marriage rested upon the consent of the parties — *concensus, non concubitas, fecit nuptias* — and might, therefore, be dissolved at the pleasure of either party. While the marital union was admitted to involve a sharing of all for life — *consortium omnis vitæ* — this was declared to mean a voluntary, not a forced, partnership. To hinder a separation when a consensus had ceased to exist was regarded *contra bonos mores,* in plain English, "immoral."

Early Teutonic marriage law did not differ greatly in fundamentals from that of Rome. Though disguised by ceremonials the transaction was essentially a barter. In the original and crudest form the custom was to give the father so much for his daughter, the price being fixed in accordance with the wealth and rank of the families participating in the treaty. The contract was made handfast, just like any other bargain, by a pledge or part payment. In progress of time this pledge, *vadium,* took the form of an ornament of more or less value presented to the bride at the betrothal — in modern practice an engagement ring. In time also the *arrha* (purchase money) became a gift to the bride instead of a payment to her father, though the latter retained it in trust for his daughter. The payment of the marriage settlement — and this the *arrha* was in effect — might be postponed during the lifetime of the husband, on his giving security for the transfer of an equivalent out of his estate to his widow. The purchase price for the bride thus became dower in form as it had always been in essence and in intent. Some early Teutonic laws distinctly sanctioned the "robber-marriage," which was nothing more than an abduction, or, the bride being willing, was simply an elopment. The penalty the abductor was required to pay to the outraged father was usually identical in amount with the prescribed amount of the settlement or dower in the more orderly form of wedding — indicating that barter marriage and robber marriage stood on about an equal footing of respectability. The Teutonic maiden when given in marriage was usually provided with an outfit for housekeeping and a dowry. Possibly an abducted bride would receive neither, which may be the reason why abductions were sometimes accomplished by connivance of the bride's family. In modern days elopments are often similarly motivated. There is nothing new under the sun, even in marriages. Betrothals in a regularly arranged ancient Teutonic marriage were attended by festivities on a scale comparable with those attending the wedding itself. Indeed, some investigators of primitive law insist that the troth-plighting was not a mere promise to marry but was, in verity, the contract of marriage. The giving of a pledge (*vadium*) to bind the bargain would indicate to a person exercising ordinary common sense that the betrothal was no more than an executory contract. It created an obligation to wed but did not actually establish a marital relation. The disputations on the subject have the appearance of mere quibblings with words. To be sure, if one buys a thing to be delivered to-morrow and pays part of the price, a sale has doubtless taken place. Of course, a delivery is necessary to complete the transaction; and, if the thing purchased be a cow, it might be said that she is not under complete dominion

of the new owner until he has put her into his stable and locked the door. Possibly some such mental kinks is responsible for the suggestion of other investigators of ancient Teutonic customs that *concubitus* was a legal essential to the consummation of a marriage. Be that as it may, the idea of a threefold stage in the process of acquiring a wife — the troth-plighting, the wedding and the consummation — has persisted in legal phraseology and has colored even very modern legal conceptions. Early Teutonic law permitted a husband to put aside his wife for adultery or barrenness, and it seems to have countenanced dissolution of the matrimonial bond by mutual consent.

From the very outset Christianity set its face against the looseness of the later Roman law respecting marriage. The legislation of the Christian emperors shows a reaction against the extremely liberal doctrines of the Antonine jurisconsults. The prevalent state of public opinion explains why, in the fusion of patriarchal practices, Roman jurisprudence and barbaric usages, so many retrogressive customs of the latter respecting the position of women should have found their way into the new alloy. The principles of the Roman law prevailed in so far that unmarried women were relieved of bondage to the family after attaining their majority. But the position of married women became fixed in barbaric archaisms and the husband drew to himself all the powers that had belonged to the wife's male kindred. The Church declared marriage to be a sacrament and the consequence was the enunciation of the doctrine of the indissolubility of the matrimonial union except by death. Through the decretals, through its influence on the customary law in the matter of dower and through the assumption of jurisdiction by the ecclesiastical courts over matrimonial questions, the Church established a universal marriage law throughout the Christian world. The canonists accepted the principle of the Roman law that the consent of the parties is essential to the making of a legal contract of marriage, just as it is to the making of any other contract. The lack of free consent, because of a material error in fact or because of physical or moral duress, or because of natural or legal incapacity of one or both of the parties (impotency, insanity or minority) were declared insuperable impediments to the execution of the contract, and grounds for its annulment if executed. From the Roman law also the canonists carried over into their system the age of consent — 14 for males and 12 for females — but they rejected the requirement of parental consent. In seeming contradiction to this, the father still "gives away" the bride in the marriage service. The Roman idea, that betrothal (*sponsalia*) was merely a promise to marry, was modified under the influence of Teutonic usage, by which the troth-plight was considered to have created the relation of husband and wife. Ultimately the canonical law made a distinction between *sponsalia de futuro* and *sponsalia de præsenti.* The former was declared a mere promise; but a present agreement (*accipio*) was held to constitute a valid marriage. Such a marriage if not consummated was dissoluble, however, either by a vow of celibacy taken by one of the parties, or by special dispensation. The troth-plighting in the marriage service and the wedding of the bride with a ring may be reminiscences of the Teutonic hand-fasting and the payment of the *vadium* or pledge, while the marriage settlement looks very much like a modern variation of the transfer to the bride of the *arrha.* Formidable impediments to marriages within the family, even between very distant relations, were created by the canons of consanguinity and affinity. The degrees of kinship were measured from the common male or female ancestor downward in collateral lines of descent. Each successive generation being but one degree further removed from the source of the blood, persons might stand in close relation to each other, though wide apart collaterally. Second cousins, for instance, were akin in the third degree by the canon, though the Levitical and Roman law would both place them in the seventh degree. The earlier Church canon forbade intermarriage down to the seventh degree, so that sixth cousins could not enter into matrimonial relations with one another. In the later Church law the prohibition ended with the third degree canonical, or with second cousins. Relations by affinity or marriage were laid under similar disabilities as blood relations. Sisters-in-law and brothers-in-law were as incapable of contracting marriages as natural brothers and sisters; likewise the children of husbands and wives by former marriages. These prohibitions conform to a sense of delicacy and they accord with a not unreasonable interpretation of the Levitical canon. But a reason for tracing relationship of any person to an uncle by marriage and to his children by a former wife and these children's children is hard to discover. Nevertheless, these canonical restrictions were not without salutary effect. The practice of intermarriage between kindred, in order to keep property within the family, had become prevalent not only among the nobility but in all ranks. Near relationship in blood or by marriage might exist among the entire population of a small commune, and such cases were not exceptional under conditions of life that did not encourage travel or changes of habitation. By compelling men and women to seek mates outside their own little circle, the Church set a wholesome limit to inbreeding. The habitual shifting of population and the great freedom of locomotion in modern times have made the extreme restrictions of the canon law quite dispensable. The Reformation produced important changes in the law of marriage. The Council of Trent pronounced clandestine marriages of minors to be nullities and required the presence of two witnesses in all cases. The Protestant ecclesiastical law denied the indissolubility of the matrimonial bond and regarded all betrothals as, presumably, *sponsalia de præsenti.* The words, "I will," Luther remarked, did not, in the Teutonic language, express a future intention but a present purpose; unless qualified so as to introduce an element of uncertainty any promise to marry, followed by cohabitation, was to be considered a valid marriage. Indeed, cohabitation in conjugal relation was quite generally regarded presumptive evidence of a marriage *per verba de præsenti,* though the presumption was not conclusive. By acts of Parliament passed in the second half of the 18th and the first part of the 19th centuries,

urch weddings were required in all cases and marriages not thus celebrated were declared id. Informal marriages, however, were still od in Scotland; and this circumstance exins how Gretna Green became a Mecca for naway lovers. The statute of George II also de the parent's or guardian's consent essenl to a valid marriage; but this requirement s rescinded later on. A statute of Henry II had adopted the Levitical canon as the le for reckoning degrees of consanguinity England. This permitted marriages between st cousins and persons of more distant relanship in blood, and it abolished, or was inded to abolish, all disabilities growing out affinity or relationship by marriage. The urch of England, however, continued to the t in opposition to marriage with a deceased fe's sister, and still insists upon the indisubility of the matrimonial bond except by e death of one of the parties.

In the eye of the modern law marriage is imarily a civil relation. Most of the European codes and, with one or two exceptions, en those of Catholic countries, make a civil arriage and the registration thereof in the blic records indispensable. A religious ceremony may follow at the option of the contracts, but is not legally essential. A relation eslished by the civil authority can, of course, dissolved by the same authority. Adherence the doctrine of the sacramental character of arriage has become a matter of conscience; e law will not force obedience to the same. ne modern law has generally raised the age consent and has made the consent of parents guardians necessary to the validity of the arriages of minors. All marriages must be blicly contracted. In England the requisite blicity may be obtained either in accordance th the rites of the Established Church or ner religious denomination, or in accord with e rules made by the public registrar or by tute. Betrothal almost everywhere is now nsidered merely a promise to marry, and acns to recover damages for a breach of the omise are permitted in only a few countries. ne dissolution of marriages by consent of the rties is, generally speaking, disallowed, but nost everywhere divorces may be obtained by ocess of law — in Austria only between nonholics. The powers of married women to al with property vary considerably. In some the French provinces the pre-Revolutionary *utumes* gave to married women, below the nk of nobility, nearly all the independence ich Roman jurisprudence in its final stages d allowed them. These local customs tother with parts of the Roman law became the sis of corresponding provisions of the Code poleon and through the latter and to some tent the Spanish law have affected the law of uisiana and a few other States of the Union. usband and wife by this law acquired no genal interest in each other's property on marge. The only property the wife brought into e matrimonial pot was her *dot,* or dowry, ich is in the nature of a wedding gift from r family. While the husband did not become e owner of the *dot,* he had the use of the me during the continuance of the marriage. e husband could even sue the wife if she dered him in the enjoyment of the usufruct reof. Every species of property owned by the wife at the time of marriage or subsequent thereto could become the subject of a dotal gift. The most interesting disposition of property permitted to husbands and wives, however, was the creation of a *communio bonorum.* The principle of the *communio bonorum* is that husband and wife shall have no property apart from one another. All that either of them owned at the time of, or before, their marriage, and all that either or both together acquired while living in the marital relation, was included in the communal property. As in the case of a partnership in business, the community property could not be made answerable for the individual obligations of the parties to a *communio bonorum* until all joint obligations had been satisfied out of the same. The husband became the managing partner or curator, however; the wife is excluded from every case in which her acts cannot be referred to an express or implied authority of the husband. The latter incurs all debts or charges for the community. The community ceases on termination of the marriage relation either by agreement, divorce or death; in the latter event the rights of the survivor are fixed by law. The *communio bonorum* is a form of marital partnership recognized not only in Louisiana, but in Texas, Florida, Missouri, California and other States carved out of territory once in French or Spanish possession. The principle has been greatly modified under influence of the common law and the modern statutes respecting the separate property of married women. The *communio bonorum* exists by legal presumption only with respect to property acquired during marriage, or in the name of either husband and wife, including the produce of their reciprocal industry and labor. The presumption may be rebutted by proof that any property so acquired was intended to be acquired as separate estate. Separate property brought into the marriage by either party forms no part of the community, except by express agreement; nor does property acquired after marriage by gift or inheritance.

In the United States a marriage may be either religious, civil or quite informal. Civil marriage was authorized, or required, in all the New England colonies. Milton's tractate on divorce and his denunciation of ecclesiastical «meddling» with marriage had borne fruit in the Civil Marriage Ordinance of Cromwell, passed in 1653. By this ordinance obligatory celebration before a justice of the peace was instituted, and a system of lay notice, certification and record was established. The action of the Puritans and Independents in England found ready followers in America. The States-General of the United Netherlands in 1656 adopted the principle of an older law of the provinces of Holland and Friesland, which had established a permissive form of civil marriage soon after their independence of Spain was achieved, and this naturally passed over into the law administered in New Amsterdam. For years the celebration of a marriage before a clergyman, as such, was illegal. Religious marriages were sanctioned later on throughout New England, and long before the close of the colonial era the dual civil and religious system was established, which has since prevailed. The «common-law» marriage, still recognized in most of the States, is nothing more than the canonical

sponsalia de præsenti under another name. Any agreement to marry *per verba de præsenti*, which is followed by cohabitation as man and wife, constitutes a legal marriage. A presumption of marriage is raised when the parties have lived together in marital relations, have acknowledged themselves (or have been generally reputed) to be husband and wife. This presumption, of course, is not conclusive and may be rebutted. A relation, originally meretricious, will not be transformed into a marriage by a mere informal agreement. This also is in accord with the canonical law. In all the States formalities attending marriage are prescribed by statute. Licenses to marry must be obtained, and the publication of the issuing of a license gives some sort of publicity, as does the requirement of the presence of witnesses and the making of marriages matters of public record. The persons who may perform the ceremony, clergymen or civil officials, are designated. The clerk issuing the license must be satisfied, by affidavit or otherwise, that there are no legal impediments to the marriage, and, in cases of minors, the consent of parents or guardians is usually required. In most of the States, however, the statutory requirements have been held by the courts to be merely «directory» and not mandatory. Non-conformity may involve the non-conformers, and the officials and ministers concerned, in legal penalties; but the marriage is not invalidated. In Massachusetts, however, the courts have always insisted upon the observance of the statutory formalities, declaring such observance to be essential to the validity of a marriage. The Massachusetts rule has been followed in some States and in others the statutes are mandatory. For either of these reasons the «common-law» marriage may be deemed to have been abolished in California, Illinois, Kentucky, Massachusetts, Missouri, Maryland, North Carolina, Vermont and West Virginia. In New York (since 1901) non-ceremonial marriages must be evidenced by a written agreement, signed in the presence of two witnesses and acknowledged in the same manner as a conveyance. The effort to secure the adoption by the States of a uniform marriage law has, thus far, been unsuccessful, and the greatest diversity continues to exist. Moreover, the general rule, that a marriage which is legal in the place where it is established will be regarded as formally perfect everywhere, permits the parties to evade inconvenient requirements of the laws of the place of their domicile by going out of the State to make the contract. The age of consent varies in the States, ranging from 16 to 21 years for males and from 14 to 18 years for females. Where the statutes are silent the canonical prescription of a minimum of 12 years for females and 14 for males still holds good. Infant marriages are voidable at the option of parents or guardians, if contracted without their consent. When any of the essential ingredients of a contract are lacking the marriage agreement, like any other contract, is a nullity. Consent being an essential, when one party or both have insufficient mental capacity to give intelligent assent no valid marriage can result. A misunderstanding as to a vital fact will avoid the contract, but only if the mistake was of such a character that there could have been no real consent. Duress excludes volition, and there is no such thing in law as involuntary consent. Impossibility of performance avoids the contract. Impotence, meaning want of physical capacity, makes marriage a nullity; but sterility does not. The marriage of a person having a living and undivorced former spouse is a nullity. Null and void also are marriages between persons in the prohibited degrees of consanguinity. All States forbid marriages between blood relations in the direct line of descent or ascent and between brothers and sisters of the half blood as well as of the full blood. All States forbid marriage between uncles and nieces or nephews and aunts and in 20 States the prohibition extends to consanguines within the fourth degree, which bars marriage between first cousins. Affinity through marriage among collaterals is usually disregarded, but in the ascending or descending line, as between step-father and step-daughter or between father-in-law and daughter-in-law the prohibition is frequent. In 25 States whites and negroes are forbidden to intermarry, the laws often defining to a nicety the fractional part of African blood which vitiates the marriage. In five States the prohibition extends also to the marriage of whites with Chinese or other Mongolians, and in four States marriages between whites and Indians are forbidden. In recent years legislation on the subject of marriage has been affected greatly by eugenic considerations. In Connecticut and Minnesota epileptics and feeble-minded persons are not permitted to marry and similar statutes have been enacted in other States as have laws prohibiting the marriage of persons afflicted with venereal diseases. Under these statutes those intending marriage must first undergo a physical examination before a marriage license is granted. These examinations include all of the rigid tests known to medicine. A woman on marriage usually takes her husband's nationality.

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STEPHEN PFEIL.

MARRIAGE OF FIGARO, The ('Le Mariage de Figaro'), Beaumarchais' most popular play, possibly the wittiest and politically the most effective of all dramas, was ready for the stage in 1778, three years after the success of 'The Barber of Seville' (q.v.), to which it was a sequel. But even while in manuscript it

ecame the centre of intensely active and com-icated political intrigue. Louis XVI rightly scerned in it danger to his throne, and it as not publicly presented till 1784, when it hieved a success till then unparalleled, being strange irony most applauded by the aristo-atic class whose ruin it portended. To Napo-on, after the event, it seemed "the Revolu-on already in action," and it certainly con-ibuted greatly to hasten and provoke by its veling tendencies the disintegration of the nventions and even the foundations of the d social régime, though this seems the result ther of Beaumarchais' delight in his own wit, mere wantonness, than of a realization hither his work was tending or of any delib-ate revolutionary purpose. Figaro in 'The arriage' is still the light-hearted, versatile, ilosophic scapegrace of 'The Barber'; Al-aviva and Rosine are what that play would ad one to expect they would be after some atrimonial disillusion. Of the new characters uzanne, on whom Almaviva has set his grant fancy and Figaro his heart, is genially nceived, and Chérubin, the page and disquiet-gly precocious gallant, was a really daring eation, provoking reprobation and inviting ntroversy. Figaro is successful in defending s beloved from the wiles of Almaviva, but it as been not unjustly said that if the object of medy is to make vice ridiculous or odious or ntemptible 'The Marriage' can hardly claim attain it. Universal mockery, supremely vacious, a wit whose brilliancy puts morality f its guard, mar ethically a drama whose stained excellence in dialogue had been hardly tained even by Molière. The best edition of e Mariage de Figaro is in 'Théâtre de eaumarchias,' edited by d'Heyli and Marescot Vol. III). For the circumstances of its writ-g, prohibition, reception and contemporary iticism, consult Loménie, 'Beaumarchais and is Times' (Vols. III and IV), also 'Le Cen-naire du Mariage de Figaro,' edited by A. aër (Brussels 1884). The play furnished the xt for 'Le Nozze di Figaro,' a popular opera Mozart (1786).

BENJAMIN W. WELLS.

MARRIED WOMEN, Legal Status of. ee HUSBAND AND WIFE.

MARRIED WOMEN, Right to Conduct usiness. See HUSBAND AND WIFE.

MARROW, a substance of soft vascular ssue filling the cells and cavities of the bones mammals. It contains fat and both red and hite blood corpuscles and is a valuable con-ituent of soups. The bone contents of mam-als show wide variation. The largest con-ituent is usually water, but some marrows, as the long bones, are mostly a yellow oil. races of albumen, fibrin and salts are also ound. Red bone-marrow is highly nutritious id is recommended for anæmia. (See BONE). he vegetable marrow is a species of squash *Cucurbita ovifera*), of oval form, ribbed and reenish-yellow color.

MARRYAT, măr'ĭ-ăt, **Florence,** English ovelist, daughter of Frederick Marryat (q.v.): Brighton, 9 July 1838; d. London, 27 Oct. 899. She was successively Mrs. Church (1854–0) and Mrs. Francis Lean. Her many novels, though not at all remarkable, were popular, id were published in various versions through-out Europe. They include 'Nelly Brooke,' 'Fighting the Air,' 'Facing the Footlights' and more than 80 others, many being devoted largely to spiritualism. She published and edited her father's 'Life and Letters' (1872).

MARRYAT, Frederick, English naval of-ficer and novelist: b. London, 10 July 1792; d. Langham, Norfolk, 9 Aug. 1848. In 1806 he entered the navy, served on the coast of North America in 1811 in the *Æolus,* and in 1823 was commander of the *Larne* during the first Burmese War, in 1825 had the naval command of a successful expedition up the Bassein River, and in the same year was made captain of the *Tees.* From 1828 until his resignation in 1830 he commanded the *Ariadne.* He received the gold medal of the Royal Humane Society (1818) for saving life at sea; adapted to the mercantile marine Sir Home Popham's system of signaling; was elected Fellow of the Royal Society in 1819, and was also something of a caricature artist. He is best known, however, for his stories of the sea, beginning in 1829 with 'The Naval Officer.' The most familiar of them is 'Midshipman Easy' (1836), in which his chief characteristics, lifelike and circum-stantial narration and a rollicking humor, ap-pear perhaps at their best. Others of the series are 'The King's Own' (1830), probably the best constructed of his works; 'Newton Forster' (1832); 'Peter Simple' (1834); 'Jacob Faith-ful' (1834); 'The Pacha of Many Tales' (1835); 'The Pirate, and the Three Cutters' (1836); 'Snarleyyow' (1837); 'The Phantom Ship' (1839); 'Poor Jack' (1840); 'The Privateer's Man' (1846). He wrote also a series of juveniles, chief of them 'Masterman Ready' (1841). He visited Canada and the United States in 1837–38; and recorded his im-pressions in 'A Diary in America' (1839), which gave some offense to the people of the nation, then hypersensitive to foreign criticism. In 1832–35 he edited the *Metropolitan Magazine,* in which he published a review of N. P. Willis' 'Pencilings by the Way,' which the latter, then in England, considered abusive. Willis chal-lenged Marryat, and they exchanged shots at Chatham without injury. (See MIDSHIPMAN EASY, MR.). Consult Marryat, F., 'Life and Correspondence' (1872); Hannay, 'Life' (in 'Great Writers' series).

MARS, Anne Françoise Hippolyte Bou-tet Monvel, än fräṅ-swäz ē-pō-lēt boo-tā môṅ-vĕl märs, usually called MADEMOISELLE MARS, French actress: b. Paris, 5 Feb. 1779; d. there, 20 March 1847. As Célimène in Molière's 'Misanthrope,' and Elmira in 'Tartuffe,' as well as in several similar characters in the plays of Marivaux, she was very great. Louis XVIII settled on her, as well as on Talma, a pension of 30,000 francs. She retired in 1841.

MARS. Mars is the fourth planet from the Sun, its orbit being considerably more eccentric than the Earth's. The eccentricity is exceeded only, among the nine large planets, by that of the orbits of Mercury and of Pluto, and amounts to 0.093, while its mean distance from the Sun is 141,500,000 miles. This large eccen-tricity causes considerable differences in the planet's distance from the Sun, the change being from 128,300,000 to 154,700,000 miles at peri-helion and aphelion respectively. As the orbit of Mars is wholly outside ours, Mars may ap-

proach us, under the most favorable circumstances, to within 34,600,000 miles at opposition, i.e., when the planet is on the meridian at midnight and hence most advantageously placed for observation, while it can recede to 250,000,000 miles when it is behind the Sun. At an average opposition, however, Mars is 48,000,000 miles distant. Its magnitude therefore can vary from -2.8 to $+1.6$, which amounts to a change of 55 times in brightness. The siderial period of Mars contains 687 of our days, but its synodic, from one conjunction to the next, is 780 days. Though Venus approaches us more nearly, yet this happens when Venus is between us and the Sun and hence unobservable. Mars, on the contrary, is most favorably placed when nearest, and therefore can be observed under better circumstances than any planet. Despite this fact, as the planet has an atmosphere, there is a very slight uncertainty in its diameter, due to the difficulty of exactly allowing for the height of this atmosphere over the solid surface and for the effects of irradiation. The value usually accepted is 4,206 miles; photographs in yellow light however give 4,240 miles. Results at the Lick Observatory, largely due to W. H. Wright, give a value for the solid globe of 112 miles less than this. This implies an atmosphere which is appreciable enough to show up on the photographs 56 miles above the surface. It must be understood that this is by no means the probable height of the whole atmosphere, the upper and less dense parts of which probably are not recorded on the plates. The apparent diameter varies from 3″.5 at conjunction to 25″.1 at a most favorable opposition. It can at once be seen that when nearest an angle of 1″ at the distance of Mars corresponds to 168 miles. Obviously then an object subtending an angle of 0″.1 is 17 miles wide, and, as this approaches the smallest angle that can, under perfect conditions, be seen using the largest refracting telescopes in existence, it needs no further argument to show the impossibility of seeing really small surface features on Mars. For instance, the Himalayas would be less than 0″.04 high on the limb of the planet, an angle quite undetectable with any telescope. It therefore seems very strange that many books assert the planet has a relatively smooth surface, for even our highest mountain ranges, if there, would not show up directly. Also, as the shadows are not sharp as on the atmosphereless Moon, it is very doubtful if we could detect them by means of the shadows they cast, though with a low Sun these latter would much exceed the angular heights of the mountains themselves, when on the planet's limb. Even the effects of sunrise or sunset on the tops of mountains, just beyond the terminator, would be difficult to detect, due to the greater thickness of the Martian atmosphere through which we would have to observe them in this twilight region.

The mass of Mars is 0.108 that of the Earth, or about one three-millionth that of the Sun. Its density is 4.0 times that of water, and bodies on its surface would weigh only 0.38 what they do with us. This latter means that, could a man be transported to Mars, keeping his muscular strength and suffering no ill effects, his weight would be only 38 per cent of what it is on the Earth, and he would be able to accomplish far more with less effort. It also proves that the «velocity of escape» for gases is much lowe for Mars than for the Earth, and hence tha planet would be less able to retain gases in i atmosphere. The lighter ones would largely o wholly escape. It is calculated that Mars re flects about 15 per cent of the Sun's light fal ing upon it, which means that it has twice a good a reflecting surface as the Moon. Y even this reflecting power corresponds only t that of dark rocks. The greatest deviation fro the full phase is the gibbous and when nea quadrature the disk is far from circular. Ma is usually brighter near the limb than in i center, but not along the terminator. The plan is also slightly flattened at the poles, and theo retical reasons make us believe that it is th most nearly homogenous of all the eight plane which can be studied—Pluto is too small to b measured. The equator of Mars is incline about 24° to the plane of its orbit; this mean it has seasons exactly like our own. The da on Mars is 24 hours 37 minutes 23 seconds long therefore, only about half an hour longer tha the day here. Hence, so far as diurnal and sea sonal phenomena are concerned, we find a strik ing similarity with our Earth. The amount o heat received per square mile on Mars averag 44 per cent of that we receive, but due to th eccentricity of its orbit at perihelion the heat 1.45 greater than at aphelion. The souther hemisphere of Mars now, as with us, happens t have longer and colder winters, with shorter an hotter summers, due to this cause.

The planet possesses two small satellites o moons: Phobos, distant only 5,800 miles fro the planet's center and making its complet siderial revolution in 7 hours 39 minutes; an Deimos, distant 14,600 miles, in 30 hours, minutes. Both bodies are small, probably le than 10 miles in diameter. They were disco ered in 1877 by Asaph Hall (q.v.) with th Washington 26-inch refractor, then the fine existing telescope. They can never be see through small telescopes, and only under goo conditions through the largest. Bearing this fa in mind, a most remarkable statement, made b Dean Swift in his 'Gulliver's Travels,' publish in 1721, must be mentioned. This was a centu and a half before anyone knew these satellit existed, and about a century before any instr ment was made with which they could possib have been seen. The quotation is as follows:

«Certain astronomers . . . have likewise di covered two lesser stars, or satellites, which r volve about Mars, whereof the innermost distant from the center of the primary plan exactly three of its diameters, and the oute most five; the former revolves in the space o ten hours, and the latter in twenty-one and half . . . which shows them to be governed b the same law of gravitation . . .»

When it is noted how very close Swift can to the truth, not only in merely predicting tw small moons but also the salient features o their orbits, there seems little doubt that th is the most astonishing «prophecy» of the pa thousand years as to whose full authentici there is no shadow of doubt. The nearness o Phobos to the planet's surface means that it ca never be seen from large areas in the polar re gions. Its period of less than eight hours oblig it to rise in the west and set in the east. In th latter respect it is unique among all bodies i the universe, so far discovered. Yet Swift ha

this fact also included. On account of their very small size, they can give little «moonlight» to the planet and only the phases of Phobos could be seen without optical aid. Phobos is so near the planet's surface that it would appear much larger when on the meridian than when rising or setting.

To the average eye Mars is red, but when a telescope is used, it is found that orange-red is the prevailing color of the disk. The reddish color of the planet, when the absence of an appreciable per cent of oxygen in its atmosphere is remembered, has led to the following suggestion. When terrestrial rocks weather, rust appears, which is the uniting in them of iron and atmospheric oxygen. Such rust is reddish. Can it be that most of the presumably scanty supply of oxygen on Mars has so disappeared, leaving a reddish soil as a result? There are, however, darker areas of various sizes as well as two easily discernible polar caps. In fact, these latter can be seen with a small telescope. The so-called canals appear first to have been announced by Giovanni Schiaparelli in 1877 and his maps of the planet, though made with a telescope of only 8.6 inches aperture, showed a wealth of detail never before equaled by observers. The darker markings are of a greenish-blue color and lie mostly in a belt south of the equator. They cover nearly 40 per cent of the surface. The most easily seen of these is a projection, not unlike India in shape, which reaches well in the northern hemisphere. This is so easily recognizable that it can be identified certainly on drawings by Robert Hooke and Christian Huygens made over 200 years ago, and when compared with modern observations is the basis for the extremely accurate rotation period. As the planet's day so nearly equals ours in length, the same features on its surface, at the same hour of observation on successive nights, are but slightly displaced. The reddish areas undergo little variation in appearance; changes occur mostly in the polar caps and dark regions. The cap, in the hemisphere where winter prevails, extends nearly half way to the equator, but as the Martian spring equinox approaches, the cap begins to shrink along its edges, rather uniformly, so that by the summer solstice it may be some 500 miles in diameter and later in the summer very much smaller. In fact, during some years, the southern cap has wholly vanished; the northern never entirely disappears though decreasing to 200 miles in diameter. After the autumn equinox, the white material again forms, generally in isolated patches and overnight. These eventually joining form the continuous cap which lasts throughout the winter. One of the proofs that the planet's surface is not wholly at what would be the equivalent of sea level is that the locality in the south cap where it is longest visible is not the pole itself but an area 250 miles distant. This area must therefore be at a considerably higher level. There are some other phenomena reported, over regions where the Sun has just risen, that resemble the actions of hoarfrost. It was once believed the darker areas were bodies of water; this is now admitted to be impossible as the reflection of sunlight is never seen from them, and their color, sometimes even their size, changes with the seasons or perhaps in different years. As a generalization, such regions are more prominent in the hemisphere which has spring; their tints fade or turn yellowish in autumn. In some cases, a brown color has been reported for winter.

Turning now to the canals, Schiaparelli announced the discovery over the reddish parts of Mars of numerous fine, dark, straight lines for which, in the original Italian article, the word *canali* was used. This word means *channels* as well as *canals,* but while the former signification seems to have been intended, the translation *canals* had a greater appeal to the imagination and hence was adopted popularly. In 1881 he announced many were double. In 1892 W. H. Pikering detected small spots, connected with the canals, and in 1894 A. E. Douglas noted canals in the dark areas also. Percival Lowell, the founder of the observatory of that name and an indefatigable observer of the planet, believed that he fully confirmed the straightness and narrowness of the canals, as well as their duplication. At Lowell Observatory over 400 were mapped. However, E. E. Barnard, perhaps the most skillful of all American observers, saw no such complicated geometrical system of fine lines, though he used the two largest of all refractors, those at Lick and at Yerkes Observatories, as well as the superb 60-inch Mount Wilson reflector. On the contrary, he reported shorter, wider, and more diffuse lines, and also many small dark spots; and further, that with the best seeing conditions a wealth of detail could be glimpsed quite beyond human skill to fully delineate. E. M. Antoniadi, working with the great 32-inch Meudon refractor in France, confirms the lack of fine, geometrical lines, and the presence of an infinite amount of small detail, glimpsed in the rare moments of perfect seeing. Other observers take a midway position. It may be asked at once why cannot all skillful observers, having the use of great telescopes, see the same thing? And further, why cannot photography settle the question? It will be remembered it was shown that, even when nearest, 1″.0 on Mars equaled 168 miles. It is difficult under ordinary conditions to detect a dark line on a bright planet which is less than 0″.2 wide, almost impossible if it is below 0″.1. These are equivalent to 34 and 17 miles respectively. For the lines to show up, as Lowell drew his canals, they would have to be from 15 to 30 miles wide, at least. When detail is near this limiting size, no two pairs of eyes see it exactly alike since it is always at the extreme limit of vision. It is therefore not strange that observers, straining their eyes to the utmost, often put in detail others do not see or draw it differently. Everyone can see the larger topographical features and all agree fairly well on their outlines. It is the finer details over which controversy occurs. As to photography, even with an enlarging lens, the size of Mars on the plate is very small. Photographs in great numbers exist that show the polar caps, dark areas, even areas temporarily shrouded by clouds, but no possible photographic technique comes anywhere near equaling trained human eye in ability to detect fine planetary markings. The reasons for this may not be discussed here for lack of space, but are perfectly well known. Hence photography is inadequate to prove or disprove the existence of the narrower canals. Lowell and some of those who agreed with his delineation of what they observed on the planet's surface aroused great popular interest because they believed the

canals had been dug by intelligent beings, seeking to conserve a pitifully inadequate water supply for their needs. It is but just to point out that these astronomers did not believe the canals themselves to be of the widths mentioned. Their idea was that the vegetation growing along the narrow channels would cause the effects they saw and recorded as narrow straight lines. An example would be an airplane picture at very great height over the Nile Valley. The river itself might not show up, but the strip of vegetation, going out to several miles on either side, would appear as a narrow dark line. The spring melting of the polar caps was thought to be the source of the scanty and precious supply of water.

Fantastic theories of supermen and a society which had evolved far beyond ours may be found in various articles and books published during the period from 1880 to 1920; since then, serious writers have become more conservative. This is due to more recent evidence as to the constitution of the Martian atmosphere and the actual measurement of the temperature of various localities. While the atmosphere was known to exist two centuries ago, only refined spectroscopic observations could show the presence of oxygen and water vapor, the two constituents considered essential to biological life. The earlier observations confirmed the presence of both, but in quite small quantities. More recent ones from Mount Wilson, however, made with more powerful spectroscopes, have failed to reveal any trace of either. It is but fair to say that this does not mean that absolutely no oxygen or water vapor is present; only that their amounts are less than 0.001 for the former and 0.05 for the latter, as compared with our atmosphere. Mars' spectrum is practically that of reflected sunlight only.

On the contrary, we have the evidence of the polar caps, covering large areas, and shrinking with the advent of summer, and by analogy we could assume them to be composed of snow and ice. Further, at times, details in restricted areas of the planet simply disappear from view, as though covered by fog, clouds, or a haze of dust. Lastly, actual clouds have been seen, in relief, on the terminator of the planet, at considerable heights above the surface. But clouds of this sort have been rarely noted, nor is the fog very often reported. Series of photographs have been taken in light of different colors, both W. H. Wright at Lick and E. C. Slipher at Lowell having had remarkable success. Certain facts become evident on examining these plates. First of all, the polar caps are more conspicuous in violet light, so much so that on some plates they actually seem to protrude from the disk. In this same light, however, all ordinary details of the surface practically disappear, and what remain visible have vague outlines. Also images taken in violet or ultraviolet light are measurably larger than those taken in red light. Wright compared pictures of Mars taken in two wavelengths with two of the landscape west of the Lick Observatory, using the same color screens. The distant terrestrial mountains are almost invisible in the violet, but every detail stands out in the infrared. As mentioned, somewhat the same effects are found for the Martian surface. This would imply considerable optical density for the atmosphere of Mars, which obviously allows rays of longer wave length to penetrate quite as with the Earth's. The difference size of the violet and infrared images shou then give a definite clue as to the thickness that part of the atmosphere where appreciab absorption exists. As stated, this value is abo 56 miles. With regard to the protruding pol caps, Wright is inclined to believe them, at lea in part, as cloud caps floating over whatev may lie beneath. Even if the white substan we see is snow and wholly on the surface, v know nothing of the thickness of the mantle. few inches covering the ground would look t same to us as would a layer a thousand fe thick. Other substances have been suggested, b most astronomers still believe there exists thin layer of snow, despite negative spectr scopic evidence as to water vapor. Most of t seasonal changes can also be explained in th simple way.

One of the indisputable laws of science that light and heat vary inversely with t square of the distance. As Mars averages abo 1.5 times as far from the Sun as does the Eart the quantity of heat received there per squa mile should be 4/9 of that received here. Tur ing this into temperature has technical but n insuperable difficulties. For Mars, the calculat extremes at mean distance would be —51° +43° C, the correct value probably lying betwe these limits. Measures made at both Lowell a Mount Wilson Observatories have agreed on t following: that along the sunrise edge of t planet we find the temperature about —10° —20° C, at the center of the disk (for noo from +20° to +30° C, and for the sunset ed —10° to +10° C. The values found for the pol caps vary enormously, the lowest being —70° In view of these figures, we may decide that t earlier conclusion of some scientists that Mar surface never is above freezing, i.e., 0° C, is i correct. Further, that at noonday temperatur are found which would be comfortable enou near the equatorial regions, but even there t nights must be very cold indeed. The Lowe measures show the dark areas are warmer tha the reddish ones, which Wright believes inim cal to the theory they represent areas of veget tion. Later measures at Mount Wilson confir that at aphelion the temperatures on Ma should be 27° C lower than at perihelion, whe the earlier measures were usually made. Ther fore, on the average, Martian temperatures a 14° lower than the values at perihelion and t various parts of the planet would be colder tha the values given above by about this amount.

In view of all the facts outlined we ma come to some fairly intelligent conclusions abo the chances for life existing on Mars. On t favorable side we find the length of day an the type of seasons approximately like our ow The lower surface gravity need not be a hand cap, and the planet's surface, while only 28 per cent of the Earth's, is still large enoug for a great population. Sunlight also is ad quate. On the unfavorable side we find a ten perature which is semiarctic. The atmospher of the planet, though extensive, is probabl tenuous. Also for life to exist as we know i and that is all we can discuss scientifically, t excessively low relative percentage of oxyge and water vapor, if not their total absence, seem to make all higher forms absolutely impossibl Nor is there good reason to believe there wer in «geologically recent» times, large quantiti

of these gases which have since so gradually disappeared that higher species could adapt themselves to their loss and still survive by modification of their lungs or other organs. Yet there seems some observational evidence that vegetation exists; at least, certain phenomena can be most simply explained in this way. Hence without venturing a positive opinion, there are grounds for this belief, and if vegetation exists, then low forms of reptile or other animal life might be inferred. But the supposition that higher forms exist, such as mammals, stretches one's imagination beyond any bounds which science can substantiate. The attempts at planetary intercommunication, even if there were beings to receive our messages, are not as yet subjects for serious consideration. The ideas advanced for travel from planet to planet are simply wildly imaginary and take no proper account of perfectly well-known facts and natural laws. Thus radio messages to Mars, much less reaching the planet by rocket ships or similar devices, are at present wholly beyond the limits of serious scientific study.

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MARS, the legendary god of war; *in Roman mythology*, contracted from *Mavers* or *Mavors*, in the Sabine or Oscan language *Mamers*, was at an early period identified by the Romans with the Greek *Ares*. As the Italian Mars was originally a divinity of a very different nature, the two conceptions must be treated separately. Originally Mars was an agricultural deity surnamed *Silvanus*, and propitiatory sacrifices were offered to him as the tutelary god of fields and flocks. As the Italian shepherds were familiar with war, the transition from the idea of Mars as an agricultural to that of a warlike deity was natural and easy. He was regarded as the father of the Roman people, for, according to tradition, Romulus and Remus, the founders of Rome, were the fruit of his intercourse with Rhea Sylvia. Several temples in Rome and the Campus Martius were dedicated to him, the most important of which was that outside the Porta Capena, on the Appian Road, and that of Mars Ultor, built by Augustus in the forum. His service was celebrated not only by particular *flamines* devoted to him, but by the College of the Salii, or priests of Mars. The month of March (q.v.), the first month of the Roman year, was sacred to him, and his festivals were celebrated every year in the Circus on the 1st of August. The Campus Martius, where the Roman youth engaged in their athletic and military exercises, was named in his honor.

MARSALA, mär-sä'lä, seaport, Sicily, in Trapani Province, located on the Mediterranean near the mouth of the Marsala River on Cape Boeo (Lilibeo) 18 miles south of Trapani. It was known as Lilybaeum in the time of the Carthaginian supremacy. The seaport obtained its present name from the Saracens, who valued it so highly that they called it Marsa Allah (Port of God). There is a 16th century cathedral dedicated to St. Thomas of Canterbury, and traces of the early city walls. The modern harbor has been greatly improved. Most important export is Marsala wine, which is produced in the neighborhood; a white, sweet, strong wine, it resembles Madeira but has a distinctive, pleasing flavor and golden color. Grain, soda, and salt are among other exports. In 1860 Giuseppe Garibaldi (q.v.) landed at Marsala with 1,000 of his famous Redshirts to commence his campaign in Sicily. Pop. (1936) 62,171.

MARSCHALL VON BIEBERSTEIN, mär'shäl fŏn bē'bĕr-shtīn, BARON **Adolf Hermann**, German statesman and diplomat: b. Neuershausen, Baden, Oct. 12, 1842; d. Badenweiler, Sept. 24, 1912. He was the grandson of Baron Karl Wilhelm Marschall von Bieberstein (1763–1817), a Baden diplomat who represented the grand duchy at the Congress of Vienna in 1814. After studying law at Heidelberg and Freiburg he entered the grand duchy's civil service, and from 1875 to 1883 he was a member of the Baden upper chamber; during 1878–1881 he was also member of the imperial diet. In 1890 he transferred to the imperial civil service, succeeding Count Herbert Bismarck as Prussian minister of state. He incurred the bitter hostility of the Agrarians and certain court circles, and was the subject of a police intrigue which he defeated. Political opposition compelled him to resign his office in June 1897, and four months later he was sent to Constantinople as German ambassador to Turkey. There he revealed remarkable ability as a diplomat. He acquired great influence over Sultan Abdul-Hamid II, from whom he obtained the concession for Germany to construct the Baghdad Railway. Representing Germany at the Second International Peace Conference at The Hague, in 1907, he prevented adequate discussion of the subject of restricting armaments. In 1912 he was appointed German ambassador in London, but his health shortly gave way and he died within four months.

MARSDEN, märz'dĕn, **Samuel**, English missionary in Australasia: b. Horsforth, near Leeds, July 28, 1765; d. Windsor, New South Wales, May 12, 1838. After study at Cambridge and ordination in 1793, he went in 1794 as chaplain to the convict settlement at Parramatta, Australia, where his model farm became self-supporting and contributory to the development of local schools and missions. In 1814 he extended his work to New Zealand among the Maoris, who through his efforts became Christianized. He compiled a dictionary and grammar of the Maori language and introduced a settled form of government.

MARSEILLAISE, La, mär-sĕ-lāz', the French national anthem, a revolutionary song, composed by an engineer officer, Claude Joseph Rouget de Lisle, during the night of April 24-25, 1792 in Strasbourg. The song quickly spread. The people of Marseille adopted it to be sung at the meetings of their clubs. It was they who carried it all over France, and hence from them it received its name. De Lisle was a proscribed royalist at the time. His mother wrote to him in alarm, asking, "What is this revolutionary hymn, sung by bands of brigands who are prowling through France and with which our name is linked?" He had originally given it the name of *Le Chant de Guerre pour l'Armée du Rhin* (Battle Song of the Rhine Army). Alphonse M. L. de Prat de Lamartine wrote that de Lisle himself was terrified at the tremendous effect of his composition: "It was the firewater of the Revolution, which instilled into the senses and

soul of the people the intoxication of battle." Thomas Carlyle describes it as "the luckiest musical composition ever promulgated, the sound of which will make the blood tingle in men's veins; and whole armies and assemblages will sing it, with eyes weeping and burning, with hearts defiant of Death, Despot and Devil." On Jan. 8, 1795, the Director ordered the air to be played at all theaters. Its inspiring strains are known throughout the world more than perhaps any other melody. During the Empire and Restoration the Marseillaise was suppressed as a revolutionary demonstration, but was revived with the July Revolution of 1830. The original version consisted of only six couplets; the seventh was added when it was dramatized for the Fête de la Fédération, in order to complete the characters among whom the verses were distributed, namely, an old man, a soldier, a wife, and a child. The stanza commencing with "Nous entrerons" is the one added, intended for the child part. It was written by Dubois, editor of the *Journal de la Littérature*. The complete version follows, with a strict translation.

LA MARSEILLAISE.

1

Allons, enfants de la Patrie,
Le jour de gloire est arrivé;
Contre nous de la tyrannie,
L'étendard sanglant est levé.
Entendez-vous dans ces campagnes
Mugir ces féroces soldats?
Ils viennent jusque dans vos bras
Egorger nos fils, nos compagnes!
Aux armes, citoyens! formez vos bataillons!
Marchons, marchons,
Q'un sang impur abreuve nos sillons!

2

Que veut cette horde d'esclaves,
De traîtres, de rois conjurés?
Pour qui ces ignobles entraves,
Ces fers dès longtemps préparés?
Français, pour nous ah! quel outrage!
Quels transports il doit exciter!
C'est nous qu'on ose méditer
De rendre à l'antique esclavage.
Aux armes, etc.

3

Quoi! ces cohortes étrangères
Feraient la loi dans nos foyers?
Quoi! ces phalanges mercenaires
Terrasseraint nos fiers guerriers?
Grand Dieu! par des mains enchaînées
Nos fronts sous le joug se ploieraient!
De vils despotes deviendraient
Les maîtres de nos destinées.
Aux armes, etc.

4

Tremblez, tyrans, et vous perfides,
L'opprobre de tous les partis,
Tremblez! vos projets parricides
Vont enfin recevoir leur prix!
Tout est soldat pour vous combattre.
S'ils tombent, nos jeunes héros,
La terre en produit de nouveaux
Contre vous tout prêts à se battre!
Aux armes, etc.

5

Français, en guerriers magnanimes,
Portez ou retenez vos coups;
Épargnez ces tristes victimes
A regret s'armant contre nous.
Mais ces despotes sanguinaires,
Mais les complices de Bouillé,
Tous ces tigres qui sans pitié
Dechirent le sein de leurs mères!
Aux armes, etc.

6

Nous entrerons dans la carrière
Quand nos aînés n'y seront plus;
Nous y trouverons leur poussière
Et la trace de leurs vertus!
Bien moins jaloux de leur survivre
Que de partager leur cercueil,
Nous aurons le sublime orgeuil
De les venger ou de les suivre!
Aux armes, etc.

7

Amour sacré de la Patrie,
Conduis, soutiens nos braves vengeurs;
Liberté, Liberté, chérie,
Combats avec tes défenseurs!
Sous nos drapeaux que la Victoire
Accoure à tes mâles accents;
Que tes ennemis expirants
Voient ton triomphe et notre gloire!
Aux armes, etc.

THE MARSEILLAISE.

1

Come, children of the fatherland,
The day of glory now is here;
By tyranny against us
The bloody banner is raised:
Do you hear in the land
Those ferocious soldiers roar?
Up to our arms they come,
Strangling our sons, our women!
To arms, citizens, form your battalions,
Let us march, let us march!
That the foul blood may drench our furrows!

2

What seeks this horde of slaves,
Of traitors and conspiring kings?
For whom these base manacles,
These irons already long prepared?
For us, Frenchmen, ah, such outrage!
What passions it must raise!
'Tis us whom they dare purpose
To restore to former slavery.

3

What! shall these foreign cohorts
Make the law in our homes?
What! shall these hireling phalanxes
Throw our proud warriors down?
Great God! with fettered hands,
Our heads bowed down beneath the yoke!
And despots vile become
The masters of our destinies.

4

Tremble, ye tyrants and traitors,
The shame of every faction,
Tremble! your parricidal projects
Shall at last gain their reward!
Each one is soldier to fight you.
And if our young heroes fall,
The land shall produce them afresh
All ready to struggle against you!

5

Frenchmen, as magnanimous warriors,
Restrain or deal your blows;
Spare those sad victims
Who reluctantly armed against us.
But those bloody despots—
Those accomplices of Bouillé—
All those tigers who pitilessly
Lacerate the bosoms of their mothers!

6

We shall begin our career
When our elders are no more;
Yet we shall find their ashes
And the trace of their virtues!
Less eager to survive them
Than to share their tomb,
It shall be our sublime pride
To avenge or follow them!

7

Sacred love of fatherland,
Guide, sustain our brave avengers;
Liberty, dear Liberty,
Fight with thy defenders!
That victory under our flags
Shall hasten to thy noble call;
And may thy dying enemies
Behold thy triumph and our glory!

MARSEILLE, mär-sā′, or **MARSEILLES,** mär-sālz′, seaport, France, capital of the Bouches-du-Rhône Department, located on the northeast shore of the Gulf of Lions (Golfe du Lion) 98 miles west-southwest of Nice. It is the second largest city and the principal commercial seaport of France, and is an important military and naval station. The city is strongly defended by various works, and lies in the form of an amphitheater round a natural harbor of moderate size (about 70 acres), known as the Old Harbor. From the Old Harbor, one of the finest of the city thoroughfares, called the Cannebière, runs inland in a straight line; while at right angles to this another great thoroughfare traverses the city, planted with trees, lined with fine edifices, and bearing different names at different points. In the older part of the town the streets are narrow and irregular, but in general the streets are spacious and regular and lined with handsome houses. Marseille, however, is not rich in public edifices. The chief are the large cathedral, in the Byzantine style, consecrated in 1893; the church of Notre Dame de la Garde, a modern Romanesque building, on a hill of the same name, whence a splendid view is obtained; the church of Saint Victor, a building of great antiquity; the Hôtel de Ville; the Prefecture; the Palais des Arts de Longchamp, containing a picture gallery and natural history museum; the exchange; the public library (120,000 vols.); the palace of justice or law courts; and the episcopal palace. Marseille is the see of a bishop and possesses a court of first instance, a mint, an Academy of Sciences, Belles-lettres, and Arts, and various learned societies and educational institutions.

Including Old and New Harbors, the total water area is 414 acres; there are seven wet docks, with depths at ordinary tides ranging from 25 to 66 feet, six dry docks, and 13 miles of quayage. A canal irrigates the neighboring slopes and plains, transforming them from arid tracts into fruitful fields. The surrounding districts are now occupied by a considerable population, employed in raising vegetables and fruits on the reclaimed and improved lands. The Marseille-Rhône Canal, intended to open up waterways from Marseille to the interior of France and central Europe, was authorized in 1903, and was completed and opened in 1926. The canal, which is 50 miles long, has no locks and is at sea level throughout its entire course; and with its tributaries it forms a series of waterways 350 miles long, navigable by heavy barges. The most important manufactures are soap, soda, and other chemical products; other products include olive and other oils, sugar, machinery, iron and brass work, matches, candles, glass, earthenware, and cosiery. Shipbuilding is also a major industry.

Marseille was founded by Phocaeans (Ionian Greeks) about 600 years before Christ, the original name of the settlement being Massilia; the Greek language is said to have been spoken here several centuries before Christ. Its progress for centuries was rapid and almost without interruption, and its inhabitants founded several colonies along the Gallic and Spanish coasts of the Mediterranean. The city aided Rome against the Gauls and the Carthaginians but, supporting Pompey, was subjugated by Julius Caesar in 49 B.C. On the decline of the Roman empire it became a prey to the Visigoths, Ostrogoths, and Franks. In 735 it fell into the hands of the Saracens, who completely destroyed all the ancient monuments which the barbarians had spared. It was acquired by the kingdom of Arles in 879, and in the 10th century it became a fief of Provence. In 1218 Marseille secured independence, but it was taken by Charles of Anjou in 1256; in 1481, with the rest of Provence, it was united to the French crown. Certain of the old privileges which it retained were abolished by Louis XIV in 1660. A pestilence in 1720–1721 carried off about half of the inhabitants. In 1793, after a period of revolutionary enthusiasm, came a revolt against the Convention; in 1815 there was a violent reaction against those suspected of Napoleonic sympathies; and disturbances in 1871 led to the prefecture being shelled. The development of the French possessions in North Africa in the 19th century and the opening of the Suez Canal did much to stimulate the growth of the city and port. Pop. (1946) 636,264.

MARSEILLES, city, Illinois, in La Salle County, located on the Illinois River 8 miles east of Ottawa; it is served by the Rock Island Railroad. Industrial products include building and roofing materials, paper cartons, and chemicals. The 400-acre Illini State Park has recreational facilities, and is a noted bird and game refuge. Marseilles adopted the commission form of government in 1912. Pop. (1940) 4,455; (1950) 4,514.

MARSH, George Perkins, American lawyer, diplomat, and philologist: b. Woodstock, Vt., March 15, 1801; d. Vallombrosa, Italy, July 23, 1882. He was graduated at Dartmouth College in 1820, and after admission to the Vermont bar practiced at Burlington. During 1835–1843 he was a member of the Executive Council of Vermont, and for the next six years he was a Whig congressman. From 1849 to 1853 he was United States minister to Turkey; in 1852 he was sent to Greece to investigate the case of Jonas King, an imprisoned American. He was minister to Italy from 1861 until his death. His philological studies were noteworthy.

Among his works were *Lectures on the English Language* (1860); *The Origin and History of the English Language* (1862); and *Mediaeval and Modern Saints and Miracles* (1876). His *Man and Nature, or Physical Geography as Modified by Human Action* (1864) was revised as *The Earth, as Modified by Human Action* (1874). He edited Hensleigh Wedgwood's *Dictionary of English Etymology for American Readers* (1862).

MARSH, Othniel Charles, American paleontologist: b. Lockport, N. Y., Oct. 29, 1831; d. New Haven, Conn., March 18, 1899. After graduating from Yale University in 1860 he spent two more years there in scientific study, then proceeding to Germany for further study in Berlin, Heidelberg, and Breslau. In 1866 Yale established the chair of paleontology for him, and he continued in this professorship until his death. He headed numerous scientific expeditions to the Rocky Mountain region. Among his discoveries are those of the *Odontornithes,* a subclass of Cretaceous birds, with teeth; the *Dinocerata,* ungulate animals of the Eocene period, elephantine in size; the first known American pterodactyls, or flying lizards, and several new families of dinosaurs. Perhaps he was best known for his study of the primitive horse, the *Eohippus, Orohippus,* and *Epihippus.* In 1890–1899 he made

researches in the geology of the region between the Appalachian range and the Atlantic. He was curator of the geological collection of the Yale Museum of Natural History in 1867–99, and in 1898 presented to the university his own collections. He was a nephew of George Peabody (q.v.), and it is said to have been at his suggestion that the Peabody Museum at Yale was established. In 1887 he was made honorary curator of vertebrate palæontology in the United States National Museum, and in 1898 received the Cuvier medal of the French Academy of Sciences. He was president of the American Association for the Advancement of Science in 1878 and of the National Academy of Sciences in 1883–95. From a bibliography of 237 titles these works by him may be cited: 'Odontornithes: A Monograph of the Extinct Toothed Birds of North America' (1880); 'Dinocerata: A Monograph of an Extinct Order of Gigantic Mammals' (1884), and 'The Dinosaurs of North America' (1896). Consult memoir by C. E. Beecher in the *American Journal of Science,* June 1899.

MARSH, Sylvester, American engineer: b. Campton, N. H., 30 Sept. 1803; d. Concord, N. H., 30 Dec. 1884. In 1826 he established a provision business in Boston, in 1833 in Chicago and from 1837 was in the grain trade at Chicago. He originated the meat-packing industry and is regarded as one of the founders of Chicago. From 1864 he resided in New Hampshire. On 25 June 1858, he obtained a charter for a railway to the summit of Mount Washington, a project deemed so impossible that he was called "crazy Marsh." The railway, 2.81 miles long, with an ascent of 3,625 feet, was completed in July 1869. The chief feature in the operation of the road is a central cog-rail. The principle proved so practicable that literally hundreds of similar railways have been constructed on the sides of famous mountains all over the world.

MARSH CROCODILE, or **MUGGER,** the common inland crocodile of India, locally venerated by the Hindus, to whom it is known as "Mugger." It inhabits the tanks and marshes of India and Ceylon, and suitable places westward almost to the Persian coast and eastward throughout the Malay Peninsula and islands. It is dark, olive-brown in general color above, lighter on the ventral surface; the young are paler, with black spots. A specimen 12 feet long is considered large, but instances of a length of 18 feet have been recorded. The head is rough-coated, but has no ridges; the snout is broad and the teeth number 76. These crocodiles swarm in river-marshes, weedy ponds and artificial reservoirs, throughout their range, feeding on fish and small animals, and little feared by horses, cattle or human beings, for in general they are cowardly and reluctant to attack men or even to resist injury. In case the water of their home dries away, they migrate to other pools, and in seasons of drought are likely to be met with anywhere wandering in search of water; as a last resort they will bury themselves in the mud and remain in torpor until revived by the coming of rains. These reptiles display considerable cunning in capturing their food and in avoiding harm, feigning death very cleverly. They are kept in a semi-domesticated condition in many parts of India by pious Hindus, whose priests build temples near the great ponds, protect and feed the reptiles and imagine the service pleasing to the gods as well as profitable to themselves. Extensive descriptions of the animal and of its worship may be found in the zoological works of Blanford, Jerdon, Tennent, Gadow and others and in such volumes as Adams, 'Wanderings of a Naturalist in India' (Edinburgh 1867) and Hornaday, 'Two Years in the Jungle' (New York 1885).

MARSH GAS. See METHANE.

MARSH HARE. See HARES.

MARSH HAWK, or **HARRIER,** a migratory hawk (*Circus cyaneus*) of medium size, commonly known in one or another of its varieties throughout the north temperate zone, which frequents marshy meadows, where it makes its nest upon the ground in a tussock of grass, and lays five to seven roundish, dirty white eggs. In such places it finds its food, chiefly mice and frogs, and sails slowly back and forth close to the ground watching keenly for movements in the grass and ready to pounce upon its prey. Its wings are long and its flight may be swift and powerful when occasion demands, but it was accounted "ignoble" among falconers. It rarely seizes birds or even young poultry, although one of its names is "hen-harrier," and should be protected and encouraged by farmers as one of the most useful and persistent mousers. This hawk may be readily recognized by the broad patch of white on the rump displayed by both sexes. The male is dull grayish-blue, in general tint, and the female rusty brown, both streaked with white. The American harrier (*C. hudsonius*) is generally brown, though the adult males are blue-gray on the back; the tail-coverts are white. Consult Coues, 'Birds of the Northwest' (1874).

MARSH-HEN. See MUD-HEN.

MARSH MALLOW, a coarse, large leaved herb (*Althea officinalis*), of the Old World, but naturalized in marshy places along the eastern coast of the United States, which is related to the hollyhocks (q.v.); the flowers are pale rose-color, some in a terminal spike and some axillary. Its root is mucilaginous and of service as a demulcent in medicine, but it is mainly used as a basis for the confection called "marsh mallow." See MALLOW.

MARSH-MARIGOLD. See COWSLIP.

MARSH-WREN, either of two species of American wrens that inhabit reedy marshes. They have the diminutive brown bodies, short wings and tails, the latter often held cocked up over the back, awl-like bills and inquisitive activity characteristic of wren (q.v.) generally. One is the long-billed (*Cistothorus palustris*), most numerous in the salt-marshes along the Atlantic coast; and the other the short-billed, better known about inland lakes and rivers. The former is somewhat the larger, has a decidedly longer bill and lays eggs dark chocolate in color, while the eggs of the short-billed species are pure white. Both make elaborate nests in the form of ball-like baskets, with a little entrance at the side, woven of leaves of wild rice or marsh grasses and fastened to the stems of the reeds. A curious habit of the species is that each pair will make several nests

each season, only one of which serves the purposes of incubation. These wrens give in the spring an exceedingly pretty clattering song and when dozens are singing together in a patch of reeds the effect is most pleasing.

MARSHAL, a federal officer appointed by the president in each judicial district and corresponding to the sheriff of a county. His duty is to execute all precepts directed to him, issued under the authority of the United States, and is under the jurisdiction of the United States District and Circuit courts. The United States government maintains marshals in its principal dependencies, as the Philippines, Alaska, Puerto Rico, Hawaii, etc. They are appointed by the president for four years, and in addition to serving the courts have certain duties regarding internal revenue, public lands and the postal service. Sometimes the chief of police in American towns is known as marshal. In some European countries the title of marshal confers the highest military distinction, that of marshal of France being especially prized. The word is derived from the Old High German word *marah,* a horse; and *scalh,* a servant; hence *Marascalh,* a man appointed to take care of horses. The marshal of the German Empire derived his origin from the Frankish monarchs and was equivalent to the *comes stabuli* or *connétable.* He was bound to keep order at the coronation of the emperor, and to provide lodgings for the persons connected with the ceremony. He was called *arch-marshal,* a dignity belonging to the electorate of Saxony. At the coronation it was his duty to bring oats in a silver vessel from a heap in the open marketplace, and to present the vessel to the emperor. His duties were discharged by a hereditary marshal (*Erbmarschall*). In Prussia general field marshal is the highest military honor. In England field marshal is given as an honorary rank to general officers who may have no immediate command. Marshal also signifies a person who regulates the ceremonies of certain solemn celebrations or, as in the United States, at parades, street processions, and the like.

MARSHALL, mär'shal, **Alfred,** English economist: b. London, July 26, 1842; d. July 13, 1924. He was educated at Saint John's College, Cambridge, and in 1877 was principal of University College, Bristol. In 1883–84 he was lecturer at Balliol College, Oxford, from 1885–1908 he was professor of political economy at Cambridge, and a member of the Royal Commission on Labor in 1891. He published *Economics of Industry* (1879); *Principles of Economics* (1890); *Elements of Economics* (1891); *Fiscal Policy of International Trade* (1903).

MARSHALL, Frank James, American chess master: b. Brooklyn, N.Y., 1877. He acquired fame when a boy by winning the championship of the famous Brooklyn Chess Club. Next he took the championship of the Manhattan Chess Club. Thereafter he became a professional player and entered in most of the international tournaments. In 1905 he won the International Chess Tourney at Cambridge and challenged Lasker for the world's championship, but was defeated. In all he won first prize in seven international tourneys. He won the Pan-American championship by defeating Capablanca in Cuba in 1912. In the years following he played with varying success. He succeeded Showalter as United States champion.

MARSHALL, George Catlett, American chief of staff, diplomat, and secretary of state: b. Uniontown, Pa., Dec. 31, 1880. Being the son of a Kentucky Democrat in a Republican state, West Point was apparently denied, so he left Uniontown to attend Virginia Military Institute. He stood number 35 in the freshman class and at that early age showed his character by not revealing the identity of the sophomore who bayoneted him during an interclass conflict. He began drill in the awkward squad. He grew in stature and in the favor of his classmates, attaining 15th place in the class and becoming senior officer and first captain. Late in his college career, with high cadet ranking already assured, he decided to go out for football. His play was so brilliant that he was selected all-Southern tackle in 1900. While at V.M.I. he scoured the Civil War battlefields, reconstructing the battle details. Graduating in 1901, he was recommended for and accepted commission as a second lieutenant of infantry. In 1907 he became a first lieutenant and was an honor graduate of the Infantry-Cavalry School. He was graduated from the Army Staff College at Leavenworth in 1908, attaining such phenomenal grades that he was there, as a lieutenant, appointed instructor with captains and majors in his classes, a very unusual procedure at that time.

In 1913 he was a lieutenant in the Philippines. The chief of staff of the "defending" forces fell ill. The lieutenant was called upon. He questioned the regimental commander and ordered an attack, dictating the plan of battle without making a single correction. Maj. Gen. J. Franklin Bell, the army's first chief of staff, in commending the lieutenant for this set of field orders, said that his work put generals to shame and that "he is the greatest military genius since Stonewall Jackson."

He became a captain in 1916 and in 1917, with a Moroccan division in France, won the Croix de Guerre and the Legion of Honor. By 1918 he had become a full colonel. He was selected by General Pershing to be chief of operations of the First American Army under Gen. Hugh Drum. During this assignment, he completed the accredited cleanest piece of staff work of the First World War—the smooth transport without German knowledge of 500,000 men and 2,700 guns from St. Mihiel to the Argonne front in two weeks.

After the armistice, he reverted to captain and spent four years as military aide to General Pershing. He became a major in July 1920, a lieutenant colonel in 1923, a colonel in 1933, a brigadier general in 1936, and a full general as chief of staff on Sept. 1, 1939. He had been assistant chief of staff from July 6, 1938 to Oct. 15, 1938, deputy chief of staff from Oct. 16, 1938 to June 30, 1939, and became acting chief of staff on July 1, 1939. He was the second non-West Pointer to become chief of staff—Leonard Wood was the first. In becoming general in 1939, he was advanced over 34 higher officers —14 brigadier generals, and 20 major generals.

Under General Marshall, the army accomplished the smooth transition from skeleton square divisions and less than 200,000 men in

1939 to streamlined triangular divisions with 8,000,000 men at peak strength during World War II. Promoted to five-star rank, Dec. 15, 1944, the general made his valedictory in his biennial report, published in 1945, which summarized the American military achievement. A month later he relinquished the post of chief of staff.

In December 1945 he flew to China as the president's emissary to mediate between the government of Chiang Kai-shek and the Communists, but his yearlong efforts proved unsuccessful.

The general's appointment as secretary of state, on Jan. 7, 1947, was popularly received, particularly in view of sharpening international tensions. He strongly supported the Truman program of aid to Greece and Turkey, and in his Harvard Commencement address of June 5, 1947, enunciated a program for the rehabilitation of Europe (Marshall plan, q.v.), which was later embodied in the European Recovery Program. He resigned as secretary of state on Jan. 20, 1949, because of poor health, but on Sept. 22, 1949, accepted the presidency of the American Red Cross.

General Marshall was appointed secretary of defense on Sept 12, 1950, special legislation being passed by Congress on September 15 to allow him to take the post. As head of the National Military Establishment, he was responsible for the coordination and direction of the departments of the army, navy, and air force. He resigned Sept. 12, 1951.

MARSHALL, Henry Rutgers, American psychologist and architect: b. New York, July 22, 1852, d. there May 3, 1927. He graduated from Columbia College in 1873 (M. A. 1876) and began to practice architecture in 1878. Ten years later he became interested chiefly in psychology, philosophy and aesthetics. His writings include *Pain, Pleasure and Aesthetics* (1894); *Instinct and Reason* (1898); *The Relations of Aesthetics to Psychology and Philosophy* (1905); *War and the Ideal of Peace* (1915); "The Pacifist at War," *Atlantic Monthly* (May 1918); *Mind and Conduct* (1919); *The Beautiful* (1924).

MARSHALL, Humphrey, American politician: b. Fauquier County, Va., 1760; d. near Frankfort, Ky., July 1, 1841. He joined the Continental Army at the outbreak of the revolution, became captain of Virginia cavalry (1778), in 1780 established himself on a Kentucky plantation, opposed the separation of Kentucky from Virginia, and as a delegate to the Danville Convention of 1787 was prominent in defeating the measure. He was also a delegate to the Virginia Convention that ratified the Constitution of the United States, and in 1793 was a representative from Woodford County in the Kentucky legislature, where he declared his opposition to the plans for raising in Kentucky troops under Gen. George Rogers Clark for an attack on the Spanish settlements near the mouth of the Mississippi River. From Dec. 7, 1795 to March 3, 1801 he was a Federalist senator in the Congress of the United States, and in 1806 was active in denunciation of Aaron Burr. He represented Franklin County in the Kentucky legislature in 1807–1809, and had a dispute with Henry Clay which resulted in a duel in which both received slight wounds. He sat again for Franklin County in 1823. He published the first *History of Kentucky* (1812; rev. ed., 1824).

MARSHALL, Humphry, American botanist: b. West Bradford (the present Marshallton), Pa., Oct. 10, 1722; d. there, Nov. 5, 1801. He began the collection and cultivation of the more interesting indigenous plants, and in 1773 established the Marshallton botanical garden, where were assembled trees and herbaceous plants of the United States. His *Arboretum Americanum* (1785), was translated into several European languages.

MARSHALL, John, chief justice of the United States: b. Germantown (now Midland), Fauquier County, Va., Sept. 24, 1755; d. Philadelphia, July 6, 1835. He was the eldest son of Col. Thomas Marshall of Westmoreland County, Va., a distinguished officer in the French and Indian War and in the War of Independence, and of Mary Keith, a member of the well-known Randolph family. Thomas Marshall removed from Westmoreland County to Fauquier soon after his marriage; this community was sparsely settled, and the educational advantages which he could give his children were meager; consequently he became their earliest teacher and succeeded in imbuing them with his own love of literature and of history. For two years John Marshall had, as tutor, James Thompson of Scotland and he was sent for one year to the academy of the Messrs. Campbell of Westmoreland County, where James Monroe was also a pupil. He had no college training except a few lectures on law and natural philosophy at William and Mary in 1779. He was always fond of field sports and excelled in running, leaping and quoit throwing. He loved the free natural life of the country, and his long tramps through the woods around his father's home, Oak Hill, together with his athletic exercises gave him great strength and agility. At 18 he began the study of law, but soon left his studies to enter the Revolutionary Army. He was active in endeavoring to enlist men for the service and helped to form and drill a company of volunteers. As a member of his father's regiment he took part in the Battle of Great Bridge where he displayed signal valor. In 1776 he became a lieutenant in the 11th Virginia Regiment, and the next year was made captain. He served in Virginia, New Jersey, Pennsylvania and New York, always displaying great courage and valor and a cheerful acceptance of hardships and privations. This experience was of untold value to Marshall: it broadened his views and quickened his insight in governmental questions. As he says, he entered the army a Virginian and left it an American. In 1780, during a period of military inactivity, he attended a course of law lectures at William and Mary and in 1781, after leaving the army, was granted a license and began the practice of law in Fauquier County. The next year he was elected to the Virginia Assembly, and shortly afterward was made a member of the executive council. He served his state as legislator during eight sessions. In 1784, although he had then removed his residence to Richmond, he was again elected delegate from Fauquier County, and in 1787 served as member from the county of Henrico. When the city of Richmond was granted a representative in the legislature, Marshall had the honor of holding this office from 1788 to 1791. He was also a member of the Federal Convention which met in 1788 to discuss the ratification of the Constitution of the United States,

ind it was largely due to his convincing argu-
nents that ratification was carried, as the ques-
ion was hotly debated and the anti-Constitu-
ion party had able and determined representa-
ives. For several years he held no public office
nd devoted himself entirely to his extensive
aw practice, but in 1795 was again elected to
he legislature. During this session he defended
he unpopular "Jay Treaty" with England, and
y his overwhelming arguments completely re-
uted the theory of his opponents that the ex-
cutive has no power to negotiate a commercial
reaty. Marshall's attitude during his service
s legislator toward all questions concerning
ederal power demonstrated his increasing be-
ief that a strong central government is neces-
ary to real efficiency. In 1783 he had married
Mary Ambler, daughter of Jacqueline Ambler,
reasurer of the state, and soon after his mar-
iage made his permanent home in Richmond.
The honors bestowed on him testify to the
steem in which he was held by the state and
y the nation. He refused the attorney-gen-
ralship and the ministry to France, but in
797 accepted the office of special envoy to
France with Charles Cotesworth Pinckney and
Elbridge Gerry. This mission related to the
ndignities which the French had offered the
American Navy and attempted to adjust the
ommercial relations between the two countries.
t failed on account of the arrogant attitude of
France, but "Marshall's dignified correspond-
nce added greatly to the prestige of America,"
nd on his return he was welcomed with many
vidences of approbation from his grateful
ountrymen. Yielding to the earnest solicita-
ion of Washington he became a candidate for
Congress and was elected a member of that
ody in 1798. In Congress he was the leader
f the administration party and the greatest
lebater in the House on all constitutional mat-
ers. In one of his most noted speeches he de-
ended the action of President Adams in the
ase of Jonathan Robbins and proved conclu-
ively that this case was a question of execu-
ive and not of judicial cognizance. In 1800
e was made secretary of state, and in 1801 ap-
ointed chief justice of the United States,
vhich office he held until his death in 1835. In
829 he, like ex-Presidents Madison and James
Monroe, was a member of the Virginia conven-
ion which met to alter the state constitution,
nd by his wisdom and moderation did much
o prevent radical changes and to thwart the
ttempts of politicians against the independence
f the judiciary. In 1831 his health, hitherto
nusually vigorous, began to fail; he underwent
severe surgical operation in Philadelphia and
vas seemingly restored, but the death of his
vife was a great shock and a return of the
lisease in 1835 proved fatal. He died in Phila-
lelphia, whither he had gone for medical relief,
nd was buried by the side of his wife in the
New-Burying-Ground, now Shockhoe Hill Cem-
tery, Richmond. The sorrow over the country
vas deep and widespread; even his bitterest
nemies mourned for the kindly, upright man.

Though somewhat ungainly, Marshall was
lways dignified in appearance; his tall, loosely
ointed figure gave an impression of freedom,
vhile his finely shaped head and strong, pene-
rating eyes bespoke intelligence and power.
Directness and simplicity were his dominant
haracteristics. He was free from any display
of pomp, air of office or studied effect. His un-
failing good humor, his benignity, his respect
for women, his devotion to wife and family and
his well-known reverence for religion made him
loved and admired even by those who heartily
disliked his political opinions. As chief justice
for more than 30 years he rendered numerous
decisions which were of prime importance to a
nation in process of formation. The faculty
which made Marshall invaluable as a jurist was
his power of going directly to the core of any
matter. No subtleties, no outside issue con-
fused him, his analysis was unerring, his logic
incontrovertible; he cared nothing for the
graces of rhetoric and made no appeal to the
emotions; his power lay in his deep conviction
and in his illuminating and progressive argument.
At a period when the powers of the Constitution
were ill-defined, when our government was ex-
perimental, Marshall's decisions in constitutional
and international cases were invaluable factors
in forming a well-organized federal government.
"He made the Constitution live, he imparted to
it the breath of immortality, and its vigorous
life at the present hour is due mainly to the wise
interpretation he gave to its provisions during
his long term of office." Marshall was the author
of numerous reports and papers, of a history
of the colonies and of a *Life of George Wash-
ington,* 5 vols. (1804–07), a book of small lit-
erary merit, but containing a mass of valuable
authentic information. Consult Beveridge, Al-
bert J., *Life of John Marshall,* 4 vols. (New
York 1916-19); Palmer, Bradley W., *Marshall
and Taney, Statesmen of the Law* (New York,
1939).

EMILIE W. MCVEA,
Late President of Sweet Briar College.

MARSHALL, Louis, American lawyer: b.
Syracuse, N.Y., Dec. 14, 1856; d. Sept. 11, 1929.
He was educated in the Syracuse public and high
schools and at the law school of Columbia Uni-
versity. In 1878 he began practice at Syracuse.
He was a member of the firm of Guggenheimer,
Untermeyer and Marshall. He argued many
important causes in the higher courts, specializ-
ing especially in constitutional and corporation
law. Marshall was a member of the New York
Constitutional conventions of 1890, 1894 and
1915; served on the commission appointed by
Mayor Low, in 1902, to investigate East Side
conditions; chairman of the State Immigration
Commission appointed in 1908 by Charles Evans
Hughes (q.v.), then governor, and counsel for
William Sulzer in his impeachment trial. He
was prominent in the movement for the abroga-
tion of the treaty of 1832 with Russia. He was
mediator in settling the cloakmakers' strike in
1910, and prepared the protocol of settlement.
He took an active part in Jewish charitable work
and was president of the American Jewish Relief
Commission during and after the First World
War. Marshall was a trustee of Syracuse Uni-
versity 1910–29.

MARSHALL, Thomas Riley, 28th vice
president of the United States: b. North Man-
chester, Ind., March 14, 1854; d. Washington,
D.C., June 1, 1925. He was graduated from
Wabash College in 1873, studied law and was
admitted to the Indiana bar in 1875, practicing
his profession at Columbia City. In 1908 he was
elected governor of Indiana. His administration

(1909–1913) was progressive. Several laws that he sponsored, including an employers' liability law and a child labor law, were enacted, but he failed in his endeavor to have a new state constitution adopted. At the Democratic National Convention held in Baltimore in 1912, he was the favorite-son candidate of the Indiana delegation for the presidency, and when Woodrow Wilson was nominated for that office, Marshall was chosen for the vice presidency. Renominated and re-elected in 1916, he served with Wilson until 1921. He was a good presiding officer of the Senate and enjoyed much popularity. He became known for his humorous remarks; in 1917, during a Senate debate on the country's needs, he said, "What this country really needs is a good five cent cigar." During President Wilson's absences from Washington and during the president's illness, Marshall often received official visitors. After his term of office expired, he made his home in Indianapolis. He was a member of the United States Coal Commission in 1922. Shortly before his death, he wrote *Recollections of Thos. R. Marshall, Vice-President and Hoosier Philosopher—A Hoosier Salad,* published posthumously in 1925.

Consult Thomas, C. M., *Thomas Riley Marshall, Hoosier Statesman* (Oxford, Ohio, 1939).

MARSHALL, William Louis, United States army engineer: b. Washington, Ky., June 11, 1846; d. Washington, D.C., July 2, 1920. A grandnephew of John Marshall (q.v.), he studied at Kenyon College from 1859 to 1861. He served in the Union Army in 1862–1863, and in the following year was appointed a cadet at the United States Military Academy. Graduating in 1868, he was assigned to the Corps of Engineers as a second lieutenant. He was promoted through the grades, reaching the rank of brigadier general in 1908, on his appointment as chief of engineers. In 1870–1871, Marshall was acting assistant professor of natural and experimental philosophy at West Point, and from 1872 to 1876 he was in charge of the Colorado section of the explorations west of the 100th meridian. He discovered Marshall Pass through the Rocky Mountains in 1873, and the gold placers of Marshall Basin, San Miguel River, in Colorado, in 1875. From 1876 to 1884 he was assistant engineer on river improvement projects in Alabama, Georgia, and Tennessee, and had charge of a section of the Mississippi River. From 1884 to 1899 he was in charge of harbor improvements on Lake Michigan, and he also superintended the construction of the Hennepin Canal (1890–1899). During this period he patented a breakwater and two types of dams. Placed in charge of fortifications and river and harbor works at New York Harbor in 1899, he completed the 40-foot Ambrose Channel and extended Governor's Island. As chief of engineers, he was in charge of river, harbor, and fortification works in the United States from 1908 to 1910, when he retired from active service. Soon thereafter he was appointed consulting engineer to the secretary of the interior, a position he held until his death.

MARSHALL, city, Illinois, seat of Clark County, situated at an altitude of 615 feet, 53 miles south of Danville, on the New York Central and Pennsylvania railroads. In an agricultural and oil-producing region, the city has cheese and paint factories, oil refineries, and rock-crushing plants. Named for Chief Justice John Marshall (q.v.), it was incorporated in 1853. Pop. (1950) 2,960.

MARSHALL, town, Liberia, situated on the Atlantic Ocean, at the mouth of the Farmington River, 30 miles east-southeast of Monrovia. North of the town is Roberts Field, the country's major commercial airport. After the completion of a new deepwater port at Monrovia in 1948, Marshall lost its supremacy as Liberia's chief rubber-shipping port, but it still exports sizable quantities of rubber.

MARSHALL, city, Michigan, seat of Calhoun County, situated on the Kalamazoo River and the New York Central Railroad, at an altitude of 900 feet, 12 miles east-southeast of Battle Creek. The surrounding area raises livestock, grain, and onions. The city's industrial establishments produce automobile parts and trailers, heating and refrigeration equipment, pharmaceuticals, medical supplies, and paint, and process meat and dairy products. Marshall has a public library and a municipal airport. First settled in 1831, it was incorporated as a village in 1836 and as a city in 1859. Government is of the commission type. Pop. (1950) 5,777.

MARSHALL, city, Minnesota, seat of Lyon County, situated at an altitude of 1,170 feet, on the Redwood River and the Great Northern and the Chicago and North Western railroads, 130 miles southwest of Minneapolis. The shipping center of an agricultural area, the city processes dairy products and poultry. It has two public libraries and a municipal airport. First settled in 1871, Marshall was incorporated as a village in 1875 and as a city in 1901. It is governed by a mayor and council, and the water, power, and light systems are publicly owned. Pop. (1950) 5,923.

MARSHALL, city, Missouri, seat of Saline County, situated at an altitude of 780 feet, on the Missouri Pacific and the Gulf, Mobile and Ohio railroads, 30 miles north of Sedalia and 88 miles east-southeast of Kansas City. It is the trading center of a predominantly agricultural region raising corn, wheat, fruit, soybeans, cattle, and sheep. The city has bottling, milling, seed and fertilizer, and milk and poultry processing plants; shoes are the principal factory product. Marshall is the seat of Missouri Valley College (q.v.), of a state school for feebleminded and epileptic persons, and of homes for crippled children and aged women. Settled in 1836, it was named for John Marshall (q.v.) in 1839, and incorporated in 1866. Government is of the council-manager type. The city owns its water and electricity systems and an airport, and operates a highly developed park and recreation program. Pop. (1950) 8,850.

MARSHALL, city, Texas, seat of Harrison County, situated at an altitude of 375 feet, on the Texas and Pacific Railway, 38 miles west of Shreveport, La., and 64 miles south-southwest of Texarkana. The city is the center of a fertile agricultural region producing cotton, vegetables, and dairy products. Although the lumbering operations of earlier days have been reduced as reserves of timber have declined, second-growth pine is used in sawmilling. The presence nearby of oil and natural gas, lignite, clay, and glass sands has stimulated the city's industrial develop-

henr. Marshall has railroad shops, a car wheel nd foundry plant, cotton compresses, food- rocessing plants, clothing factories, potteries, and rick and tile yards. The city is the seat of t. Mary's Academy, a coeducational Roman atholic institution; East Texas Baptist College, ounded in 1912 as the College of Marshall; and wo coeducational colleges for Negroes: Wiley ollege, a Methodist institution founded in 1873, nd Bishop College, a Baptist institution founded n 1881. Marshall is in a resort section; 15 miles o the northeast are Caddo Lake, from which the ity draws its water supply, and Caddo State ark. The city has a public library, three high chools, and a municipal airport. Government is f the city manager type.

First settled in 1841, Marshall was incorpo- ated as a town in 1843 and as a city in 1848. t was named for Chief Justice John Marshall q.v.). During the Civil War it was the seat of he Confederate state government of Missouri. s headquarters of the ordnance, quartermaster, nd commissary departments, it played an im- ortant role in the administration of the Con- ederacy. Large stores of military supplies were ept in Marshall, and the trans-Mississippi agency f the Confederate postal service had its head- uarters in the city. Pop. (1950) 22,327.

MARSHALL COLLEGE, a coeducational nstitution located at Huntington, W. Va. It was ounded in 1837 and opened the following year. ames E. Morrow, father of United States Sena- or Dwight Whitney Morrow (q.v.), was presi- ent of the college at the time of his son's birth. n 1947–48 the college reported an enrollment of 008 students—2,179 men and 829 women—a aculty of 157 members exclusive of administra- ve officers, a summer school enrollment of 1,072 udents, and an income for the year of $564,603. he grounds, buildings and equipment of the ollege were valued at $3,997,000. The library ontained 40,939 volumes.

MARSHALL ISLANDS, an archipelago in he western Pacific Ocean, north of the Equator. he islands are situated eastward of the Caro- nes and northward of the Gilbert Islands, and e between 5° and 12° N. lat. and 165° and 171° . long. They were annexed in 1885–86 by ermany, and after the First World War became mandate of the League of Nations; the mandate as assigned to Japan, whose activities on the rchipelago remained largely veiled. The group onsists of two parallel chains, about 700 miles n length, the Radak ("Sunrise") group of 18 lands in the east and the Ralik ("Sunset") roup of 14 islands in the west, the chains being pproximately 100 miles apart. The aggregate rea of the islands is 160 square miles, and the opulation was reported to number 10,446 in 1935. abur, a small town on Jaluit (38 miles long by l miles in breadth), an island of the Ralik group, the administrative headquarters; Majuro, of he Radak group, is the most populous island, ormally containing 1,600 inhabitants. Coconuts, ugar, and cotton are cultivated; breadfruit trees, andanus, and taro also grow, as well as bananas nd yams. The natives, who are Micronesians, re skillful in weaving mats and in the construc- on of large canoes.

In 1942–43 the islands enjoyed virtual im- unity from American attacks, but on Jan. 31, 944, United States forces struck at Kwajalein Lae, and Namu atolls of the Ralik group, and within less than a week had completed their cap- ture. In the same group, to the north and north- west, Eniwetok was captured on Feb. 18, Wotho on March 12, and Ujelang on April 25, 1944. No attempt was made to seize other of the Marshall Islands, though the Japanese garrisons on them were frequently bombed. It was estimated in February 1945 that by-passed Japanese troops on Wotje, Maloelap, and Mili, of the Radak group, and on Jaluit, totaled 12,000 to 14,000 men. Na- tives of Majuro, Arne and Aur atolls in June petitioned the United States "to be our guardian and protector" after the war should end. The bypassed garrison surrendered late in August.

MARSHALL PLAN or **EUROPEAN RE- COVERY PROGRAM (ERP).** In an address made at the commencement exercises of Harvard University on June 5, 1947, Secretary of State George C. Marshall called on the European na- tions whose economies had been shattered by the effects of World War II to unite in planning their economic rehabilitation. He stated that American aid would be forthcoming if a number of European countries should agree on a joint program of reconstruction, and he promised that this assistance would be substantial and would extend over a period of three or four years. But the initiative for a program designed to place Europe on its feet economically, he observed, should come from Europe, while the role of the United States should consist of friendly aid in drafting a European program and then of sup- porting it to the best of its practical ability. He continued:

> "It is logical that the U.S.A. should do whatever it is able to do to assist in the return of normal economic health in the world, without which there can be no political stability and no assured peace. Our policy is directed not against any country or doctrine but against hunger, poverty, desperation and chaos. U.S. assistance should not be doled out as crises develop. Any assistance this Government may render in future should provide a cure rather than a palliative. Any Government willing to assist it in the task of recovery will find full co-operation on the part of the U.S. Government. Any Government which maneuvers to block the recovery of other countries cannot expect help from us. Furthermore, Governments, political parties, or groups which seek to perpetuate human misery in order to profit therefrom politically or otherwise will encounter the opposition of the United States."

While the last two quoted sentences were ob- viously intended as a warning to the Kremlin, Mr. Marshall at a press conference on June 12 emphasized that the term "Europe" as he had employed it throughout his address signified "everything west of Asia," including Great Brit- ain and the Soviet Union. Two days later in London it was announced that Foreign Minister Ernest Bevin would in a few days visit France to discuss with Prime Minister Paul Ramadier and Foreign Minister Georges Bidault "the new American approach to Europe." Synchronously it was announced in Paris that the French gov- ernment had asked the Soviet government whether it was prepared to exchange views on the Ameri- can proposals. As disclosed by the head of the economic department of the Quai d'Orsay on June 16, French suggestions previously made to Mr. Marshall were, that those countries wishing to avail themselves of the American offer should organize working committees to draw up a bal- ance-sheet of Europe's resources in the vital fields of iron and steel, coal, transport and agriculture, the United States having representation on each committee, also Germany through the occupying

powers. A joint communiqué issued by the British and French foreign ministers in Paris on June 18 welcomed Mr. Marshall's pronouncement and stated that their governments considered comprehensive programs should be drawn up by all participating European countries in liaison with the appropriate United Nations organization, also that an invitation would be sent to Foreign Minister V. M. Molotov of the USSR for a joint meeting of the foreign ministers of the three chief European powers "in order to discuss these proposals as a whole." Meanwhile, on June 13 the secretary general of the United Nations had issued a statement that the U.N. was prepared to support the American plan.

Between June 27 and July 2 the three-power conference of foreign ministers held five sessions in Paris. Molotov strongly opposed drafting a broad program of international aid as preliminary to receiving American assistance. It would infringe on the national sovereignty of smaller states, he argued. "The plan of Britain and France," he declared, "would lead to their separating themselves and those associated with them from the other states in Europe," and he warned of grave, though unspecified, consequences that would result. Bevin rejected Molotov's arguments as "based on a complete travesty of the facts," and in response to the covert threats he remarked, "My country has faced grave consequences and threats before, but it is not the sort of prospect which will deter us from doing what we consider our duty." Bidault's reply contained a counter-warning to the Soviet Union against dividing Europe into two groups.

Russia having definitely refused to cooperate, Bevin and Bidault on July 3 issued a joint statement declaring that their governments had "decided to invite all European States (with the temporary exception of Spain) who desire to participate in framing a reply to Mr. Marshall's suggestion to collaborate with them in setting up this organization, whose task will be to draw up a program of European reconstruction in which the resources and needs of each country will be coordinated in such manner as each freely decides."

Fourteen countries accepted the Franco-British invitation to a European economic conference, as follows: Austria, Belgium, Denmark, Eire, Greece, Iceland, Italy, Luxembourg, The Netherlands, Norway, Portugal, Sweden, Switzerland, and Turkey. A fifteenth, Czechoslovakia, formally accepted on July 8, but two days later withdrew its acceptance, actuated, it was generally believed, by fear of Russian reprisals. Other eastern European countries dominated by Russia which declined were: Poland, Yugoslavia, Bulgaria, Hungary, Rumania, Finland and Albania.

Meeting in Paris with Bevin as chairman from July 12 to 15 the conference of 16 nations appointed a 16-member Committee of Cooperation (later called the Committee of European Economic Cooperation, or CEEC). Reports gathered during July and August for the executive committee indicated that the total dollar deficit for a 4-year period should be estimated at $28,000,000,000, with annual deficits expected to continue after 1951. At a conference on August 30, United States Department of State representatives criticized the preliminary findings. On September 22 the final CEEC report was issued in two volumes. The estimate for the 4-year dollar deficit of the 16 countries and Western Germany was scaled down to $19,330,000,000, and there were detailed plans for European reconstruction involving restored or increased production in all branches of the economy. Plans for achieving financial and fiscal stability were outlined, and proposals were made for the promotion of freer trade among the cooperating nations.

It was now the turn of the United States to take responsive action. President Truman on October 23 summoned the United States Congress to convene on November 17 and the next day, in a radio broadcast to the nation, called for both immediate and long-term aid to Europe, including $357,000,000 of interim aid for France and $285,000,000 for Italy, also some provision for Austria. On November 8 his committee on foreign aid estimated Europe's 4-year dollar deficit at between $17,000,000,000 and $23,000,000,000, and recommended year-to-year appropriations totaling between $12,000,000,000 and $17,000,000,000. Two days later, Secretary Marshall addressing the Senate Foreign Relations Committee estimated Europe's needs for the future period of April 1, 1948 to June 30, 1949 at $7,500,000,000. To provide interim aid until March 31, 1948 he asked $328,000,000 for France, $227,000,000 for Italy, and $42,000,000 for Austria. The president's message to Congress on November 17 supported the secretary of state's request for a total of $597,000,000 of interim aid; on December 15 a combined bill was passed by the Senate granting the full amount, and was signed by the president two days later. However, in the appropriations bill passed by both houses on December 19 the total was reduced to $540,000,000, of which $18,000,000 was earmarked for China, and the balance for France, Italy and Austria.

President Truman's second message to Congress, of December 19, described the long-range program to assist European recovery. His recommended program called for a total amount of $17,000,000,000 to be allocated to the 16 countries and western Germany during the period 1948–1951 in annual instalments. The first would be for the period April 1, 1948 to June 30, 1949, and would require an appropriation of $6,800,000,000. In his next message of Jan. 7, 1948, he reiterated these recommendations.

A Senate committee recommended in February that the first major appropriation be made for a 12-month period, from April 1, 1948 to Mar. 31, 1949, rather than for the proposed 15-month period, and that the amount in aid be set at $5,300,000,000 for this shorter span. On March 14 the Senate approved the bill, thus amended, by a vote of 65 to 17.

Meanwhile, the House Committee on Foreign Affairs proposed to combine the European Recovery Program (ERP) with programs to aid China ($570,000,000 had been requested by President Truman on February 18 to bolster China's sagging economy) and also Greece and Turkey (Secretary Marshall on February 26 requested $275,000,000 for continuing military aid to the latter countries). Accordingly, on March 31, by a vote of 329 to 74 the House passed a bill to provide $6,205,000,000, of which $5,300,000,000 was alloted for the first year of the European program. (On June 20 the total was cut to $6,030,710,228.) The House also voted to include Spain in the program over strong administration protests, also protests from the European participants. On April 3 a compromise bill omitted Spain from the program and set the total for the first 12 months at $5,300,000,000 (reduced on June 20 to $4,875,-

000,000). On April 4 the Economic Cooperation Act of 1948 was signed by the president. Though approved in principle, the program required congressional appropriations to become effective. On April 5 the president directed the Reconstruction Finance Corporation to advance $1,105,000,000 to initiate the program.

Creation of the Economic Cooperation Administration (ECA) was followed on April 6 by the appointment of Paul G. Hoffman, a leading industrialist, as administrator. On May 11, W. Averell Harriman was appointed ambassador to head the ECA missions in Europe with headquarters in Paris. These missions were required to negotiate economic cooperation agreements with each of the participating governments. By mid-July all agreements had been signed with the exception of that with Switzerland which, not desiring any direct aid from the United States, declined to sign an agreement.

The second conference of the 16 states opened in Paris on Mar. 15, 1948 and appointed a committee to make plans for a permanent Organization for European Economic Cooperation (OEEC). In a report of March 17 stress was laid on recent gains in European production, but the shrinkage of dollar supply and imports from dollar countries was also noted. On the same day the 5-power 50-year pact of mutual defense was signed at Brussels by plenipotentiaries of Belgium, Britain, France, Luxembourg and The Netherlands.

At the fourth meeting of the OEEC, July 8-11, the council agreed to allocate the United States dollar aid among its members and to the Anglo-United States zone of Trieste. In subsequent meetings further fruitful understandings were reached. On September 11 a committee of five experts of the OEEC made the allocation of the total of $4,875,000,000 to the various countries. The largest single allotment of $1,263,000,000 went to the United Kingdom and the next largest, $989,000,000, went to France. Italy received $601,000,000; Bizonia (British and U.S. zones in Germany), $414,000,000; The Netherlands, $412,000,000; and other countries received lesser amounts.

The ECA act provided that part of the assistance to Europe should be in the form of loans. By October 6, 1948, ECA loans had been concluded with 11 countries for a total amount of $817,300,000 with payment of interest (at 2½ per cent) and repayment of principal beginning after July 1, 1952.

Wherever Communist parties were entrenched in the labor movement, as in England, France and Italy, they used every means of propaganda, strikes and sabotage to disrupt national economies and frustrate the objectives of the OEEC and the ECA, particularly during the spring and summer of 1948. But it was not until early 1949 that the Soviet government shifted from a negative position of mere violent denunciation of the Marshall Plan and fifth-column efforts to destroy it to an affirmative policy of setting up a rival organization for eastern Europe. On Jan. 25, 1949, Moscow announced the formation of a 6-nation Council for Economic Mutual Assistance (CEMA). This "Molotov Plan" bound the satellite states of Bulgaria, Czechoslovakia, Hungary, Poland and Rumania to the USSR by closer trade ties. Yugoslavia was not a member of CEMA, for Marshal Tito's nationalist heresy was already causing concern to the Cominform.

On Aug. 31, 1949, the OEEC approved a schedule of allotment of ERP shares for the second year aid (1949–1950), based on the expectation that the U.S. Congress would make $3,776,500,000 available, and that to this amount could be added $150,000,000 which the ECA had set aside as a reserve fund for trade and colonial projects. The largest shares, in millions of dollars, were: $962.0 for the United Kingdom; $704.0 for France; $407.0 for Italy; $348 for West Germany (Trizonia); $312.5 for Belgium-Luxembourg; and $309.2 for The Netherlands (including Indonesia). The accompanying report to the ECA stated that Europe's slump in exports to the United States during 1949 had wiped out all progress toward balancing the ERP recipients' trade. It warned that there was no prospect of Europe becoming self-sufficient by 1952 with annual reductions of ERP payments, and urged the United States to reconsider Marshall Plan fundamentals "at a very early date."

What would be the effects on Europe's economic rehabilitation resulting from the devaluation of the British pound (from $4.03 to $2.80) on Sept. 18, 1949, and similar devaluations in 24 other countries, including France, the Low Countries, Scandinavia, Canada, and India, within the next four days, was still in the realm of conjecture at the close of the year.

DRAKE DE KAY,
Editorial Staff, "Encyclopedia Americana."

MARSHALLTOWN, Iowa, city and Marshall County seat; alt. 863 feet; on the Chicago and North Western; Chicago Great Western; Minneapolis and St. Louis railroads, 58m. NE. of Des Moines. The Iowa River borders the city. Marshalltown is located in the heart of a great hog-and-hominy section, and meat packing is a leading industry. Minneapolis and St. Louis Railroad shops are here, and there are foundries. Gaskets for automobiles, furnaces, and heating specialties are among the manufactured products. Pop. (1950) 19,821.

MARSHALSEA, mär'shal-sē, a prison in London, attached to the Marshalsea Court, originally established under the earl-marshal of England for the trial of servants of the royal household. Later it was used as a prison for debtors and defaulters, as well as persons convicted of piracy on the high seas. It stood near the church of Saint George, Southwark, and existed in the reign of Edward III. It was abolished in 1849. The Marshalsea will be longest remembered as the home of "Little Dorrit." Charles Dickens' father was for some time an inmate of the Marshalsea, and in *Little Dorrit* the novelist gave a vivid picture of the life of a debtor and his family in this prison.

MARSHBUNKER or **MARSBUNKER.** See MOSS-BUNKER.

MARSHFIELD, märsh'fēld, town, Massachusetts, in Plymouth County, at an altitude of 24 feet, 15 miles east of Brockton, on a state highway. It is a summer resort town, and has cranberry bogs. Daniel Webster lived here during the latter part of his life, and is buried here in the Winslow Cemetery. The township includes the resort villages of Humarock, Ocean Bluff, Sea View, and Green Harbor. The town was settled in 1632, incorporated in 1642. Pop. (1950) 3,267.

MARSHFIELD, Wis., city in Wood County; alt. 1,288 feet; 185m. NW. of Wilwaukee; on the Soo Line; and the Chicago and North Western Railroad. In the northern dairy belt, the city is a shipping point for milk products, including butter, cheese, and casein. Local industries center upon the manufacture of veneer panels and doors, shoes, steel tanks, culverts, vaults, springs and mattresses, beer, agricultural instruments, and apiary supplies. Originally settled in 1868, by 1887 it had become a large sawmill community, with furniture factory, hub and stave factories, and boiler works. In that year, fire destroyed most of the town; and with the rebuilding, its industrial interests gradually shifted from lumbering to dairying and cheese-making. Incorporated as a town in 1875, Marshfield became a city in 1883. Government: mayor and council. Pop. (1940) 10,359; (1950) 12,394.

MARSHMAN, Joshua, English Baptist missionary and Orientalist: b. Westbury, Leigh, Wiltshire, April 20, 1768; d. Serampore, India, Dec. 5, 1837. He was, like his father, a weaver, but had an insatiable thirst for learning and always kept a book on his loom. Thus he fitted himself to teach in a Baptist school in Bristol; and thence, in 1799, he went to Serampore as a Baptist missionary, and there founded, in 1810, a missionary college. He was an able linguist, and published *The Works of Confucius, containing the Original Text* (1809); *Clavis Sinica* (1814); a Chinese version of the Bible. He cooperated with Carey in the preparation of Telegu version of the Bible, a Bengali-English dictionary and a Sanskrit grammar. Consult Carey, *Marshman and Ward* (1864).

MARSILEACEAE, a natural order of acotyledonous plants, nearly allied to Lycopodiaceae, but differing in the lack of a stem, and in the usually stalked leaves. The species all are inhabitants of ditches and pools, chiefly in temperate regions. No species was known to be of any importance till the discovery of the Nardoo of Australia.

MARS-LA-TOUR, France, village in the department of Meurthe-et-Moselle, 15 miles west-southwest of Metz, on the road to Verdun. In the Franco-Prussian War of 1870–1871 it was the scene of part of the battle of Gravelotte. The 38th German brigade was annihilated here.

MARSTON, John, English poet and dramatist: b. 1575?; d. London, 1634. His comedies include *The Malcontent, The Dutch Courtezan,* and *Eastward Ho,* the last written with Ben Jonson and Chapman. His *Sophonisba* and *The Insatiate Countess* were tragedies.

MARSTON MOOR, England, in Yorkshire, is celebrated for the defeat there in 1644 of the royal forces numbering about 18,000 under Prince Rupert by the Parliamentary troops and Scots, totaling about 27,000 under Fairfax (Earl of Manchester) and Cromwell. Rupert escaped with only 6,000 followers into Lancashire and later rejoined King Charles. As a result, the whole north of England was left to the Parliamentary troops. Consult Kennedy, J. W., *Scottish Borderers at Marston Moor,* 1644 (1902).

MARSUPIAL FROG, any of several small tree frogs (*Hylidae*) of the South American genus *Nototrema,* which incubate their eggs in brood-pouches formed by infoldings of the skin on the back of the female. The eggs are few, of large size and abundantly provided with food-yolk, and the young sometimes remain in the pouches after hatching until they have completed their metamorphosis and attained considerable growth; but the species vary in this respect. See also Tree Frog.

MARSUPIAL MOLE, a small burrowing marsupial of southern Australia (*Notoryctes typhlops*), called "urquamata" by the natives, which has a remarkable similarity to a true mole in appearance (except its reddish color). It represents a family (*Notoryctidae*) first described by Stirling in the *Transactions* of the Royal Society of South Australia for 1891.

MARSUPIALIA, the marsupial mammals, a group ranked as an order, yet embracing the whole of the superior group *Metatheria* or *Didelphia,* as it has been variously named. The latest investigations, however, tend to invalidate the distinctions upon which these groups were formerly sharply separated from the higher mammals and to cause the marsupials to be regarded only as an order of *Eutheria* (q.v.), now distinguished chiefly by their extremely local distribution and degenerate non-placental type of reproduction. Their origin was extremely ancient and its sources are not known; but the group appears to have risen to Mesozoic times among the earliest of mammalian forms and to have begun, even before the advent of the Tertiary period, a course of special modification and degeneration, especially in the line which has survived to the present. The former belief that the marsupials stood in the direct line of ancestry of mammals generally, which were thus considered as modified and diversified offshoots from the stock, is no longer held; on the contrary, the marsupials are regarded as a branch from some very early generalized stock, if not a group of independent origin. It is noteworthy, according to Woodward (*Vertebrate Palaeontology,* 1898), that the earliest known complete mammalian skeletons, which pass upward by insensible gradations into undoubted *Eutheria,* are scarcely distinguishable from the skeletons of the more generalized existing marsupials (for example, *Thylacinus*). In the later Mesozoic Age the marsupials were apparently scattered over all the land area of that time, as their remains have been discovered in many parts of both hemispheres; but even previous to the Eocene epoch they had disappeared entirely from north of the equator. From the first they are divisible into the two branches or suborders of *Polyprotodontia* and *Diprotodontia.* The former, characterized by numerous small incisor teeth, includes a majority of the most ancient forms and such modern groups as the opossums and desyures; while the latter, characterized by only about six upper incisors and two, much enlarged, lower incisors, contain, besides some ancient forms, the majority of modern representations of the order, as the kangaroos, phalangers, wombats, etc.

The marsupials take their name from the ventral pouch of skin, covering the mammary glands, in which the young are nourished or

protected in most families, and which is indicative of the peculiar method of reproduction characteristic of the order, and for the support of which two bones (the epipubic bones), not present in higher mammals, project forward from the pelvis. The internal organs of reproduction are double, the two oviducts not uniting into a single uterus or vagina, although the separation of the two parts is often imperfect; hence the term *Didelphia* (q.v.). The testes of the male are suspended in a scrotum in front of the penis, the *glans* of which is often double. As a rule no allantoic placenta is present, but there is reason to suppose that the primitive marsupials were placental, and rudiments of this structure persist in the existing Australian bandicoots—a fact which invalidates the former prime distinction made between the marsupials and higher *Eutheria.*

The young are dropped from the mother's womb as minute, undeveloped foetuses, those of the largest kangaroos being not half as large as mice when born. These larvae (for they are that) are then taken by the lips of the mother and placed, one by one, within her ventral pouch, where each is attached to one of her teats, where it clings by means of its temporary sucking-mouth and is nourished by the milk which oozes or is passed down its throat. They remain there a length of time varying with the size of the species, until they have grown to an advanced stage of development, when they gradually emerge; but for a long time afterward return to the mother's pouch for refreshment, rest or safety when alarmed. The pouch varies in its capacity and completeness, in some families being quite absent, so that the young are shielded only by the long hair upon the mother's belly.

While this strange method of reproduction is the most prominent peculiarity of the marsupials, they differ from other orders of mammals in several anatomical features, such as the simplicity of the brain, in which the cerebellum is completely exposed, and the tendency to separation of bones of the skeleton, usually solidly anchylosed in other mammals.

Since early Tertiary times marsupials have been confined to South America and the Australasian region, with the single exception of the few North American opossum (q.v.). This family (Didelphyidae) is restricted to the western hemisphere and alone remains of the large number of Tertiary forms once prevalent in South America, save a single Patagonian diprotodont, the opossum-rat (q.v.). The home of the group, then, is Australia, Tasmania and the Papuan group, where about 125 species are known; and the race seems to have survived in that insular region owing to the absence of destructive enemies, for most of them are almost defenseless vegetable feeders. They have, however, developed into a great variety of forms under the influence of varying conditions and long competitions, and present a most curious parallel to the diversities observable among the higher and more widely diffused mammalia. Some have large size, go in herds and occupy grassy plains; others are smaller, more agile and confined to mountainous districts. Others are still smaller, burrow and feed upon roots or resemble little terrestrial rodents in appearance and habits; while many forms dwell altogether in trees and often simulate squirrels of various kinds. In another direction have been evolved a variety of predatory marsupials, whose needs have developed bodies, teeth and powers resembling those of wolves or bears, and which are wholly flesh eaters. There is, in fact, hardly a group of mammals which does not find a counterpart among the marsupials—even the moles and shrews.

The classification of the order divides it into 10 or 12 well-defined families, some of which are wholly extinct, as follows:

POLYPROTODONTIA:

Doubtful primitive forms.—*Triconodon,* Amphitherium, etc.

Didelphyidae.—Opossum (q.v.).

Dasyuridae.—Dasyures, Thylacines, etc. (qq.v.).

Peramelidae.—Bandicoots (q.v.).

Notoryctidae.—Marsupial mole (q.v.).

DIPROTODONTIA:

Epanorthidae; Abderitidae, etc.—Fossil in the Miocene strata of Patagonia; but surviving in *Caenolestes.*

Phalangeridae.—Phalangers (q.v.).

Diprotodontidae.—Extinct gigantic phalangers.

Phascolomyidae.—Wombats (q.v.).

Macropodidae.—Kangaroos (q.v.).

Consult Beddard, Frank Evers, *Mammalia* (London 1902); Gould, J., *Mammals of Australia* (London 1863); and scientific works on Australia, especially those of George Robert Waterhouse and Richard Lydekker.

MARSUPPINI, mär-sŭ-pi'ni, **Carlo** (sometimes called CARLO ARETINO), Italian humanist and scholar: b. Genoa, 1398; d. Florence, April 24, 1453. Originally from Arezzo, his family moved from Genoa to Florence where Marsuppini lived the greater part of his life. There he became the teacher of Lorenzo de' Medici and Giovanni di Cosimo and was noted for his public lectures and recitations. In 1444 he was appointed chancellor of the republic.

Among the literary remains of Marsuppini are letters, epigrams, elegies, and translations of the farced epic *Batracomyomachia* (1429), and portions of the *Iliad* into Latin hexameters.

MARSYAS, mär'sĭ-ăs, in Greek mythology, the son of Hyagnis and one of the Sileni of Asia Minor. Athena, having seen the reflection of herself in water, had thrown away the flute which she had invented, displeased because it disfigured the countenance in playing, and had pronounced the severest maledictions against any one who should take it up. Marsyas accidentally found this instrument, on which he soon acquired such skill that he dared to challenge Apollo to a contest, the conditions of which were that the victor should do what he pleased with the vanquished. The Muses, or according to some the Nysaeans, were invited to be the judges and decided in favor of Apollo, who put to death his rash competitor by binding him to a tree and flaying him alive. In this way was the curse of Athena accomplished.

Marsyas' statue was erected in several Roman cities as a symbol of liberty and other statues have been found illustrating his experiences, one by Praxiteles, which has been preserved in the Athens Museum.

MARTA OF THE LOWLANDS (Terra baixa), the foremost achievement of the Catalan theater, was written in Catalan by Angel Guimerá for Fernando Díaz de Mendoza and

María Guerrero and performed for the first time by these actors in the Spanish translation by José Echegaray. It is the first Catalan work to obtain general currency beyond the limit of the provincial tongue. During the present century no play has been more popular in the Spanish or Hispano-American countries, where it has maintained itself upon the stage without interruption since 1896, enlisting the talents of all the leading actors. 'Terra baixa' is predominantly social and human in appeal. This is its fundamental quality; but in equal degree it possesses high theatric effectiveness, which is not inferior to the best work of its period in this vein, whether produced in Spain or elsewhere. Simple feeling and torrential passion, in conjunction with sensitive insight and unusual grasp of significant situation, convey an impression of elemental forces operating behind the broad effects of a carefully elaborated theatrical art, happily employed strictly in subservience to the theme. More than any other play, 'Terra baixa' has contributed to fix the general conception of Iberian peasant drama which prevails in Europe and America. A certain idealization may be noted in the rural characters, a reminiscence of the author's apprenticeship in the poetic drama. In objective realistic detail Guimerá is an unequivocal master. 'Terra baixa' has been translated into more than 20 languages. The English version by Wallace Gillpatrick (New York 1914) was acted successfully in England and the United States previous to publication. As 'Tiefland,' the play is favorably known in operatic form, with music by Eugène d'Albert.

JOHN GARRETT UNDERHILL.

MARTEL, Charles. See CHARLES MARTEL.

MARTEL DE JANVILLE, Gabrielle, COMTESSE DE ("Gyp"), French author: b. Coëtsal, Morbihan, 1850. She is a great grandniece of Mirabeau and at the age of 19 was married to Comte Martel de Janville. Her writings deal with types of Parisian life, of which Petit Bob, Loulou and Paulette have become famous. Over 135 volumes in all have issued from her pen. These include 'Petit Bob' (1882); 'Autour du mariage' (1883); 'Un homme délicat' (1884); 'Elle et lui' (1885); 'Autour du divorce' (1886); 'Pour ne pas l'être?' (1887); 'Pauvres petites femmes' (1888); 'Bob au salon' (1888); 'Mademoiselle Eve' (1889); 'Bob à l'Exposition' (1889); 'L'Education d'un prince' (1890); 'Monsieur Fred' (1891); 'Mariage civil' (1892); 'Du haut en bas' (1893); 'Mariage de chiffon' (1894); 'Le cœur d'Ariane' (1895); 'Le bonheur de Ginette' (1896); 'Totote' (1897); 'Israël' (1898); 'L'Entrevue' (1899); 'Le pays des champs' (1900); 'Le friquet' (1901); 'Sœurette' (1902; 2d ed., 1910); 'Un ménage dernier cri' (1903); 'Maman' (1904; 2d ed., 1910); 'Le cœur de Pierrette' (1905); 'Ces bons Normands' (1907); 'La paix des champs' (1908); 'Joies d'amour' (1909); 'L'Amoureux de Line' (1910); 'La guingette' (1911); 'Le grand coup' (1912); 'Napoléonnette' (21st ed., 1913).

MARTELLO TOWERS, so called by corruption from *Mortella,* in Corsica, where a strong tower maintained a determined resistance to a superior English force in 1794. In consequence of the great strength exhibited by this fort the British government erected a number of similar towers round the coast of Great Britain, and especially on the Kentish coast, as a defense against the threatened invasion from France. They are circular, with walls of great thickness, and roofs bomb-proof, there are two stories, the lower for the reception of stores and the upper for the casement of troops. One traversing gun was mounted upon each, in working which the men were secured by the lofty parapet. The ordinary guard was from 6 to 12 men. With improved modern artillery Martello towers are useless, and in many places were dismantled, but some have received a new and more powerful armament, or have been adapted to the use of the coast guard, or revenue officers. In some instances they are rented to private individuals. Martello towers are still to be found in New Brunswick and Nova Scotia. There are also several on the Gulf of Mexico and one still remains at Kingston, Canada.

MARTEN, the name of several fur-bearing animals of the weasel family (*Mustelidæ*) that are mainly arboreal in habits, and do not change their color to white in winter. All inhabit the cooler parts of the Northern Hemisphere. The beech or stone marten (*Mustela foina*) is to be found in Europe generally south of the Baltic, although not now a native of Britain. It is about 17 inches long in body, and its tail adds nine inches; its breast is white. It is tractable, and is believed by some to be the animal domesticated by the ancient Greeks as a mouser. The pine, or sweet, marten (*M. martes*) is rather smaller, but with a much longer tail, proportionally, and is more northerly in its distribution, occurring from the British Isles and Norway eastward to Siberia. It has a finer, more valuable fur than the other, and a yellow throat. Very nearly allied to it in size, form and color is the Siberian sable-marten (*M. zibellina*), noted as furnishing in its coat the finest and most expensive of the furs from animals of this group. The demand for this fur can be met only by the most difficult, and often dangerous, exertion in trapping and hunting in remote Asiatic forests; and it has resulted in a steady diminution of the supply and very high prices for the pelts. There is also a native marten in India and another in Japan. North America has two species of the genus — the American pine-marten, or Canadian sable (*M. americana*), and the pekan (*M. pennanti*). The former is hardly distinguishable from the sable of the Old World, and its fur, although regarded as somewhat inferior, is largely used as a substitute for genuine Siberian sable. (See FUR-TRADE). The pekan is very distinct by its greater size (length, 24 inches, plus tail, 13 inches), its long and very dark coat and its dog-like head. Its fur is of great value.

The body in all these martens is elongated and supple, with a long and somewhat bushy tail; the legs short and the toes separate and flexible, with long sharp claws adapted to the life in trees that most of them follow. They are fierce and cunning hunters, pouncing successfully on all sorts of small animals and birds, destroying birds' nets, catching frogs, and in winter pursuing and killing animals as large as hares and porcupines. The pekan, or fisher, is especially bold and voracious, but does not eat fishes in spite of its name. Both the

American species were formerly common in the mountainous parts of the eastern United States, but are now restricted to the remoter woods of Canada. They make their dens, bedded with leaves and grass, in some high hollow of a tree-trunk, as a rule, but frequently choose a crevice among rocks, and there produce annually a litter of from one to seven young. The period of gestation is about three months, and the young begin to leave the nest when two months old.

Breeding for Fur.—These bloodthirsty little carnivores are the very type of savagery, and even the kittens are almost untamable. The high value of their fur (in 1948 the average marten pelt brought $27.56 on the Canadian market; in 1949, $15.76) has caused much effort to be expended, especially in Canada, to breed them in confinement, but thus far the results have been small, although encouraging. The general treatment and food seem to be like that for minks. A large pen made of inch-mesh wire and floored with this, or in some way so prepared that the animal cannot dig out, should contain stumps and bushes to give the marten accustomed exercise. Two males cannot be put together. When the female is ready for a mate she is placed in his cage, or vice versa, and the mating will take place at night, so that the pair must usually be left together several days. Mating occurs naturally in January or February. When the young are about two months old they may be removed from the mother, and should be brought up by hand, if possible, so as to become more gentle. These general directions apply to the pekan, but his quarters should be larger than for the sable.

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MARTENSITE, mär'tĕnz-īt, a constituent of steel, existing at a high temperature, and which being retained by sudden cooling confers hardness upon the steel.

MARTHA'S VINEYARD, mär'thăz vĭn'-yĕrd, an island, Massachusetts, off the southwest coast of Cape Cod, constituting, with the Elizabeth Islands, the county of Dukes. It is separated from the mainland by Buzzard's Bay, the Elizabeth Islands, and Vineyard Sound. New Bedford, with which it has steamship connections, is 20 miles distant; Boston, 80 miles by water. The island is 20 miles long and 10 miles across at its widest part. The largest towns on the island are Tisbury (including the village of Vineyard Haven), Oak Bluffs, and Edgartown, the county seat. The northern coast is high and rocky, rising to 308 feet. The southern coast is low and irregular, with sand bars and inlets. At Gay Head is one of the island's several lighthouses and a Coast Guard station. The island, once the headquarters of a whaling fleet, is a popular summer resort. A large part of the interior has been set aside as a state park.

It was discovered and named by Bartholomew Gosnold in 1602, and was a part of the original New York grant until 1692. The Indians who then occupied the place were quiet and friendly and professed conversion to Christianity. They remained loyal to the whites even during King Philip's War. Pop. of Dukes County (1950) 5,633.

MARTI, mär-tē', **José Julian,** Cuban author and patriot: b. Havana, Jan. 28, 1853; d. Dos Ríos, Cuba, May 19, 1895. He studied in Havana, was sent to the quarries in 1869 while only a boy as a political suspect, then was exiled to Spain, where in Madrid and Saragossa he studied for the bar and made himself famous for his liberal views, and on his return to America was professor in the University of Guatemala, whence he came to New York City in 1890 as consul for Uruguay, Paraguay, and Argentina. In 1894 he attempted to land armed men in Cuba, but was intercepted in Florida; in the next year he succeeded in landing, joined Gen. Maximo Gómez y Báez and was killed in a skirmish with the Spanish at Dos Ríos. A poet who supported himself mainly by journalism, he is regarded as one of the greatest Spanish-American prose writers. His *Ismaelillo* (1882) is considered by some critics as foreshadowing the modernist movement in Spanish letters.

MARTIAL, mär'shăl (MARCUS VALERIUS MARTIALIS), the world's greatest early writer of epigrammatic poetry, was born in Bilbilis, Spain, March 1 of one of the years 38 to 41 A.D., and died probably between 102 and 104 A.D. Like his literary friends, the Senecas, Lucan, and Quintilian, who also were of Spanish birth, Martial in his writings was thoroughly Roman, and indeed has left us our most valuable picture of contemporary Rome. A Fronto and Flacilla, whom he mentions, may have been his parents, but we know nothing of their origin or station. The grammatical and rhetorical training which his parents secured for him perhaps at Tarraco (Tarragona) or Corduba (Córdoba), he half-seriously disparaged as being of no financial advantage, but it was really to his pen that he owed, at least indirectly, his support through life. For, although he was apparently fully equipped for practice at the bar, the profession of an advocate was too exacting to be attractive. On his arrival in Rome in 64 A.D., powerful friends launched him on a literary career which rapidly carried his fame even to the limits of the empire. But success as a poet brought him no contentment, since in return for the money, food, and clothing, which by flattery and begging he got from imperial courtiers and other men and women of wealth, he had daily to perform social duties that were highly irksome to his indolent nature. From the patron's reception at dawn to the end of the latest dinner, he had to dance attendance with wit that should never fail.

We find him living at first in humble lodgings on the Quirinal, later in a house of his own on the same hill. A barren farm near Nomentum was his usual refuge from the cares and noises of the capital, but he sometimes made long journeys in Italy, often visiting the country houses of his friends. To his poetical and social talents he also owed political favors from Titus and Domitian. A tribuneship gave him membership in the equestrian order, but probably not the fortune of a knight. He likewise received the coveted privileges to which a father of three children was entitled, the *ius trium liberorum*, though unearned; for the references that have given rise to the theories that he was married from one to three times are not of personal application. It is probable that even Marcella was no more than his patroness. When disgust at the client's life in Rome led him in 98 to return to Bilbilis, this Spanish lady gave him a fine estate. A longing soon seized

him, however, to be back in Rome with all its inspirations, a longing never to be gratified; Pliny the Younger, who had helped Martial with a gift of money on his departure from Rome, records the poet's death in Spain. Besides those already named, Juvenal and Silius Italicus should be mentioned as Martial's friends. Noteworthy among contemporaries whose names do not appear in his poems are Tacitus and Statius. The former could have had little sympathy with his character, the latter was no doubt his rival in literary mendicancy. We have 1,575 of Martial's poems. More than half of these are of four lines or less. His earliest book published in 80 contains epigrams describing shows given by the emperor. Then followed books XIII and XIV made up of two-line inscriptions for presents at the Saturnalia. The other books (I–XII), containing many poems which we should not call epigrams at all, appeared at varying intervals in the period 85–101. Martial's influence in his chosen field has never ceased. A remarkable number of the best epigrams in modern languages are merely adaptations or translations of his poems. His personal character has received general condemnation. Obscenity and servile flattery are the main charges. But in judging even the insincere language that he uses in speaking of the tyrant Domitian we must remember that it went only a step beyond the requirements of formal court etiquette. Kindly critics find in Martial some good points, his modest valuation of his own work, his freedom from envy, his scorn of all hypocrisy, his steady resistance to all temptations to use his powerful weapon of satire in either an unjust or unkind spirit, his tender love of children, humane treatment of slaves and above all his deeply affectionate attachment to his friends. See EPIGRAM.

Bibliography.— The best text edition of his poems is that of W. M. Lindsay, Oxford, Clarendon Press. The German annotated edition of Friedlaender is invaluable. The only complete translation in English, is in the Bohn series.

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MARTIAL LAW, government by arbitrary military power; that supersedes municipal law, or State law, yet is not a military law. When in time of extreme peril to the State, either from without or from within, the general safety cannot be trusted to the ordinary administration, or the public welfare demands the adoption and execution of extraordinary measures, it may become necessary to declare the existence of martial law. This is, indeed, no law at all in its ordinary sense; it is in fact the abrogation of it. That which is done under martial law has not an immediate constitutional or legislative sanction, as the military or the statute law, for example, has. Yet remotely and indirectly martial law expresses the will of the people. The Supreme Court of the United States has held that a State legislature may proclaim its existence whenever the public safety demands it; and the Constitution, by implication at least, also permits its proclamation by that clause which provides that the privileges of the writ of *habeas corpus* shall not be suspended, unless when, in cases of rebellion or invasion, their suspension is essential to the general welfare. See also LAW, MILITARY; MILITARY COURTS AND COURT-MARTIAL.

MARTIAL'S EPIGRAMS. Marcus Valerius Martialis, the epigrammatist, was born about 40 A.D. in Bilbilis, Spain, 20 miles west of the present Aragonese city of Saragossa. He went to Rome at the age of 23, and after nearly two score years of residence at the capital returned to his native town, where he died about 104. At the age of 40 he celebrated the dedication of the Coliseum and won the favor of the Emperor Titus by composing the 'Book of Spectacles,' a collection of epigrams on the incidents of the day's sport. Several years later he published two collections of couplets to be used with dinner favors and with presents at the Saturnalia, which afterward took their places in his works as books XIII and XIV. Books I to XII, his really characteristic work, were published at intervals more or less regular from 86 to 102, the last one having been sent from Spain after his return. The total number of pieces in the 15 books is about 1,550, of which three-fourths are in the elegiac couplet, like the verse of Ovid and the great part of Greek epigram.

Though at first glance Martial seems to continue the tradition of the epigram, which had already had long life and great fame in the Greek tongue, he is really to a large extent original and creative, and is of the greatest importance in literary history as being the founder of the epigram as it has been popularly conceived ever since; that is, as a short, highly concentrated poem with a point that is made to appear suddenly or with a surprise.

> "Chloë weeps with one eye. Do you ask how it's done?
> The answer is easy: she has only one."
> (Dimsdale.)

Whether his influence has been the best is sometimes questioned. Those who are familiar with the calm, sunny, contemplative, tripping genius of the Greek Anthology, which, though its epigrams are always neat and concise, and sometimes stinging, has not as a whole the satiric character, will be likely to think Martial somewhat hard and metallic in both form and content. Those who enjoy «verbal exactness and mechanical ingenuity» (Dimsdale), and look to the epigram for the character of stinging, satiric pointedness usually associated with it, will agree with Lessing that he is the world's greatest epigrammatist, and understand his appeal to Dryden, Pope and Johnson.

Martial is not all pungency. A not inconsiderable number of his pieces are epigrammatic rather than epigrams; a few of them might be classed as short poems without reference to epigram. They are nevertheless homogeneous. Even more than perfection of form, the characteristic that gives them all a unity, is their quality as a human document. Martial was right when he said, «My page smacks of human life.» Provincially and simply bred, pursuing the existence of a free lance in a great capital in an intense age, gifted with a keen understanding, a quick eye, and a responsive pen, he converted into clear, cameo-like literary pictures for the amusement of his own time, and for the amusement and instruction of all time, innumerable vivid impressions from the fascinating realities among which he moved. To read his epigrams in quantity is like sitting before a cinematograph of the Flavian era. There flash before us lively scenes

of men and things: numerous faces of the known and the nameless, types of men and women from every sphere, the bawling schoolmaster with his noisy pupils, the poetical bore reciting his verses to unwilling ears, the stingy host, the snowstorm in the amphitheatre, the routine of the Roman day, the patron who is never at home, the guest who comes too early, the transparent hypocrite, the slow barber, the waste slopes of recently active Vesuvius, the incident of the circus or theatre or the dinner or the street. In an age of *ennui*, the world is fresh and interesting to Martial. Not only men, but things, find him attentive. Thinking of this and of his facility of expression, Verrall says ('Literary Essays, Classical and Modern,' p. 15) that he is "perhaps the only writer in whom plate and tapestry, earthenware and hardware, beds and sofas, become truly poetic." Dimsdale ('Latin Lit.,' p. 472), commenting on his method of attaining vividness by the use of realistic detail, says that "he uses no general expressions such as rich and poor, but speaks in terms of jewelry, scents, linen, cloaks and boots."

Martial is a satirist, but only by accident. He has no moral indignation such as a few years afterward glows from the page of Juvenal. "A certain intolerance of hypocrisy," says Mackail ('Latin Lit.,' p 194), is the nearest approach Martial ever makes to moral feeling. He does not scold; he does not even preach. He manifests no moral enthusiasms, and almost no malice for anything. He is a wit rather than a humorist, though he is by no means without humor. He merely records, and his quality as a satirist is the outgrowth and accompaniment of epigrammatic expression rather than the result of conscious purpose. To portray freely and realistically was in itself to satirize.

The reader's enjoyment of Martial unexpurgated is interfered with by coarseness in about one in 10 of his pieces. This is hardly higher or lower than the modern European average, though his coarseness is not on this account the more welcome. He is also charged with servility in his attitude toward the emperor and other patrons. It should be said in extenuation that literary patronage has until not long ago been a regular and a recognized relation and has always carried with it a certain amount of purely conventional flattery, and that Martial's servility perhaps did not seem so offensive in his own day as it does now, when the servility of the literary art finds expression in other ways. So clean-hearted and clean-lipped a man as the younger Pliny, in expressing regret at the poet's death, has left the word *candor* as descriptive of him: "he was a man of talent, penetrating, keen, with exceeding wit and satire as a writer, and with no less candor." This is probably a reference to the sincerity and frank straightforwardness of Martial the realist, who saw clearly and took no pains to cover up either other men's failings or his own. Of himself he says, "My page is free, my life upright." Of his work he says:

> "Good, fair, and bad
> May here be had.
> That's no surprise!
> Twere vain to look
> For any book
> That's otherwise."
> (Kirby Smith.)

Lovers of Spanish art in general, and of the present day novel in particular, will find themselves wondering whether Martial is not to be explained as merely an ancient example of the truthfulness and directness which so strongly characterize the Spanish genius. Paul Nixon, in "A Roman Wit," gives a spirited rendering, inevitably lacking in finish, of about 200 epigrams. The Bohn Library Martial contains a greater number of translations in both verse and prose. Kirby Smith, in the *Sewanee Review*, Vol. 26, No. 1, may be consulted for appreciation.

GRANT SHOWERMAN.

MARTIN, Saint, of Tours: b. about 316; d. about 400. He attended the catechetical school at Pavia. His father was a military tribune, and compelled him in his 16th year to take up arms. He is said to have early escaped from his father and received instruction in a Christian church. He served under Constantius and Julian, and went to Gaul, where he appeared as the model of all virtue. Among other acts he divided his cloak with a poor man whom he met at the gates of Amiens (Ambianum). The legend says that Christ appeared to him in the following night covered with the half of this cloak. Soon after this vision Martin was baptized, in 337. After living many years in retirement he made a visit to his native place, during which he converted his mother, and opposed with zeal the Arians who prevailed in Illyria. For this he was scourged from the country, on which occasion he manifested the firmness of a martyr. He now established a monastery in Milan, but when he found himself again exposed to persecution took refuge on the island of Gallinaria, in the Ligurian Sea. He next settled at Poitiers, where he assembled a number of monks, and is said to have wrought many miracles. In the year 375 (according to others 371 or 374) the bishopric of Tours was conferred on him against his will. In order to withdraw himself from the world he built the famous convent of Marmontiers, between the river Loire and a steep rock. This is regarded as the oldest abbey of France.

MARTIN, the name of five popes of the Catholic Church, as follows:

MARTIN I, Saint: b. Todi, Tuscany; d. Chersan, Crimea, 16 Sept. 655. He was elected Pope in 649, succeeding Theodore I. He summoned the first Lateran Council at which he caused the doctrine of two wills and operations in Christ to be affirmed. The Emperor Constans II upholding the doctrine which the Council had condemned, took the Pope prisoner and brought him to Constantinople on a charge of treason and then banished him to the Crimea. On account of his sufferings he is numbered among the saints. His day is 12 November.

MARTIN II, or MARINUS I: b. Montefiascone; d. Rome, 14 Feb. 884. He was elected Pope in 882 after the death of John VIII. While bishop of Caere he had been legate for three popes in their negotiations with the East. To English King Alfred he sent a piece of the wood of the cross.

MARTIN III, or MARINUS II: b. Rome; d. 946. He succeeded Stephen VII in 942 and was greatly esteemed for his learning and nobility of character.

MARTIN IV (Simon de Brion, sē-môn dė brē-ôn): b. France; d. Perugia, 28 March 1285. He succeeded Nicholas III in 1281, having previously been canon of Tours, and cardinal from 1262. He owed his election in great measure to the influence of Charles of Anjou, whom he supported thereafter and did all in his power to enable that monarch to retain possession of Sicily. In his pontificate occurred the massacre known as "The Sicilian Vespers."

MARTIN V (Oddone Colonna, ŏt-tō'nā kō-lōn'nä): b. Rome, 1368; d. there, 20 Feb. 1431. He was elected Pope in 1417, after the abdication of Gregory XII, and the deposition of John XXIII and Benedict XIII, during the Council of Constance. His first act was to promulgate a bull against the Hussites, remarkable from the circumstance that in it the Pope seems to recognize the supreme authority of the councils. He was one of the ablest of the popes, and through his efforts unity was finally secured to the Church and peace to Italy. In 1418 he dissolved the Council of Constance, though a number of difficulties were not then adjusted, and dissensions continued in the Church. Benedict XIII still lived; and at his death, in 1424, a new anti-pope was elected in Clement VIII, who renounced his pretensions in 1429, when he received the bishopric of Minorca as an indemnification.

MARTIN, Alexander Carson, American missionary and educator: b. Livonia, Ind., 10 April 1827; d. Peking, China, 18 Dec. 1916. He was educated at the University of Indiana, from which he was graduated in 1846. He later studied at the New Albany Theological Seminary (now the McCormick Theological Seminary), at Chicago, from which he was graduated in 1847. The New York University conferred the degrees of D.D. and LL.D. upon him.

He was appointed a Presbyterian missionary to China in 1849 and left here on 23 November of that year for Canton. For 67 years he worked among the Chinese. It was said of him that probably he knew China and the Chinese language as did no other American. Dr. Martin retired from active missionary work in 1868 to enter the Chinese government service. He was named by the Board of Foreign Missions here as an honorary missionary. He acted as interpreter for the United States Minister to China in the negotiations between the Washington government and the Imperial Government, at Peking, in connection with the United States-Chinese treaty of 1853. He was the organizer and president of the International Law and Language School in Peking which was destroyed in the Boxer rebellion in 1900. He was said to have been the first Western teacher to open the door of English learning to the youth of the Far East. After 30 years as adviser to the Chinese government, Dr. Martin became president of the new Imperial University of China. This movement for the establishment of a great institution of learning there was blighted by the Boxer uprising. Later Dr. Martin took the leadership of the Wu Chany University for a period of three years. He retired from this work in 1905. In the same year, when he was 78 years old, he gave up teaching, but remained in the capacity of adviser for both the government and the Presbyterian mission.

MARTIN, Bradley, American banker, brother of Frederick Townsend Martin: b. Albany, N. Y., 1841; d. 1913. In 1863 he was graduated at Union University, Schenectady, N. Y. He served in the National Guard during the Civil War, attaining the rank of lieutenant. Subsequently he was admitted to the bar. He managed his vast interests in banks, trust companies and the industries, and was one of the most prominent figures in the social life of the East. In 1893 he went abroad and thereafter lived in England and Scotland.

MARTIN, Charles Cyril, American civil engineer: b. Springfield, Pa., 30 Aug. 1831; d. Far Rockaway, N. Y., 11 July 1903. He was educated at Rensselaer Polytechnic, Troy. He was engineer in the Brooklyn navy yard during the Civil War; and afterward chief engineer of Prospect Park, Brooklyn; and was appointed John A. Roebling's second assistant in building the Brooklyn Bridge, of which he became chief engineer after Roebling's retirement.

MARTIN, Edward Sandford, American author: b. Owasco, N. Y., 2 Jan. 1856; d. New York City, 13 June 1939. He was graduated from Harvard, 1877; was a founder of *The Lampoon,* and for many years was an editor of *Life.* He also wrote for *Harper's Magazine.* His published works include 'Sly Ballades in Harvard China'; (1882); 'A Little Brother of the Rich,' verses (1890); 'Pirated Poems' (1890); 'Windfalls of Observation' (1893); 'Cousin Anthony and I' (1895); 'Lucid Intervals' (1900); 'Poems and Verses' (1902); 'The Luxury of Children, and other Luxuries' (1904); 'The Courtship of a Careful Man' (1905); 'In a New Century' (1908); 'Reflections of a Beginning Husband' (1913); 'The Diary of a Nation' (1917); 'Abroad with Jane' (1918); 'What's Ahead and Meanwhile' (1927).

MARTIN, Félix, French-Canadian clergyman and author: b. Auray, Brittany, 1804; d. 1886. He emigrated to Canada in 1842, having previously entered the Society of Jesus. His task in Canada was to aid in re-establishing Jesuit missions. Saint Mary's College, Montreal, was founded by him. Père Martin made diligent search in French and Canadian archives seeking out information regarding the early Jesuit missionaries in Canada. His principal works are 'Manuel du pèlerin de Notre Dame de Bon Secours' (1848); 'Relation des Jesuites,' an enlarged edition of O'Callaghan (1850); 'Mission du Canada, relations inédites' (1861); 'De Montcalm en Canada' (1867); 'Le reverend Père Isaac Jogues' (1873).

MARTIN, François Xavier, American jurist: b. Marseilles, France, 17 March 1764; d. New Orleans, 11 Dec. 1846. He emigrated to Martinique when 18; later removed to New Berne, N. C.; taught French there, and became a printer; studied law, being admitted to the bar about 1789; and in 1792 was requested by the State legislature to compile the British statutes in force before the Revolution. He was himself a member of the assembly in 1806-07; was judge of the Mississippi Territory in 1809; went to Louisiana in the same capacity in 1810; and in 1813 became attorney-general of the new State of Louisiana. From 1815 until just before his death Martin was a member of the Supreme Court of the State. Although blind for the last 10 of these 31 years, his ability was

not impaired, and it is due to him that the law of the State was in some measure evolved from the tangle of French and Spanish statutes in which he found it. He wrote a 'History of North Carolina' (1829); 'History of Louisiana' (1827); and a version of Pothier on Obligations.

MARTIN, Frederick Townsend, American author, brother of Bradley Martin: b. Albany, N. Y., 1849; d. London, 1914. In 1872 he was graduated at the Albany Law School. He became a member of the New York National Guard, in which he was commissioned colonel and served a period as judge-advocate. For many years previous to his death he had lived in Europe. He was prominent in charitable enterprises and a lavish benefactor of the poor. His writings deal with the doings of the wealthy and the so-called social-elect, of which class Martin was well qualified to speak. His works include 'The Passing of the Idle Rich' (1911); 'My Personal Experiences of Meeting Snobs' (1911); 'Reminiscences of My Life' (1911); 'Things I Remember' (1913).

MARTIN, George Madden (Mrs. Attwood R. Martin), American author: b. Louisville, Ky., 3 May 1866. She was educated in the public schools of Louisville, finishing at home on account of her health. In 1892 she was married to Attwood R. Martin. She became a frequent contributor of short stories to magazines and periodicals and is author of 'Emmy Lou—Her Book and Heart' (1902); 'The House of Fulfilment' (1907); 'Abbie Ann' (1907); 'Letitia—Nursery Corps, U.S.A.' (1907); 'Selina' (1914); 'Emmy Lou's Road to Grace' (1916); 'Warwickshire Lad' (1916); 'Children of the Mist' (1920); 'March On' (1921).

MARTIN, Gregory, English translator of the Bible: b. Maxfield, Sussex, date unknown; d. Rheims, France, 28 Oct. 1582. Martin received his education at Saint John's College, Oxford, where he took the degree of B.A. in 1561 and that of M.A. in 1565. He was very well versed in Hebrew, Greek and Latin and was made tutor to Philip Howard. Martin opposed the Established Church; remained a staunch Roman Catholic and exerted a powerful influence on the Howards to remain true to the ancient faith. In 1570 his continued opposition to the new ecclesiastical order of things in England obliged him to seek refuge at Douai, Flanders, where he became professor of Hebrew in the newly-founded English College. He went to Rome in 1577 to aid in founding the English College there. In 1578 Martin went to Rheims, to which city the English College was moved from Douai, and there spent his remaining years in writing the production of the English version known as the Douai Bible. It is the official Bible for English Catholics, was made from the Vulgate of Saint Jerome and collated with the Greek and Hebrew versions. In 1582 the New Testament was issued but not until 1609–10 did the Old Testament appear. English Protestants criticized Martin's version, yet the commission of Forty-Seven made extensive use of it in preparing the Authorized Version in the reign of James I.

MARTIN, Helen Faucit, Lady. See Faucit, Helen.

MARTIN, Helen Reimensnyder, American author; b. Lancaster, Pa., 18 Oct. 1868; d. New Canaan, Conn., 29 June 1939. She was educated at Swarthmore and Radcliffe colleges, and in 1899 married Frederic T. Martin. She was especially noted for her depiction of Pennsylvania Dutch life, which she portrayed in numerous short stories contributed to magazines. All told she published 30 books, the last one, 'Emmy Untamed' in 1937. Other books include 'Tillie, A Mennonite Maid' (1904); 'Sabina, a Story of the Amish' (1905); 'The Betrothal of Elypholate' (1907); 'Revolt of Anne Royle' (1908); 'The Crossways' (1910); 'When Half-Gods Go' (1911); 'The Fighting Doctor' (1912); 'The Parasite' (1913); 'Barnabetta' (1914); 'For a Mess of Pottage' (1915); 'Challenged' (1925); 'Ye That Judge' (1926); 'Sylvia of the Minute' (1927).

MARTIN, Henry Austin, American surgeon: b. London, 23 July 1824; d. Boston, 7 Dec. 1884. He came to the United States at an early age and was graduated from the medical school at Harvard in 1845, when he established a practice in Boston. He served as a surgeon until nearly the close of the Civil War, when he resigned and was brevetted lieutenant-colonel for gallant service. He devoted his attention principally to surgery and to the treatment of smallpox, upon which subject he was a generally recognized authority. He was the originator of many important innovations in the field of surgery and published valuable professional articles in periodicals.

MARTIN, Henry Newell, American biologist: b. Newry, Ireland, 1848; d. 1896. He received his education at University College, London, and at Christ's College, Cambridge, He was appointed to the chair of biology at Johns Hopkins University in 1876 and was also made director of the biological laboratory. Dr. Martin carried out important experiments on respiration. He was chosen president of the American Society of Naturalists in 1890. He published 'The Human Body' (1881); 'Observations in Regard to the Supposed Suction-Pump Action of the Mammalian Heart' (1887). Professor Martin assisted Huxley in the latter's 'Practical Biology' (1876) and edited 'Studies from the Biological Laboratory of Johns Hopkins' and the *Journal of Physiology.*

MARTIN, Homer Dodge, American painter: b. Albany, N. Y., 28 Oct. 1836; d. Saint Paul, Minn., 12 Feb. 1897. He was elected a member of the National Academy of Design in 1875; and resided in France in 1882–86. While he was influenced somewhat by the Barbizon School of painters, he developed a style entirely his own, which placed him among the best known of American landscape painters. His works include 'Landscape on the Seine'; 'An Equinoctial Day'; 'Brook in the Woods'; 'In the Adirondacks'; 'Sand Dunes on Lake Ontario'; and 'White Mountains, from Randolph Hill.' Consult for reproductions Carroll, D. H., 'Fifty-Eight Paintings by Homer D. Martin' (1913).

MARTIN, Joseph, Canadian statesman: b. Milton, Ontario, 24 Sept. 1852; d. 2 March 1923. He was educated in Canadian and Michigan public schools and at the University of Toronto. He was admitted to the bar in 1882 and from 1882–92

was a member of the Manitoba legislature. From 1888 to 1891 he was attorney-general and minister of education of Manitoba. In the latter capacity he introduced the bill abolishing the separate school system in Manitoba and thus precipitated a memorable crisis in Manitoba and Dominion politics. Martin failed of election to the House of Commons in 1891, but sat for Winnipeg in 1893–96. He removed to British Columbia in 1897 and in the following year became a member of the legislature of that province, sitting until 1903. In 1898–99 he was provincial attorney-general and minister of education and in 1900 was premier of British Columbia. In 1907 Martin was owner and editor of the Vancouver *Guardian*. In 1908 he removed to England, contested Southwest Warwickshire in the Liberal interest in 1909. In Canada he took an active part against the Canadian Pacific Railway monopoly, in the abolition of French as official language and advocated the introduction of the Torrens system of land registry. He was a strong freetrader and advocate of reciprocity between the United States and Canada.

MARTIN, Josiah, English colonial governor in America: b. probably in Antigua, West Indies, 23 April 1737; d. London, England, July 1786. He rose to the rank of lieutenant-colonel in the British army in 1771, and in the same year was appointed to the royal governorship of North Carolina. He was successful in pacifying the "regulators," many of whom remained zealous Tories; and took a firm and energetic attitude in the maintenance of British authority. But on 24 April 1775 he was compelled to escape to the sloop *Cruiser*, from which on 8 August he issued a prodigiously long proclamation which the Whigs ordered burnt by the hangman. He was with Sir Peter Parker at Charleston (June 1776), and accompanied Cornwallis into North Carolina after the British victory over Gates at Camden; but in March 1781 withdrew to Long Island, and thence went to England.

MARTIN, Luther, American lawyer: b. New Brunswick, N. J., 9 Feb. 1748; d. New York, 10 July 1826. He was graduated from the College of New Jersey (Princeton) in 1766; studied law at Queenstown, Md.; was admitted to the Maryland bar in 1771; in 1774 was one of the commissioners appointed to oppose the claims of Great Britain; in 1778 became attorney-general of Maryland; and in 1787 was a delegate from Maryland to the convention that framed the Constitution of the United States. His opposition to the instrument was so strong that, rather than sign it, he left the convention, thus earning from Jefferson the sobriquet of "the Federal bull-dog." In 1804 he defended Samuel Chase (q.v.) in the latter's impeachment trial before the Senate, and in 1805 resigned his attorney-generalship and resumed private practice. He was counsel for Burr in Burr's trial at Richmond in 1807, in 1814–16 was chief judge of the Baltimore Court of Oyer and Terminer, and in 1818–20 was again attorney-general of Maryland. Among his writings was the series of pamphlets, 'Modern Gratitude' (1801–02). Consult Goddard, 'Luther Martin' (1887).

MARTIN, Percy F., English author and journalist: b. 30 March 1861. He received his education at University College, London, served as correspondent in Mexico of the *Times*, the *Tribune* and the Glasgow *Herald;* and in India of the *Times* (Engineering Supplement) and the *Evening Standard*. He also served as special correspondent of the *Financial Times* and *The Engineer* in Central and South America and as contributor to the *Times Trade Supplement*. He has published 'Through Five Republics of South America' (1905); 'Mexico's Treasure House' (1906); 'Mexico of the Twentieth Century' (1907); 'Salvador of the Twentieth Century' (1911); 'Peru of the Twentieth Century' (1911); 'Greece of the Twentieth Century' (1912); 'Maximilian in Mexico' (1913); 'The Sudan in Evolution' (1916); 'Egypt, Old and New' (1923). He is a contributor to periodicals and magazines.

MARTIN, Sir Theodore, English lawyer and author: b. Edinburgh, 16 Sept. 1816; d. 16 Sept. 1906. He was educated at the University of Edinburgh and became a solicitor in Edinburgh in 1840. In 1846 he became a parliamentary solicitor in London, carried on an important and extensive business and varied professional cares with literary work. With Aytoun he published the once famous 'Bon Gaultier's Ballads' (1845). He married in 1851 Helen Faucit, the celebrated actress. His translations comprise many of the works of Goethe, Schiller, Horace, Catullus, etc., and he has written 'Essays on the Drama'; 'Madonna Pia' (1855); 'Life of Lord Lyndhurst' (1884); 'Life of the Prince Consort' (1875–80); 'Helena Faucit, Lady Martin' (1900). He was created K.C.B. in 1881.

MARTIN, Thomas Commerford, American electrical engineer and author: b. London, England, 22 July 1856; d. 17 May 1924. He was educated in an academy at Gravesend, England, by a private tutor and subsequently studied divinity. He was associated with Thomas A. Edison in laboratory work and electrical development in 1877–79 after which he engaged in editorial work. From 1883 to 1909 he was editor of the *Electrical World* and after 1909 he was advisory secretary of the National Electric Light Association. In 1900–15 Mr. Martin was engaged as special expert of the Census office of the United States. He lectured at the Royal Institution of Engineers, La Société Internationale des Electriciens, Paris, the University of Nebraska, Columbia and Lehigh universities, Delaware College and for the New York Board of Education. He was a member of the conference committee organized by engineering societies to expend the $1,500,000 given by Andrew Carnegie for a united engineering building and the Engineers' Club of New York. Mr. Martin was a member of many scientific societies and published 'The Electric Motor and Its Applications' (1886); 'Inventions, Researches and Writings of Nikola Tesla' (1893); 'Edison — His Life and Inventions,' with F. L. Dyer (1910), and contributions to reference books, magazines and journals on electrical topics.

MARTIN, Thomas F., Democratic leader in New Jersey: b. in New England, about 1868. He came to Hudson County, N. J., in 1896, and worked as a reporter on the *Hudson Dispatch*. Later he became business manager, and when the publishing company failed bought in the property at auction, re-established the paper and made it a political power. Entering politics, he

was chosen to represent North Hudson in the state legislature. For several terms he was the Democratic leader in the House of Representatives, including Woodrow Wilson's governorship. After 1916 he served as secretary of the state of New Jersey.

MARTIN, Thomas Mower, Canadian artist: b. London, England, 1838; d. Toronto, Canada, March 16, 1934. He studied art at the South Kensington Art School; removed to Canada in 1862 and settled in Toronto, Ontario. His best-known pictures are *The Untamed Wilderness; A Summer Idyl; Sunrise, Muskoka.* He was one of the founders of the Royal Canadian Academy, the Ontario Society of Artists, the Art Union of Ontario, and the Ontario School of Art. His publications are *An Artist's Letters from the Rockies* (1889) and *Canada from an Artist's Point of View* (1895).

MARTIN, Thomas Staples, American legislator: b. Scottsville, Virginia, July 29, 1847; d. Charlottesville, Va., Nov. 12, 1919. In 1864–1865 he was a cadet at the Virginia Military Institute and for a year served with the cadets in the army of the Confederate States. In 1865–1867 he studied at the University of Virginia and in 1869 was admitted to the practice of law. From 1895–1919 he was United States senator from Virginia. During World War I he was majority floor leader of the Senate.

MARTIN, Victoria Claflin Woodhull, Anglo-American financier and reformer: b. Homer, Ohio, Sept. 23, 1838; d. Tewkesbury, England, June 9, 1927. In 1853 she married Canning Woodhull, from whom she later separated. Her second marriage was to John Biddulph Martin who died in 1897. With her sister Tennessee, in 1870, Mrs. Woodhull founded a stock brokerage house in New York, from which was issued *Woodhull and Claflin's Weekly.* For many years she edited the *Humanitarian Magazine.* In 1870 Mrs. Woodhull memorialized Congress for women's suffrage, and lectured throughout the United States on finance, women's suffrage, and religious and scientific improvement of the human race. In 1872 she was nominated for the presidency of the United States by the Equal Rights Party. She organized conventions for the discussion of social reform, carried on continuous propaganda work in the interests of the working classes both in America and Europe for over 30 years. Her publications include *The Origin, Tendencies and Principles of Government* (1871); *Stirpiculture* (1888); *The Human Body the Temple of God* (1890).

MARTIN, William Alexander Parsons, American educator: b. Livonia, Ind., April 10, 1827; d. Peking, China, Dec. 17, 1916. He was graduated from Indiana State University and studied theology. He went to China as a missionary in 1850 and spent the greater part of his life there in educational and missionary work. He assisted in making the treaty between the United States and China in 1858 and was an authority in China on questions of international law. He was professor and president of Tung Wen College 1868–1898, and president of the Imperial University until 1900, when it was destroyed in the siege of Peking, in which city he was imprisoned with the American legation. In 1902 he was appointed president of the University of Wuchang. In 1911 he rejoined the Presbyterian mission. He edited in Chinese the *Peking Scientific Magazine* and the *Science Monthly,* and has published *Siege in Peking* (1900); *Chinese Legends* and *The Lore of Cathay* (1901); *The Awakening of China* (1907).

MARTIN, William McChesney, Jr., American banker: b. St. Louis, Mo., Dec. 17, 1906. Graduated from Yale in 1928 he studied at Benton College of Law in St. Louis, and at Columbia. Previous to World War II he served in banks and banking firms; in 1935 he was governor of the New York Stock Exchange. He was elected president of the exchange in 1938 and in 1940, the first definite term of office in the history of the exchange. He served in the United States army from 1941 to 1945, finishing as colonel. He served on important government commissions, and became a member of the board of directors of the Export-Import Bank in 1945; assistant secretary of the Treasury, 1949 and chairman of the Federal Reserve Board. He is a trustee of the Foreign Service Educational Fund.

MARTIN DE MOUSSY, mȧr-tăN′ dĕ mōō′sē, **Jean Antoine Victor,** French physician: b. Moussy-le-Vieux, 1810; d. Paris, 1869. His medical education was obtained in Paris, where he practiced in the military hospitals. He removed to Montevideo, Uruguay, in 1841 and in 1843–1852 directed the medical service of the French and Italians engaged in the siege of the city. In 1852 Dr. Martin was engaged by the Urquiza government to prepare a work on the geography of Uruguay. In order to prepare himself for the task he traveled up and down the country in the years 1855–1859. The work appeared in three volumes under the title *Description géographique et statistique de la confédération argentine* (1864).

MARTIN, city, Tennessee, in Weakley County, at an altitude of 475 feet; 11 miles south of Fulton, Ky.; on the Illinois Central; and Nashville, Chattanooga and St. Louis railroads. The University of Tennessee Junior College is here. Pop. (1950) 4,082.

MARTIN, a swallow. In the United States the name is restricted to the purple martin (q.v.), several other species of which, genus *Progne,* are familiar garden birds in South America. The bank-swallow (q.v.) is sometimes called sand-martin, especially in England, where the term is more generally used as a synonym of "swallow" than in America. See also SWALLOW.

MARTINE, James Edgar, American legislator: b. New York, N. Y., Aug. 25, 1850; d. Feb. 26, 1926. He received a public school education; engaged in farming near Plainfield, N. J.; acquired real estate and building interests. When Woodrow Wilson was governor of New Jersey, Martine was one of his most ardent supporters and became United States senator for the term 1911–1917. In the Senate he warmly championed the cause of labor in the discussions in regard to working conditions, and wages, in the coal mines of West Virginia and Colorado.

MARTINEAU, mär′tĭ-nō, **Harriet,** English author: b. Norwich, England, June 12, 1802; d. Clappersgate, Westmoreland County, Eng., June 27, 1876. She was a sister of the philosopher James

Martineau (q.v.). Her first work, 'Devotional Exercises for the Use of Young Persons,' appeared in 1823; and in 1830–31 she won three prizes offered by the Central Unitarian Association for as many essays designed to convert respectively the Catholics, the Jews and the Mohammedans. "The essays," observes a biographer, "probably converted nobody, but brought in 45 guineas." Next came several stories, mostly intended to inculcate some useful lesson, such as those having the title, 'Illustrations of Political Economy' (1831–34), which were followed by 'Illustrations of Taxation' (1834), and gained an immediate recognition. After a sojourn in the United States (19 Sept. 1834–1 Aug. 1836), she published 'Society in America' (1837), intended as a comparison of "the existing state of society in America with the principles on which it is proposedly founded," and 'A Retrospect of Western Travels' (1838), including some criticisms of slavery that were not well received in this country. Up to about 1851 Miss Martineau had been known as a Unitarian; but she later showed a decided leaning toward Positivism, and in 1853 published a condensation of Comte's 'Positive Philosophy.' Among her other works of importance may be mentioned her 'History of England during the Thirty Years' Peace' (1849). During the last 20 years of her life her writings consisted mainly of pamphlets and contributions to newspapers and periodicals. A remarkably candid autobiography, which had been written for many years, was published after her death (1877). Consult also Miller, 'Harriet Martineau' (1884).

MARTINEAU, James, English Unitarian clergyman and philosopher: b. Norwich, 21 April 1805; d. London, 11 Jan. 1900. His father, Thomas Martineau, the great-grandson of a Huguenot surgeon who left France after the revocation of the Edict of Nantes, was a manufacturer of bombazines. Harriet Martineau (q.v.) was an elder sister. He was sent to Derby in 1821 to study civil engineering, but in the following year became a student of Manchester College. In 1827 he took charge for a year of Dr. Lant Carpenter's school in Bristol, and in 1828 he accepted a call to the copastorship of Eustace Street Presbyterian Church, Dublin. In 1831 he published 'Hymns for Christian Worship,' and next year resigned his pastorate, but shortly afterward accepted the copastorate of Paradise Street Chapel, Liverpool, of which, in 1835, he became sole pastor. In 1836 appeared his first separate original work, 'The Rationale of Religious Inquiry,' which attracted considerable attention. In 1839 he was associated with J. H. Thom and Henry Giles in the defense of Unitarianism against attacks by orthodox clergymen, and of 13 addresses published in 'Unitarianism Defended' (1839), five were by Martineau. In 1840 he published his collection of 'Hymns for the Christian Church and Home,' and in the same year was appointed professor of mental and moral philosophy and of political economy in his old college, now named Manchester New College. On the removal of the college to London in 1853 he retained his professorship, but did not settle in London till 1857. In 1848–49 he spent 15 months on the Continent, mostly in Germany, during which his philosophical opinions were profoundly influenced by the study of Greek and German philosophy under Trendelenburg. The remaining publications of his first Liverpool period are an essay on 'The Five Points of Christian Faith' (1841), and the well-known collection of sermons entitled 'Endeavors after the Christian Life' (1843–47). During the period 1849–57, when he was pastor of Hope Street Church, Liverpool, he published many articles in reviews, among them that on 'Mesmeric Atheism,' which finally completed his sister Harriet's estrangement from him. In 1859, being now in London, he and J. J. Taylor, principal of Manchester New College, were chosen joint ministers of Little Portland Street Chapel, but from 1860 till his resignation in 1872 Martineau alone supplied the pulpit. On Taylor's death in 1869 he became principal of the college, a post which he held till his resignation in 1885. In 1866 he was a candidate for the chair of logic and mental philosophy in University College, London, but the united opposition of orthodoxy and secularism led by George Grotte managed to defeat him by a single vote. His publications include 'Studies of Christianity' (1869), a volume of sermons; 'Why Dissent?' (1871); 'Hymns of Praise and Prayer' (1873); 'Modern Materialism: Its Attitude towards Theology' (1876), a masterly attack on Tyndall and the scientific materialists; 'Essays, Theological and Philosophical' (1875); 'Hours of Thought on Sacred Things' (1876–80); 'Ideal Substitutes for God Considered' (1880), a criticism of Moral Idealism; 'A Study of Spinoza' (1883), his first great philosophical work; and 'Types of Ethical Theory' (1885), the earlier of his two masterpieces. During the remaining years of his life he published his great defense of the essential principles of religion entitled 'A Study of Religion: Its Source and Contents' (1888); and his freely critical 'Seat of Authority in Religion' (1890). The first academical degree conferred upon him was that of LL.D. by Harvard in 1872, but he received later the degrees of S.T.D. from Leyden (1875), D.D. from Edinburgh (1884), D.C.L. from Oxford (1888), and Litt.D. from Dublin (1892). Martineau was one of the most eminent preachers of his time, but his greatest work was done in the fields of ethics and philosophical theology. At first a necessarian and utilitarian, he was latterly the great modern champion of free-will and intuitionalism. In the development of his Christology from a sort of Arianism to complete Humanitarianism, and in his ever-increasing insistence upon the continuity of revelation and the purely internal character of ultimate religious authority, he sums up more than any other the history of Unitarianism, and indeed of liberal theology generally during the 19th century. He was a powerful and eloquent champion of Theism against scientific agnosticism and materialism. All his works are written in a uniquely rhythmic style, characterized by a profuse and happy use of figurative language. Consult Jackson, 'James Martineau: A Biography and a Study' (1900); Sidgwick, 'Lectures on the Ethics of Green, Spencer and Martineau' (1902); Drummond, 'Life and Letters of James Martineau'; and Upton 'A Survey of Philosophical Work' (1902)

MARTINELLI, mär-tĭ-nĕl'ĭ, **Giovanni,** operatic tenor: b. Montagnana, Italy, Oct. 22, 1885. He began his musical career as a clarinetist in an Italian regimental band, and in 1910, after studying voice, he made his opera debut in a Milan production of Verdi's *Ernani.* He was heard by Giacomo Puccini, who engaged him to appear as Dick Johnson in *The Girl of the Golden West,* produced in Rome in 1911. Going to London in 1912, he sang at Covent Garden in *Francesca da Rimini* and *The Jewels of the Madonna.* In 1913 he joined the Metropolitan Opera Company, New York City, as a leading tenor, and after the death of Enrico Caruso in 1921 he assumed many of that great artist's roles. Besides singing at the Metropolitan Opera House for more than 30 years, he appeared in many other cities throughout the United States and also sang for the radio.

MARTINEZ, mär-tē'nĕs, city, California, seat of Contra Costa County, located on Suisun Bay 18 miles northeast of Oakland; it is served by the Santa Fe and the Southern Pacific railroads. At Martinez is a vertical lift bridge across Suisun Bay having a horizontal clearance of 291.5 feet. The city is in a fruit, livestock, mining, and petroleum region, and it has petroleum refineries, copper-smelting works, vegetable and fish canneries, and fertilizer plants. John Muir (q.v.) had his home here. Settled in 1849, Martinez was named for Vincente Martinez, commandant of San Francisco Presidio in 1823; it became the county seat in 1850. Government is by mayor and council. Pop. (1950) 8,268.

MARTINEZ DE CAMPOS, mär-tē'năth thā käm'pōs, **Arsenio,** Spanish soldier and statesman: b. Segovia, Dec. 14, 1834; d. Zaraus, Sept. 23, 1900. He served in the campaign in Morocco in 1859, in Mexico in 1861, and in Cuba, with the rank of colonel, from 1869 to 1872. Following his return to Spain he opposed the republican form of government set up in 1873, and during 1874–1875 he became a leader in the movement to restore the monarchy. He assisted in seating Alfonso XII on the throne in 1874, and in 1876 he inflicted a crushing defeat upon the Carlists. For these services he was promoted captain general. Sent to Cuba as commander in chief in 1877, he brought the island's insurrection to a close chiefly by means of concessions which, as premier in 1879, he endeavored unavailingly to carry out. From 1881 to 1884 he served as minister of war, and he was president of the Senate in 1886 and 1891. In April 1895 he was sent again to Cuba as governor general and commander in chief. He found the insurrection more formidable than he had anticipated, and the following January, when his attempts at conciliation proved a failure, he was recalled to Spain. Resuming his seat in the Senate, in 1899 he was, for the third time, its president.

MARTINEZ DE LA ROSA, lä rō'sä, **Francisco de Paula,** Spanish statesman and writer: b. Granada, March 10, 1789; d. Madrid, Feb. 7, 1862. He secured a law degree at the University of Granada, and while lecturing there on ethics he began publication of a series of epigrams on local celebrities under the title *El cementerio de momo.* With the arrival of the French in Spain he took an active part in the movement against the invaders. He supported the constitution of 1812, and with its abolition in 1814 he was sentenced to 10 years' imprisonment. The insurrection of 1820 brought him liberation and appointment as premier of Spain. He became unpopular and distrusted by both political parties, and in 1823 he resigned and went to Paris. There he remained until 1830, and in 1834 he again served as premier for a few months. During 1840–1844 he once more lived in Paris, and he served there as Spanish ambassador from 1847 to 1851. Besides verse, plays, and historical works, he wrote historical novels.

MARTINEZ SIERRA, syĕr'rä, **Gregorio,** Spanish playwright and novelist: b. Madrid, May 6, 1881; d. there, Oct. 1, 1947. For 10 years, while working as a journalist, he acted with the semi-professional Spanish Art Theater. He and his wife, Maria Lejarraga, the poetess, wrote and published under his name two volumes of verse, and subsequently they collaborated on most of the plays produced as by Martinez Sierra. In 1916 he organized the Teatro Eslava, in Madrid, and he also conducted a publishing house, Renacimiento (later the Biblioteca Estrella). From 1931 until two weeks before his death he lived in the United States, Argentina, and other countries. His volumes of poetry included *Floris de escarcha* (1900); and among his works of fiction were *Almas ausentes* (1900), *Sol de la tarde* (1904), and *Tu eres la paz* (1907). He was best known abroad for his play *Cancion de cuna* (*The Cradle Song*), produced in 1911, a quiet portrait of convent life with delicate insight into various feminine types; it provided Eva Le Galliene with the principal success of her Civic Repertory season of 1926–1927 in New York City. In 1931 Catalina Barcena took the leading role in the American motion picture version of his play, *Mama* (1912). Among many other plays by him were *La vida inquieta* (1913); *El reino de Dios* (1915); *Amanecer* (1915); *Don Juan de España* (1921); *Seamos feices* (1929); *Morirse es un error* (1936).

MARTINI, mär-tē'nē, **Ferdinando,** Italian writer and statesman: b. Monsummano, July 30, 1841; d. 1928. He founded the *Fanfulla della Domenica,* a periodical which he was editing in 1874, when he entered Parliament. During 1892–1893 he was minister of education in the administration of Giovanni Giolitti, and from 1898 until 1907 he served as governor of Eritrea. He was colonial minister during 1914–1916; and in 1922 he was appointed an Italian senator. Besides volumes of short stories, he published several novels, among them *I Nuovi Ricchi* (1863) and *La Marchesa* (1876); and other works included *Cose africane* (1896) and *Nell' Africa italiana* (1891). His comedy *La Vipera,* appeared in 1894.

MARTINI, Simone, Italian painter: b. Siena, 1283?; d. Avignon, France, 1344. His surname is sometimes given as DI MARTINO and, incorrectly, as MEMMI. He was a pupil of Duccio di Buoninsegna, becoming one of the leading exponents of the Sienese school of painting. Most of his frescoes were executed in the churches of Siena, Assisi, Naples, and Orvieto, many of them in collaboration with his brother-in-law, Lippo Memmi. At the invitation of Pope Benedict XII he went to Avignon in 1339, where

he executed frescoes in the cathedral and the papal palace, and where he met Petrarch and painted the portrait of Laura. He seems to have aimed at flat decorative effect rather than artistic boldness and originality in his wall painting, and his color is harmonious and fresh, though his faces are conventional. The large painting of the Madonna on the walls of the Palazzo Pubblico is his most important work at Siena (1315); at Florence is to be seen an *Annunciation* of his in the Uffizi, and fragments of his work also survive at Avignon.

MARTINIQUE, mär-t'n-ēk', island of the West Indies, an overseas department of France. One of the largest of the Windward Islands, it lies 25 miles south of Dominica and 20 miles north of St. Lucia. The island has a length of 40 miles and greatest width of 21 miles, the area being 385 square miles. Fort-de-France, the capital, is on a bay of the same name on the southwest coast of the island. Martinique is almost wholly of volcanic origin, the northern part being mountainous. The best known of the volcanoes are Mount Pelée (4,428 feet), in the north, which killed more than 30,000 persons and destroyed the town of Saint Pierre when it erupted in 1902; and Carbet (3,960 feet) in the northwestern part of the island. The mountain slopes still retain much virgin forest yielding both fine-grain and heavy timber. The average temperature is 75° to 88°F., with high humidity in areas sheltered from the trade winds. There are three seasons: cool and showery from December to March; warm and dry from April to July; and hot with torrential downpours from July to November. Many of the numerous streams become raging torrents during the rainy season. Animals and birds once peculiar to the island are now extinct. The mongoose is common; it has practically exterminated venomous snakes, of which the fer-de-lance used to be the most dreaded.

The Caribs, the earliest of the inhabitants known to white men, were annihilated by settlers by the end of the 17th century. Most of the present population are Africans or of mixed blood, the descendants of early French settlers who intermarried with the Caribs or with imported African slave women. The island was the birthplace of the Empress Josephine, consort of Napoleon. Most of the cultivable land is devoted to sugar, which, with rum, constitutes the chief export. Cacao, coffee, tobacco, and bananas are also produced in the fertile valleys. Secondary crops consist mainly of cassava, breadfruit, corn, a variety of fruits, cotton, cola, limes, and vanilla.

Martinique was probably discovered by Christopher Columbus, but it was not until 1635 that settlement was undertaken by Frenchmen under Pierre Belain, Sieur d'Esnambuc. The first development company disposed of its rights to Dyel Duparquet, who had become captain general of the colony in 1637, and his children transferred ownership to the French West India Company; in 1674 the island passed to the French crown. It was attacked by the British in 1666–1667, by the Dutch in 1674, and again by the British in 1693. Admiral Lord Rodney seized the island in 1762, but the French regained possession the next year; it was again in British hands from 1794 to 1802, and from 1809 to 1814. When France adopted a new constitution in 1946, Martinique was constituted an overseas department. There is an elected 36-member General Council; and the department sends 3 delegates to the French National Assembly in Paris, 2 to the Council of the Republic, and 1 to the Assembly of the French Union. Pop. (1950 est.) 273,000.

Consult Roberts, W. A., *The French in the West Indies* (Indianapolis 1942).

MARTINS FERRY, city, Ohio, in Belmont County, located on the Ohio River 19 miles south of Steubensville; it is served by the Pennsylvania, the Baltimore and Ohio, and the Wheeling and Lake Erie railroads. Its industrial activities center about steel and soft coal; products include tin plate, galvanized ware, and jewelry. Settled before 1785, it was incorporated as a town in 1865 and chartered as a city in 1885. In early years it was variously known as Norristown, Jefferson, and Martinsville; its present name commemorates Ebenezer Martin, who operated a ferry here in the 1830's. Government is by mayor and council. Pop. (1940) 14,729; (1950) 13,220.

MARTINSBURG, city, West Virginia, seat of Berkeley County, in the eastern panhandle 23 miles northeast of Winchester, Va.; it is served by the Baltimore and Ohio and the Pennsylvania railroads. Situated at the head of the Shenandoah Valley, the city is in the center of a rich agricultural region. Apples, peaches, and other fruit are packed, and the city also has some light industries. There are limestone quarries in the vicinity. Named for Thomas Bryan Martin, colonel in the Revolutionary War, it was incorporated in 1778 as a town and became a city about 1859. Government is by mayor and council. Pop. (1940) 15,063; (1950) 15,621.

Martinsburg in American Civil War.— Because of its strategic position at the top of the Shenandoah Valley, the city was an important objective in military operations. Both the Federals and the Confederates held it for short periods. In June 1863 Richard Stoddert Ewell's Confederate corps inflicted heavy losses on the Union forces here. Martinsburg was held by Federal Gen. Franz Sigel on July 1, 1864, and the next day he was menaced by the approach of the Confederates, under Jubal Anderson Early, who had been ordered to clear out the lower valley and wreck the Baltimore and Ohio Railroad. John Cabell Breckinridge's division, which marched on the main road to Martinsburg, drove back Union cavalry on outpost at Darkesville. Sigel, warned of approaching danger, burned his stores, collected his command, and, leaving Martinsburg on the night of the 3d, crossed the Potomac at Shepherdstown and occupied Maryland Heights. Early cleared the valley and advanced on Washington, and on the 11th Martinsburg was occupied by Sullivan's division of David Hunter's command, and remained in Union occupation until the 25th, when George Crook, being defeated by Early at Kernstown, was driven through Winchester, made a short stand at Martinsburg, and recrossed the Potomac at Williamsport. Early again occupied the town and destroyed the railroad on either side of it, continuing in possession until August 10, when, upon Philip Henry Sheridan's advance to Halltown, he abandoned Martinsburg and Winchester and fell back to Strasburg. He advanced from Strasburg on the 17th and reoccupied the formerly abandoned Martinsburg

on the 19th with his cavalry. From this time until September 17, the place was held alternately by Union and Confederate cavalry, on the 17th by Gen. William W. Averell's Union division. On that day Gen. Jubal Early left Winchester with a heavy force of infantry, cavalry, and artillery and on the 18th attacked and drove Averell from Martinsburg across the Opequon. Gen. Philip Sheridan defeated Early on the Opequon on the 19th, and drove him up the valley, and Martinsburg was again occupied by Union troops, to remain in their possession until the end of the war.

MARTINSVILLE, city, Indiana, seat of Morgan County, at an altitude of 599 feet, 31 miles southwest of Indianapolis on the West Fork of the White River, served by the Pennsylvania Railroad. The surrounding area grows grain and has good timber. There is a state forest in the vicinity. Artesian mineral wells in the city make it attractive as a health resort. The industrial products include bricks, flour, canned goods, dairy products, clay goods, hickory chairs and mineral water crystals. The city was founded in 1822. Pop. (1950) 5,991.

MARTINSVILLE, city, Virginia, and Henry County seat, but politically independent of the county, situated near the Smith River, altitude 1,128 feet, in the east foothills of the Blue Ridge Mountains, 62 miles south of Roanoke. It is in a region of farms and forest, where industrialism is developing. Factories here produce furniture, garments, mirrors, fiberboard products, and nylon; and textiles are spun, knitted, and dyed. There is a large tobacco market. The city was named for Gen. Joseph Martin (born 1740). It was founded in 1793 and became a city in 1929. It has a council and manager. Pop. (1940) 10,080; (1950) 17,251.

MARTINY, mär-tē'nĭ, **Philip,** American sculptor: b. Strasbourg, France, May 19, 1858; d. New York City, June 25, 1927. His boyhood was spent in France working in various studios. Early in the 1880's he came to America and made further studies under the direction of Augustus Saint-Gaudens. Martiny's efforts in decorative sculpture were conspicuously successful and his work improved this branch of art in the United States. Among his best-known works are the sculpture on the grand staircase of the Congressional Library, Washington; the Carnegie Library, Washington; the New York Hall of Records; two Chamber of Commerce groups, New York; the bronze doors of St. Bartholomew's, New York; *Soldiers' and Sailors' Monument,* Jersey City, N. J.; *McKinley Monument,* Springfield, Mass.; statue of Vice President Garrett A. Hobart at Paterson, N. J.; and the *Admiral de Gernay Monument* at Newport, R. I.

MARTYN, märʹtĭn, **Edward,** Irish dramatist: b. Masonbrook, County Galway, Jan. 31, 1859; d. Tulira Castle, Ardrahan, County Galway, Dec. 5, 1923. He was educated at Christ Church College, Oxford, and in 1899 became with William Butler Yeats and George Moore one of the founders of the Irish Literary Theatre (its was primarily the financial backing of the theater, although his play *The Heather Field* was produced with Yeats' *The Countess Cathleen* at the premier of the theatrical group in 1899. The same year Martyn founded the Palestrina Choir in Dublin, established for the reform of liturgical music, an organization that in 1903 became the Schola Cantorum for Dublin.

Martyn split with the Irish Literary Theatre in 1901 because he objected to the plays about the Irish peasants, insisting that an Irish literature must be built on higher standards. He served from 1904 to 1908 as president of Sinn Fein and in 1914 founded the Irish Theatre in Dublin, organized specifically for the production of plays in the Gaelic tongue and not about peasants, and also for productions of European masterpieces that had been translated into English. Martyn was a firm promoter of the Gaelic League, and once advocated a reform of Irish church architecture. He was a governor of Galway College and of the National University. His works include *Maeve* (1899); *The Tale of a Town* (1902), rewritten by George Moore and given in 1900 as *The Bending of the Bough; Grangecolman* (1912); and the *Dream Physician* (1918), a satire on Moore. His prose includes *Morgante the Lesser* (1890) and a pamphlet, *Ireland's Battle for Her Language.*

MARTYN, märʹtĭn, **Henry,** English missionary to India: b. Truro, Cornwall, Feb. 18, 1781; d. Tokat, Asia Minor, Oct. 16, 1812. He was graduated from St. John's College, Cambridge, in 1801; became a fellow of the same college in the next year, and, turning from the law, took orders, and landed in India in 1806. After three years at Dinapur he was transferred to Cawnpore, where he opened a church in 1810, in spite of violent opposition, and where he completed a Hindustani version of the New Testament. To perfect a translation of the New Testament into Persian and to recover his health in 1811 he traveled into Persia. In Tabriz he was taken ill with a fever, and on his hurried journey home was compelled to stop at the plague-stricken town of Tokat, where he died. In 1856 a monument to his memory was erected there. He was the great missionary hero of the Church of England up to the early part of the 19th century. Martyn's works include *Controversial Tracts on Christianity and Mohammedanism* (1824), and versions of various parts of the Bible into Hindustani, Persian and Judaeo-Persian.

MARTYN, John, English botanist: b. London, Sept. 12, 1699; d. Chelsea, Jan. 29, 1768. He was lecturer in botany at Cambridge (1732–1762), being almost wholly self-educated in the subject, and was also a practicing physician. He contributed to Nathan Bailey's *Universal Etymological English Dictionary* (1721) and wrote *Historia plantarum rariorum* (1728–1737); as well as translations of Virgil's *Georgics* (1741) and *Bucolics* (1749). He was a regular correspondent with Carolus Linnaeus.

MARTYNIA, mär-tĭnʹĭ-ȧ, a genus of annual and perennial herb of the family Martyniaceae. The eight species have thick sub-erect stems, opposite or alternate heart-shaped leaves, showy catalpalike flowers in short terminal racemes, and horned capsules which suggest the names unicorn plant and proboscis flower (*M. lutea*). When ripe the capsules split and expose numerous black wrinkled seeds. The stems and foliage are clammy and malodorous, but the flowers of some species not unpleasantly perfumed. The species are all natives of warm parts of Amer-

ica. They are often planted for ornaments, as curiosities and for their capsules, which while young and tender are used as material for pickles. *M. louisiana,* to which the popular names are generally applied, is the most commonly grown.

MARTYR, Peter. See PETER MARTYR.

MARTYR (Greek for "witness"), a designation applied by the Christian Church to those persons in particular who, in the early ages of Christianity, suffered death rather than renounce their faith, and thus testified their confidence in the truth of the new doctrines. Martyrs are sometimes classified as of three classes: martyrs in will and deed, like Saint Stephen; those in will, but not in deed, like Saint John, who escaped from the death ordained for him by Domitian; and those in deed but not in will, like the Holy Innocents. An account of the life, persecutions, and death of the Christian martyrs is called a martyrology (q.v.). A tomb or oratory erected on the spot where a martyr suffered was called martyrium, martyry. Festivals in honor of the martyrs seem to have been observed as early as the 2d century. The Christians offered prayers at the martyry and thanked God for the example which they had given to the world. The rite was concluded with the sacrament of the Lord's Supper and the distribution of alms. Eulogies were also delivered, and accounts of the lives and actions of the deceased read. These festivals were called the birthdays of the martyrs, because on the day of their death they were born to eternal life. There are 14,000 martyrs commemorated in the Roman Catholic martyrology. In the early centuries of Christianity the bishop of the locality certified the names of those who were deemed worthy of the title of martyr, but after 1100 this designation became more and more reserved to the pope, especially since 1636.

MARTYRE DE SAINT SEBASTIAN, Le (THE MARTYRDOM OF SAINT SEBASTIAN), an oratorio by Achille Claude Debussy which had its first performance at Paris on May 22, 1911.

MARTYROLOGY, called also calendar of the saints, the acts of the saints, menology, anology, synaxary, a list of martyrs and other saints, in which was sometimes noted the character of their lives, and in the case of a martyr the place and date of his martyrdom and the nature of the sufferings which he underwent. Caesar Baronius, an ecclesiastical historian of the 16th century, attributes to Saint Clement of Rome, almost contemporary with the apostles, the first idea of collecting the acts of the martyrs. In the time of Gregory the Great (end of the 6th century) the Roman Catholic Church possessed a general martyrology, the author of which is said to have been Saint Jerome, who made use of materials collected by Eusebius of Caesarea. The only part of it now extant is a catalogue of the martyrs who suffered in Palestine during the last eight years of the persecution of Diocletian. There is a martyrology attributed to Bede (beginning of 8th century), but if not altogether spurious it is at least interpolated. Numerous martyrologies were produced in the next century and subsequently. In 1586, under the auspices of Sixtus V, a martyrology was printed at Rome, with notes by Baronius, with the title of *Martyrologium Universale.* Ruinart's *Acta Primorum Martyrum Sincera* appeared at Paris in 1689, and a new edition of it was published in 1859. The *Acta Sanctorum* (q.v.) of the Bollandists comprises over 60 volumes issued at various times from 1643, but the work is still incomplete. The well-known English work of John Foxe, *The Book of Martyrs* (1563), may also be mentioned.

MARVEL, Ik. See MITCHELL, DONALD GRANT.

MARVELL, Andrew, English poet and satirist: b. Winestead, Holderness, Yorkshire, March 31, 1621; d. London, Aug. 18, 1678. He was graduated from Trinity College, Cambridge, in 1638, and after four years' continental travel he became in turn tutor at Nunappleton, Yorkshire, the scene of his lyrical poems, to Mary, daughter of Lord Fairfax and afterward duchess of Buckingham, and at Windsor to William Dutton, a nephew of Oliver Cromwell. In 1657 he was appointed John Milton's colleague in the Latin secretaryship, a post he retained until the Restoration. From 1660 he represented Hull in the House of Commons. Known in his lifetime chiefly as a Cromwellian, as a friend and colleague of Milton, as a member of Parliament, a pamphleteer, and a satirist, his fame as a poet came later. His widow published a collection of his miscellaneous poems in 1681, and an edition including the political satires was issued in 1726. The complete works did not appear until 1776. His poems, especially those on gardens and country life, display an exquisite feeling for nature and language. Those by which he is chiefly remembered are the *Horatian Ode upon Cromwell's Return from Ireland, On Appleton House, To His Coy Mistress, The Garden, The Bermudas,* and *The Nymph Regretting the Loss of Her Fawn.* In his satires he attacked the Earl of Clarendon and the court party, assailed Charles II, and finally, condemned the house of Stuart, despaired of Parliament, and favored a republicanism after the model of Rome and Venice. In *Growth of Popery and Arbitrary Government in England* (1677) he alleged that the king sought to reestablish Roman Catholicism and make himself an absolute ruler; and in *The Last Instructions to a Painter* he satirized the conduct of the Dutch War. A copy of the 1681 edition of his poems was acquired by the British Museum in 1921. The site of the cottage at Highgate in which Marvell lived is marked by a tablet in Waterlow Park.

MARVIN, Charles Frederick, American meteorologist: b. Putnam, Ohio, Oct. 7, 1858; d. Washington, D. C., June 5, 1943. He graduated as a mechanical engineer in 1883 at Ohio State University, where he had been an instructor in mechanical drawing and laboratory practice since 1879. In 1884 he was appointed a forecaster in the United States Weather Bureau (at that time part of the Army Signal Corps), and rose to become its chief in 1913. He retired in 1934. Besides conducting experiments upon which were based the bureau's tables for computing moisture in the air, he made exhaustive investigations of anemometers and invented instruments for measuring and automatically recording rainfall, snowfall, sunshine, and atmospheric pressure. He made use of kites for determining meteorological conditions in the free air, and made studies of the registration of earthquakes and of the measure-

ment of evaporation, solar radiation, and temperature by means of electric resistance thermometers. His work on wind velocities and standardization of the anemometer was particularly noteworthy. He invented the clinometer, an instrument to ascertain the exact height of clouds over airports. Besides publishing numerous papers on meteorology, he wrote on the simplification of the calendar. He advocated improving the Gregorian rule for leap years by omitting four leap years in 500 years; he asserted that such a change would assure accurate reckoning for more than 10,000 years.

MARVIN, Enoch Mather, American Methodist Episcopal clergyman: b. Warren County, Mo., June 12, 1823; d. Nov. 25, 1877. He was self-educated, and in 1841 became a minister of the Methodist Episcopal Church as member of the Missouri Conference. Upon the division of the Methodist body in 1844 he cast his lot with the Methodist Church South. In the American Civil War he was for two years a chaplain in the Confederate Army. He was chosen bishop of his church in 1866, and at the time of his death had just returned from a missionary tour which took him all around the world. He published *Errors of the Papacy and Transubstantiation* (1860); *The Life of William Goff Cables* (1871); *Sermons* (1876); *The Doctrinal Integrity of Methodism* (1878); *To the East by Way of the West* (1879); *The Methodist Episcopal Churches, North and South.*

MARVIN, Frederic Rowland, American clergyman, essayist, and poet: b. Troy, N. Y., Sept. 23, 1847; d. July 22, 1918. After attending Lafayette and Union colleges he studied at the College of Physicians and Surgeons and New Brunswick Theological Seminary. He became a professor at the New York Free Medical College for Women, and subsequently was a Congregational pastor at churches in Middletown, N. Y., Portland, Ore., and Great Barrington, Mass. In 1895 he retired in order to devote himself to study and foreign travel, and from 1900 he made his home at Albany, N. Y. His numerous books included *Literature of the Insane; Epidemic Delusions; Last Words of Distinguished Men and Women; Book of Quatrains; Excursions of a Book Lover; Poems and Translations; Companionship of Books; Christ Among the Cattle.*

MARX, märks, **Karl,** German Socialist: b. Trèves, May 5, 1818; d. London, England, March 14, 1883. He was educated at the universities of Bonn and Berlin, and in 1842 took up journalism, becoming editor of the Cologne *Rheinische Zeitung,* a Democratic journal; his socialistic articles in this paper caused its suppression in 1843. Marx then proceeded to Paris, where he became one of the editors of the *Deutsch-Französische Jahrbücher,* to which he contributed articles on the "Hegelian Philosophy of Right." He was expelled from France in 1845, and retired to Brussels, where he assisted in organizing the German Workingmen's Association; he was also active in the organization of the Communist League, and with Engels issued the famous Communist Manifesto in 1847, which was the first public declaration of international socialism. In 1848 Marx returned to Cologne and started the *Neue Rheinische Zeitung,* becoming active in the revolutionary movements of that year. Banished from Germany in 1849, he went first to Paris, then to London, where he lived till the time of his death. He devoted himself largely to the study of economic questions, and was correspondent of the New York *Tribune* and other periodicals. In 1864 he took a leading part in the organization of the International Workingmen's Association; he was selected to formulate its program and practically shaped its policy for a number of years. He was also interested in the organization of the German Social Democrats, who united with the International in 1869. After 1873 he took no active part in politics, but devoted his time to the completion of his work on capitalism, *Das Kapital,* the first volume of which had been published in 1867 (English trans. 1886); the second and third volumes were left in manuscripts, and volume II was published in 1885; volume III appeared in 1894, under the editorship of Friedrich Engels. He also wrote *Zur Kritik der Politischen Oekonomie* (1859); *Lohnarbeit und Kapital* (English trans., *Wage Labor and Capital*); *Misère de la Philosophie* (1847); *The 18th Brumaire of Louis Bonaparte* (1852); *Life of Lord Palmerston* (1850), and *Revolution and Counter-Revolution,* a reprint of a series of letters in the New York *Tribune,* in regard to the Revolution of 1848 in Germany.

Marx was undoubtedly the founder of the modern socialistic school, in that he first gave definite scientific statement to the principles of modern socialism. His greatest and best-known work, *Das Kapital,* is a monument of acute reasoning, extensive reading, and knowledge, though excessively long, obscure, and tortuous in its meanings. In this he analyzes carefully his theory of value, which is that the measure of the value of a commodity is the amount of labor "socially necessary" to produce it, and shows how under the capitalistic system the laborers are exploited of what they produce over and above their wages (surplus value). These theories were by no means new, though Marx rather confused than elucidated them. He also traces the development of capitalistic production, the growth of the working class or proletariat, which is finally to transform or revolutionize society, and lays down the principle that the fundamental factor in the development of society is the method of production and exchange; hence the Socialist movement must simply assist and hasten the changes in progress. Marx was not only a scholar and thinker, but an organizer and agitator of unusual power. See also COMMUNISM; SOCIALISM; UNION OF SOVIET SOCIALIST REPUBLICS—*History and Foreign Affairs.*

MARX, Wilhelm, German statesman: b. Cologne, Jan. 15, 1863; d. Bonn, Aug. 5, 1946. He studied jurisprudence at the University of Bonn, and subsequently became presiding judge of a county court; in 1923 he was appointed to the Berlin court. In 1899 he was elected to the Prussian Diet, and in 1910 he entered the German Reichstag, where he became a leading member of the Catholic Centrist Party. He was chosen president of his party in 1921, and two years later he succeeded Gustav Stresemann as chancellor of Germany, forming a minority government of Centrists, Democrats, and People's Party members. In 1924 he attended the Reparations Conference in London, and upon his return to Berlin he succeeded in securing a two thirds Reichstag vote for approval of the Dawes Plan. On the

strength of this vote he tried in the fall to form a majority cabinet, but when this failed he was forced to vacate the chancellorship in favor of Hans Luther. In January 1926 he was appointed minister for justice and occupied territories, and later that year, after the resignation of the Luther cabinet, he again became chancellor. He retired from political leadership after defeat at the elections in May 1928.

MARY, the mother of Jesus, is known in the Roman Catholic Church as the Blessed Virgin Mary. The name is from the Gr. Μαριάμ (Mariam) or Μαρία (Maria), which in turn is from the Hebrew Míryām, a word of uncertain meaning. The New Testament narrative is silent as to her parentage and the place and date of her birth. From tradition and other sources we learn that her father was Joachim and her mother Anne, that by them she was presented in the temple at Jerusalem when she was three years old, and that in the temple she remained until the age of 12 or thereabouts. Her birthplace is variously stated as being Nazareth, Sephoris (Diocaesarea), or Jerusalem. In early youth she was betrothed to Joseph, a carpenter, a scion of the house of David. She probably belonged herself to the same royal lineage. At all events, she was a cousin of Elizabeth, wife of the priest Zachary and mother of John the Baptist. While Mary was betrothed to Joseph, and before her marriage, she was visited at Nazareth, a city of Galilee, by the angel Gabriel, who announced to her that, by the operation of the Holy Ghost, she should conceive and bring forth a son, to whom was to be given the name Jesus, who should be called the son of the Most High, and who should reign over the house of Jacob forever. The angel also said that her cousin Elizabeth had conceived a son in her old age, and was then in the sixth month of her pregnancy. Mary thereupon visited Elizabeth in the hill country of Judah, and, in response to Elizabeth's salutation, "Blessed art thou among women, and blessed is the fruit of thy womb," she uttered under divine inspiration the glorious canticle of praise known as the *Magnificat.* The visit lasted about three months. On her return to Nazareth, Mary "was found with child, of the Holy Ghost." Matthew 1:18. Joseph, however, was in a dream told by an angel of the true condition of affairs, and, instead of putting her away privately, as was his first impulse, he concluded the ritual marriage with her.

Some few months later, in obedience to a decree of Caesar Augustus prescribing a general enrollment, Joseph went from Nazareth in Galilee to the city of David, Bethlehem in Judaea, because he was of the house and family of David, to enroll himself with Mary, who was then great with child. There was no room for them in the inn, and so in a grotto, which served as a shelter for animals, Mary gave birth to her son. On the eighth day afterward the child was circumcised, and was called Jesus, in accordance with the instruction previously given by the angel Gabriel. Thirty-three days later Mary complied with the law of Moses (Leviticus 12:2-8) by offering herself in the temple at Jerusalem for legal purification, and at the same time she presented her child to the Lord in accordance with Exodus 13:2, 12 and Numbers 18:15. On this occasion Simeon pronounced the canticle of joy known as *Nunc Dimittis.* He told Mary that her child was set for the fall and for the resurrection of many in Israel and for a sign that should be contradicted, and that her own soul a sword should pierce. Anna the prophetess, on the same occasion, confessed to the Lord, and spoke of the child to all that looked for the redemption of Israel. A great danger threatened the life of Mary's son. Herod the Great, king of Judaea, having seen and questioned the Wise Men who had come from afar to pay homage to the newly-born King of the Jews, whose star they had seen in the East, concealed the alarm which these strange tidings caused him, directed the strangers to Bethlehem as the city indicated by prophecies for the birth of Christ, and adjured them to let him know, on their return to Jerusalem, where the young king was to be found, so that he too might come and pay him homage. The Wise Men, after offering to the infant Jesus their gifts of gold, frankincense and myrrh, were warned by God in a dream not to go back to Herod, and accordingly they departed by another way into their own country. Herod, not hearing from them, was enraged, and issued an order that every male child two years of age and under in Bethlehem and its borders should be put to death. In the meantime, Joseph, being warned by an angel, had taken the child and his mother and fled into Egypt, and thus the infant Jesus escaped the Slaughter of the Innocents. How long the sojourn in Egypt lasted we do not know. What we are told is that Joseph, advised by an angel of the death of Herod, returned to the land of Israel, but, learning that Archelaus was reigning in Judaea in the room of Herod his father, he decided to go, not to Bethlehem, but to Nazareth, and in the latter city the Holy Family took up their abode.

The chronology of Matthew and the chronology of Luke, the only evangelists who give an account of the events immediately preceding and immediately following the birth of Christ, are at first sight somewhat confusing, but they are not conflicting, and are quite capable of reconcilement, although in this case, as in so many others, the reconcilement will not wholly square with the popular belief.

After the return to Nazareth, Mary makes but few appearances in the Gospel narrative. We learn that she and Joseph went every year to Jerusalem at the solemn day of the pasch, and that on one of those occasions they lost Jesus, who was then 12 years old, and did not find him until after a three days' search. We next find her at the marriage feast at Cana in Galilee, where Jesus, at her request, performed his first public miracle by changing water into wine. After this she accompanied Jesus to Capernaum. Once the mother and brethren of Jesus sought to speak to him, but could not reach him for the crowd. During the passion Mary stood by the cross of Jesus on Calvary, and from the cross Jesus commended her to John, who from that hour took her to his own. The last mention of her in the New Testament occurs in the Acts of the Apostles 1:14, where it is written that, between Ascension and Pentecost, the apostles were in an upper room in Jerusalem persevering with one mind in prayer with the women, and Mary the mother of Jesus, and with his brethren. After that time we have no certain information as to where she lived, nor do we know when and where she died. One tradition says that she lived with St. John at

phesus and died there; another, that she lived nd died at Jerusalem about A.D. 45. Baronius i his *Annals,* gives the date of her death as .D. 48. In fixing that year he relied on a pas- age in the *Chronicon* of Eusebius; but there grave doubt as to the genuineness of that assage in the *Chronicon,* and the present tend- ncy is to regard it as a later interpolation. The elief that, after her death, the body of Mary as assumed into heaven has been universally eld by Roman Catholics throughout Christen- om. It became a matter of faith when the octrine of the Assumption was defined and pro- aimed by Pope Pius XII on Nov. 1, 1950. he Catholic Church teaches that Mary was con- ived without original, or racial, sin; that she ever committed actual, or personal, sin; that ie was truly the mother of God; and that she ways remained a virgin. The doctrine of the nmaculate Conception (q.v.) was not explicitly scussed until the 12th century; but it is claimed at it is implicitly contained in the teachings the early Fathers of the Church. The fes- val of the Conception of the Blessed Virgin was rtainly celebrated in the Greek Church in the h century. It was possibly kept in Spain in the me century. It was observed in Ireland as rly as 900, in parts of Italy before 1000, and England, France and Germany in the 12th ntury. St. Bernard, himself a devout client Mary, upbraided the canons of Lyon for in- ituting (1140) such a festival without the nction of the Holy See. He himself did not lmit that her conception was sinless. St. homas Aquinas, the Dominican, and St. Bona- ntura, the Franciscan, hesitated to accept the octrine of the Immaculate Conception on the round that, unless Mary had been at some time e of the sinful, she could not truly be said to ve been redeemed by Christ. John Duns cotus, the Franciscan, put forward, on the other nd, the doctrine of preredemption. He held at it was as high a tribute to the merits of nrist to assert that Mary was by Him kept free om all taint of original sin, as to say that she rst contracted sin and was subsequently deliv- ed from it. This view, at first seriously and en angrily contested, gradually spread, and thered force and momentum with the progress time. The Council of Trent declared that in decrees on original sin it did not include he blessed and immaculate Virgin Mary, other of God." At length Pope Pius IX, on ec. 8, 1854 promulgated the Bull, *Ineffabilis eus,* in which is given the authoritative defini- on, as follows. "We define that the doctrine nich holds that the Blessed Virgin Mary, om the first instant of her conception, was, by singular grace and privilege of Almighty God, view of the merits of Jesus Christ, the Re- eemer of the human race, preserved from all ain of original sin, is a doctrine revealed by od, and therefore to be firmly and steadfastly lieved by all the faithful."

The dogma of the Immaculate Conception is jected by the general body of Protestantism, many schismatics, and by the sect known as ld Catholics.

Scripture and tradition agree in attributing Mary the greatest personal sanctity, and there no dispute that the church has always held r to be free from the commission of actual, personal, sin. St. Augustine crystallizes this ew when he says (*De natura et gratia,* c.36) that, out of honor to the Lord, he wishes no question to be made of the holy Virgin Mary when sin is treated of. Her complete freedom from actual sin is confirmed by the Council of Trent (Sess. VI, can. 23): "If any one say that man, once justified, can during his whole life avoid all sins, even venial sins, unless by a special divine privilege, as the church holds in regard to the Blessed Virgin, let him be anathema."

In the New Testament Mary is called "the mother of Jesus" (John 2:1, 19, 25, 26; Acts 1: 14) and "mother of my Lord" (Luke 1:43), and there are attributed to her the usual functions of motherhood, namely, conception, gestation, parturition, and giving suck; but she is not specifically designated "mother of God." The belief that that title was properly her due prevailed, however, in the church from the beginning. The term Θεοτόκος (Lat. *Deipara* = mother of God) was probably first formally applied to her toward the end of the 3d century by theologians of Alexandria. It occurs, for example, in the works of Origen. It came into common use in the 4th century, being found in the writings of Eusebius, Athanasius, Didymus, and Gregory of Nazianzus. As St. Cyril of Alexandria put it (*De Recta Fide ad Regin.,* c.9), "This name Θεοτόκος was perfectly familiar to the ancient Fathers." Nestorius, however, contended that Mary was not rightfully called mother of God, as she was the mother, not of God, but of a mere man. Thereupon the Council of Ephesus (431) laid it down as an article of faith that Mary is really and truly the mother of God. The words of the decree are: "If any one does not confess that Emmanuel is truly God and consequently that the holy Virgin is the mother of God (Θεοτόκον, *Dei genitricem*)—inasmuch as she gave birth in the flesh to the Word of God made flesh, according to what is written: *The word was made flesh*—let him be anathema." This decree was confirmed by several later Councils, e.g., Chalcedon (451) and Constantinople (553). It may be added that this teaching was sanctioned in the English Church, for in the first Book of Common Prayer (1549) Mary is called "mother of Thy Son Jesus Christ our Lord and God," and it is still accepted by many, perhaps most, Anglican divines.

The title ἀεὶ παρθένος (Lat. *semper virgo,* ever virgin, always a virgin), which represents a very early belief in the church, was incorporated in the Creed by the Fifth Ecumenical Council of Constantinople in 553—"qui de coelis descendit et incarnatus de sancta gloriosa Dei genitrice et semper virgine Maria (ἐκ τῆς ἁγίας ευδόξου Θεοτόκον καὶ ἀειπαρθένον Μαρίας) natus est ex ea." The doctrine of Mary's perpetual virginity, that is, that she remained a virgin before, during, and after parturition, was further emphasized by the Lateran Council in 649 and by the Sixth Ecumenical Council of Constantinople in 680. It is indisputably orthodox both in the Eastern and the Western Church. It is not accepted by Protestants in general, and has been the object of severe attack by modern Rationalists and infidel Bible critics.

The principal feasts held in honor of the Blessed Virgin are the Purification, February 2 (February 14 in the Armenian Church); the Annunciation, March 25; the Visitation, July 2; the Assumption, August 15; the Nativity of

Mary, September 8; the Presentation of Mary in the Temple, November 21; and the Immaculate Conception, December 8 (December 9 in the Eastern Church). There are, besides, many minor feasts, some locally celebrated, and others general.

Devotion to the Blessed Virgin has been prevalent in the church from very early times. It received a fresh impetus from the above-mentioned decree of the Council of Ephesus. The relationship of motherhood in which Mary had been declared to stand to God, stamping as authoritative the already existing popular belief, made invocation of her as a powerful intercessor with her divine Son a natural corollary, and devotion to her grew apace. In the Middle Ages it was widespread. In England it was so common and entered to such an extent into practical life that that country was long known as Mary's Dowry. The prominence which Mary had thus attained in Roman Catholic devotions and in popular estimation produced a reaction among the Reformers. They believed indeed in the birth of Christ from a pure virgin, who was consequently to be honored as His mother; but their fundamental position, that the justification and salvation of sinful man are accomplished through faith in Christ alone, caused them to repudiate the idea of a mediator with *the* mediator, of any creature coming as intermediary between the soul and Christ. The inevitable result, among Protestants, was an immediate dethronement of the mother from her high place as intercessor with her Son, and the immediate or later denial and striking away of some of her proudest prerogatives. This change of attitude is made evident, for example, in the first Book of Common Prayer (1549) of the English Church, in which the words of the Sarum rite, "glorious and ever Virgin Mary," are changed to "glorious and most blessed Virgin Mary," and still more evident in the second Book (1552) and in the 15th and 22d Articles of Religion (1553). In some sections the Puritan element in Protestantism carried its feeling against Mary so far as to scruple the singing of the *Magnificat*, and to abandon the public use of the Apostles' Creed because her name occurs in it. Even as recently as 1898 this spirit of opposition to any honor or invocation of Mary succeeded in securing the rejection of the *Stabat Mater* from the *Church Hymnary* and the removal of the words, "Son of Mary," from one of the hymns. Such extremes, however, brought about another reaction. In the 18th century even the Scottish Church introduced the Virgin into the public services in one of its "Paraphrases," in another restored the use of the *Magnificat* in meter, and in recent years authorized the singing of it in prose and the recital of the Nicene and Apostles' Creeds. The English liturgy never abandoned these. Further, it retained, and still retains, in its Calendar, among the "Feasts to be observed," several festivals of the Blessed Virgin. Many Scottish and English divines have written of Mary in terms of great reverence, tenderness, and beauty.

It may be fairly stated that at no time in the history of the Catholic Church have love of Mary and devotion to her been purer or more extensive and intensive than they are at the present day. The Ave Maria is second only to the Lord's Prayer in frequency of use. The Rosary and the Litany of the Blessed Virgin are recited publicly and privately by millions of perso every day. Special hymns composed in h honor, like the *Ave, maris stella*, the *Stab Mater*, the *Alma Redemptoris Mater*, and t English *Daily, daily sing to Mary*, are frequent said or sung. At the end of every low Ma three Ave Marias and the *Salve Regina*, as we as other prayers, are publicly recited in t vernacular by the priest and the congregatio The month of May is dedicated to Mary, a devotions in her honor are publicly conduct every day during that month. Every day October the Rosary of the Blessed Virgin publicly recited. Every Saturday in the year specially dedicated to her. Sodalities establishe in her honor exist in every land. In all this t church, following the teaching of the Fathe and the Councils and especially of the Council Trent (1545–1563), always carefully distinguish between the adoration or supreme homage due God alone and the reverence that may proper be shown to any of His creatures. Epiphani long ago laid down the rule: "Let Mary be he in honor. Let the Father, Son, and Holy Gho be adored, but let no one adore Mary (τ Μαρίαν μηδεὶς προσκυνείτω)." *Latria* is th name given to the adoration of God; *dulia* is th name given to the honor shown to the saints to angels. As Mary is above all saints an angels—"Queen of angels" and "Queen of a saints" she is entitled in her Litany—the degre of veneration shown to her is called *hyperduli* which, while it is greater in degree than *dulia*, infinitely below *latria* and differs in essence fro it. Not every Catholic knows those words; bu every Catholic, no matter how ignorant othe wise, feels and knows the distinction which the connote.

What Christian art owes to Mary it would b well nigh impossible to tell. Painters, sculptor architects, musicians, and poets have outdon themselves in celebrating her praise. (Se MADONNA IN ART.) Shrines in her honor spran up everywhere. In pre-Reformation Englan the country was studded with such shrines, th most celebrated being our Lady of Walsingham in Norfolk. Among modern shrines the famou ones of the Holy House of Loreto in Italy, Ein siedeln in Switzerland, Lourdes in France, an Guadalupe in Mexico may be singled out fo special mention.

It is of interest to note that, by decree of th Sixth Provincial Council of Baltimore (184 confirmed 1847), the Blessed Virgin Mary, con ceived without sin, was chosen as the patron o the United States of America.

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MARY I (MARY TUDOR; often called BLOODY MARY), queen of England: b. Greenwich, Feb. 18, 1516; d. London, Nov. 17, 1558. The daughter of Henry VIII and his first wife, Catherine of Aragon, she was brought up as heir to the throne but was harshly treated by her father after his divorce of Catherine. Mary was even forced to sign a declaration acknowledging the union of her parents to have been illegal and renouncing the authority of the pope. Nevertheless she remained faithful to the Roman Catholic religion, living in retirement, chiefly at Hunsdon and Kenninghall, until the death of Edward VI, her half brother, on July 6, 1553. Despite the efforts of the duke of Northumberland to secure the succession for Lady Jane Grey, Mary had popular support and was proclaimed queen in London on July 19. Her reign was inaugurated by a series of acts of Parliament declaring her legitimacy, restoring the Latin Mass and the celibacy of the clergy, and abolishing the title of supreme head of the church which her father had assumed. New bishops were consecrated, and by December 1554 the reconciliation with Rome was virtually complete. In face of strong popular opposition, in July 1554 Mary married Philip II of Spain. Insurrections broke out, and after the suppression of that in Kent under Sir Thomas Wyatt (Wyat) her half sister Elizabeth (who was to succeed her on the throne) was imprisoned in the Tower of London and Lady Jane Grey and her husband, Lord Guildford Dudley, were executed. A stern persecution of Protestants began in 1555. The queen, embittered perhaps by her early life, by the failure of her marriage, and by bad health, must bear some share of responsibility for the persecutions which brought some 300 persons to the stake during the last three years of her reign. Those who thus perished included the bishops John Hooper, Hugh Latimer, Thomas Cranmer, and Nicholas Ridley. They were not so much victims of Bloody Mary as victims of the abrupt and ill-adjusted return to the old laws against heresy. Under the influence of Philip II, in 1557 England was forced into the existing war between Spain and France. The loss of Calais to the French in 1558, after it had been in the hands of the English for above 200 years, was a disgrace which told acutely upon Mary's already disordered health and proved to be the final blow in an unhappy life.

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MARY II, queen of England, Scotland, and Ireland: b. London, April 30, 1662; d. there, Dec. 28, 1694. She was the daughter of James, duke of York (later James II), and Anne Hyde, his first wife. In November 1677 she was married to William, Prince of Orange, her cousin, and went to live in the Netherlands. After her father ascended the English throne in 1685 she was placed in a difficult position, because he began to show special favor to Roman Catholics and her husband (stadholder of Holland since 1672) was a recognized Protestant leader in Europe. She took the side of William against James at the time of the Revolution in 1688, and in February of the next year followed her husband to England. The pair were proclaimed joint sovereigns, with William III as sole administrator, and were crowned on April 11, 1689. During the absence of William in Ireland in 1690–1691 she managed affairs at home with extreme prudence, and she acted with equal ability as regent in 1693 and 1694. She endowed William and Mary College (q.v.), in Virginia, which was originally intended for the training of missionaries.

MARY (MARY OF MODENA), consort of James II of Great Britain: b. Modena, Italy, Oct. 5, 1658; d. France, May 7, 1718. She was the only daughter of Alfonso IV, duke of Modena, her full name being Maria Beatrice Anne Margaret Isabel d'Este. On Sept. 30, 1673, she was married by proxy to James, duke of York (his second marriage), and joined him in England the same year. There she became extremely unpopular, being regarded as a papal agent, and the birth of her first son (who died in infancy) in 1675 was not welcomed. Her husband ascended the throne in 1685, and when she gave birth to a second son, James Francis Edward (later known as the Old Pretender), in June 1688, it was widely believed that an imposture had been perpetrated. In December 1688, she preceded her husband in flight to France, and there Louis XIV gave them a home at Saint Germain. A daughter, Maria Louisa, was born to her in 1692. After the death of her husband in 1701 she persuaded Louis to recognize her son as the rightful king of England. Her last years were spent in a convent.

MARY, consort of George V of Great Britain: b. London, May 26, 1867; d. there, Mar. 24, 1953. She was only daughter of the duke of Teck (1830?–1900) and Mary Adelaide, daughter

of Adolphus, duke of Cambridge, and the granddaughter of George III. In 1891 she was betrothed to Albert Edward duke of Clarence, eldest son of the prince of Wales (later Edward VII, in succession to his mother, Victoria). He died, however, on Jan. 14, 1892, and on July 6, 1893, she married George, duke of York, his brother. Their six children comprised two who eventually ascended the throne, Edward VIII and George VI; Mary, Princess Royal (1897–); Duke of Gloucester (1900–); Duke of Kent (1902–1942); and Prince John (1905–1919). On the acession of Edward VII in 1901, the duke of York became duke of Cornwall, and before the year closed he was created prince of Wales. George V ascended the throne on May 6, 1910, and Mary was crowned with him as queen consort on June 22, 1911. She was styled queen mother when her sons were on the throne; and dowager queen mother on the accession in 1952 of Elizabeth II, her granddaughter.

MARY (QUEEN OF SCOTS) (MARY STUART), queen regnant of Scotland: b. Linlithgow, Dec. 8, 1542; d. Fotheringhay, Northamptonshire, England, Feb. 8, 1587. She was the only lawful surviving child of James V, her mother being his second wife, Mary of Guise (Mary of Lorraine); through her grandmother, Margaret Tudor (consort of James IV), she was heir to the throne of England after the children of Henry VIII. With her father's death six days after her birth she was proclaimed queen, and on Sept. 9, 1543, she was crowned at Stirling Castle. Negotiations for her betrothal to Edward, Henry VIII's son and later Edward VI of England, came to nothing, and in 1548 she was betrothed to the French dauphin, Francis (later Francis II), and sent to Paris. There she was brought up in the Roman Catholic faith at the French court under the charge of the Guises, the kinsfolk of her mother, who remained in Scotland and ruled on the child's behalf. In 1558 Mary was married to the dauphin, and when he succeeded to the French throne the following year she became his queen consort. Both her mother and her husband died in 1560, and in 1561 she returned to Scotland, which had largely become Protestant through the Reformation.

Yielding to the demands of John Knox, she consented to the maintenance of Presbyterianism, but she was permitted to hear Mass in her private chapel. She was left to fight her own battles and to select a husband from a crowd of suitors, and chose her cousin, Henry Stewart, Lord Darnley, whom she married on July 29, 1565, and on whom she bestowed the title of king. Finding Darnley a broken reed, she gave all her confidence to David Rizzio, her private foreign secretary, who had arranged the marriage but now acquired great political power. With the queen's refusal of Darnley's demand that the crown be secured to him for life and to his heirs, her husband conspired with James Douglas, 4th earl of Morton and other nobles to murder Rizzio. He was dragged from Mary's supper table at Holyrood Palace on March 9, 1566, and hacked to death with daggers.

Mary never forgave her husband, although there was a formal reconciliation three months later after she had given birth to a son (later James VI of Scotland and eventually James I of Great Britain). James Hepburn, 4th earl of Bothwell, assisted her in banishing the murderers of Rizzio, and he was suspected of superintending the subsequent murder of Darnley, whose outrageous behavior had lost him all support in Scotland. On Feb. 9, 1567, when Darnley was lying ill at a house called Kirk 'o Field, near Edinburgh, and Mary was absent attending marriage festivities at Holyrood Palace, the house was blown up and Darnley was found strangled in the yard. Bothwell was merely subjected to a mock trial and acquitted. On April 24 he captured the queen herself, after a barely formal show of resistance, and on May 15, 1567, after he had divorced his wife, Mary married him in a Protestant church. This act turned all the Scottish nobles against her, and on June 15, one month later, their forces faced that of Mary and Bothwell at Carberry Hill. After parley instead of combat, Bothwell escaped and fled the country, while Mary surrendered to the lords, by whom she was imprisoned at Loch Leven Castle where, on July 24, she was compelled to abdicate in favor of her son. Mary escaped from Loch Leven on May 2, 1568, but only a few devoted loyalists gathered to her standard. They were defeated at Langside by the Earl of Moray (Murray) on May 13, and Mary thereupon fled to England.

Elizabeth I, who was guided by policy rather than generosity, almost immediately imprisoned Mary, who was held captive the rest of her life. A commission sat at York, nominally to hear the defense of the Scots lords for their rebellion, actually in order that their charges against Mary might be published. The commission was closed without giving her any opportunity of rebutting their evidence. Roman Catholics subsequently formed plot after plot to liberate her and set her on the throne of England, to which, if the marriage of Anne Boleyn (mother of Elizabeth I) to Henry VIII was really invalid, she had an irrefutable claim on the score of descent.

Each plot was detected, but without investigation of Mary's complicity—for neither her acquittal nor her condemnation would have suited Elizabeth's plans. But when war with Spain had actually been declared in 1586, Elizabeth's secretary, Sir Francis Walsingham, was given a free hand. The strict supervision of Mary's correspondence was ostensibly withdrawn, but really maintained more closely than ever. The plot of Anthony Babington (q.v.) was revealed. At the trial, letters of Mary's were produced which, if genuine, were absolutely damning; but whether the damning parts of them (approving the assassination of Elizabeth) were genuine or forged no man will ever know. Mary was found guilty on October 25, and Parliament demanded her execution. Elizabeth, after efforts at evasion, sealed the death warrant on Feb. 1, 1587. The council, without giving her time to recall it, put it in execution, and Mary was beheaded at Fotheringhay.

Mary was of a dazzling complexion—apparently her main claim to beauty—marvelously winning, and clever in argument—as was evidenced nowhere more plainly than in her trial for treason. The moot point in Mary's tragic history is whether she was a party to Bothwell's murder of Darnley. That she was, is apparently proved by letters (the Casket Letters) from her to Bothwell which the Scottish nobles declared they found in Bothwell's jewel case; but the originals of these letters are not to be found, and their authenticity is doubtful. Irrespective of the authenticity of these letters, Mary's guilty knowl-

edge of the plot against Darnley seems indubitable.

The story of Mary has frequently been utilized in poems and dramas. She figures in Sir Walter Scott's *The Abbot;* is the subject of Johann Schiller's tragedy *Maria Stuart;* of a trilogy of plays by Algernon Swinburne—*Chastelard, Bothwell,* and *Mary Stuart;* and of John Drinkwater's *Mary Stuart.* Björnstjerne Björnson made his reputation as a dramatist with *Mary, Queen of Scots;* she also figures in Maurice Hewlett's novel *The Queen's Quair* and in Maurice Baring's *In My End is My Beginning.*

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MARY, mä-rĭ′, oblast, USSR, in Turkmen SSR, Central Asia, located on both sides of the Murghab River and bordered by Afghanistan. The oblast extends into the Kara Kum (Qara Qum) Desert. Its area is 34,700 square miles.

Cotton is the chief product; wheat and alfalfa are also grown. Goats and karakul are raised in the desert areas. On the upper part of the Murghab River are groves of pistachio trees.

The oblast is crossed by the Trans-Caspian Railroad which passes through the Murghab oasis. Pop. (1946 est.) 350,000.

MARY, mä-rĭ′ (formerly MERV), town, USSR, seat of the oblast, Mary (q.v.), in the Turkmen Soviet Socialist Republic. It is located in the southeastern part of Turkmenistan, in the center of the Mary oasis, on the Murghab River 180 miles east of Ashkhabad. The oasis, some 1,500 square miles in area, is extremely fertile, much of it being irrigated. Besides cotton, which is extensively cultivated, grain crops, sugar, and rice are produced in the oasis. The town is of great antiquity. According to Hindu, Parsi, and Arab tradition it was the ancient Paradise, the original home of the Aryans, and became a great cultural center. In the 4th century it was the seat of a Nestorian archbishopric; and in the 7th the town passed into the possession of the Arabs. The oasis was occupied by the Turks in 1040, and in 1221 it was conquered by the Mongols. Thereafter the ancient town fell gradually into ruins, and the area was possessed successively by Uzbeks, Persians, and Bukhari. The Khivans subjugated the region in 1815, and in 1883 it was occupied by the Russians; a new town soon sprang up on the opposite side of the Murghab. The town was taken by the Bolsheviks on Aug. 22, 1918. Pop. (1939) 37,100.

MARY, feminine Christian name. Its meaning is somewhat doubtful, but its origin is the Hebrew Miriam, generally taken to mean bitterness, though some trace it to the Egyptian Mer Amon, beloved of (the god) Amon.

Owing to its having been the name of the Virgin Mother, it has always been, in Christian communities, a very popular feminine Christian name, while in Roman Catholic countries it is often given to men. The Greek and Latin form is Maria.

MARY MAGDALENE, mâr′ĭ măg-dâ-lē′nē (in Douay Version, MARY MAGDALEN, măg′dâ-lĕn; also, MARY OF MAGDALA, măg′dâ-lâ). In the New Testament, the name of the woman mentioned with others as being healed of evil spirits and ministering to Jesus of her substance. She was present at the crucifixion, and it was to her that Jesus is said to have first appeared after the Resurrection. The name is generally understood as indicating that she was a native of Magdala, on the west shore of the Sea of Galilee. Tradition identified Mary of Magdala with the unnamed penitent (Luke 7:36–50) who anointed Jesus with the spikenard.

MARY OF BURGUNDY, duchess and heiress of Burgundy: b. Feb. 13, 1457; d. March 27, 1482. She succeeded her father, Duke Charles the Bold, in 1477, only to have the duchy seized by Louis XI of France. In order to secure the aid of her Flemish subjects, she thereupon signed the Great Privilege, which restored to the people of the Netherlands the rights and liberties which had been taken from them by her father and grandfather (Duke Philip the Good). She refused the proposal of Louis XI that she marry Charles, the French dauphin, and on Aug. 18, 1477, married Archduke Maximilian of Austria (who became king of Germany in 1486 and Holy Roman emperor in 1493). Their elder son Philip (later Philip I of Spain) succeeded to her domains; and their daughter, Margaret of Austria, married Philibert II, duke of Savoy.

MARY OF FRANCE (MARY TUDOR), consort of Louis XII of France: b. 1496; d. June 24, 1533. She was the daughter of Henry VII of England and Elizabeth of York. In 1508 she was betrothed to Charles, prince of Castile (later Emperor Charles V), but the marriage plans were abandoned in 1514, and on October 9 of that year, when she was 18, she was married at Abbeville, France, to Louis XII, then 52 years old and in poor health. Her husband died on Jan. 1, 1515, and forthwith she contracted a secret marriage with Charles Brandon, 1st duke of Suffolk, who had been for long the man of her choice. Henry VIII was persuaded by Cardinal Wolsey to pardon Suffolk for marrying his sister without royal permission. In 1520 she accompanied the duke to the Field of the Cloth of Gold (q.v.); but she refused to accompany Anne Boleyn, her sister-in-law, in 1532 to a meeting with Francis I of France (who had, himself, planned to marry her after the death of Louis XII). Her daughter Frances married Henry Grey, 3d marquis of Dorset, and became the mother of Lady Jane Grey. Mary of France is also known as Mary of England.

MARY OF GUISE (also known as MARY OF LORRAINE), consort of James V of Scotland: b. Bar, France, Nov. 22, 1515; d. Edinburgh, Scotland, June 11, 1560. She was the eldest child of Claude, duke of Guise, and Annette of Bourbon. On Aug. 4, 1534, she was married to Louis d'Orléans; their son Francis died in 1551. Her husband died in 1537, and in June 1538 she married James V at Saint Andrews. She bore to him two sons, both of whom died in 1541, and a daugh-

ter, Mary, born on Dec. 8, 1542, six days before the death of James V. During the minority of Mary, Queen of Scots, the regency was exercised by James Hamilton, 2d earl of Arran, until 1554, when Mary of Guise became regent on behalf of her daughter. She would not countenance a proposed marriage between Mary, Queen of Scots and Edward VI of England, and sent the young monarch to the French court to be brought up by her relatives. With the aid of French troops she pursued a policy of hostility toward the Protestants in Scotland, whose leaders, known as the Lords of the Congregation, enlisted the help of England. A few months before her death she was compelled to take refuge in Edinburgh castle, which had a neutral status

MARY OF HUNGARY, consort of Louis II of Hungary: b. 1505; d. 1558. She was the daughter of Philip I of Spain and Juana, daughter of Ferdinand V and Isabella, and the sister of Holy Roman emperors Charles V and Ferdinand I. On Jan. 13, 1522, she was married to Louis II, king of Hungary and Bohemia. Her husband died in 1526, and from 1530, under the direction of Emperor Charles V, she was an able administrator of the Netherlands.

MARY OF MAGDALA. See MARY MAGDALENE.

MARY OF MODENA. See MARY, consort of James II of Great Britain.

MARY OF THE INCARNATION, French Ursuline nun and educator in Canada: b. Tours, France, 1599; d. Quebec, 1672. Her maiden name was Guyard. At the age of 18 she was married to a man named Martin; he died within a year, leaving her with an infant son. She entered the Ursuline order in Tours, and subsequently accompanied Mme. de la Peltrie, a church benefactress, to Canada. In 1639 she was appointed superior of the Ursuline convent opened at Quebec. She aided in the work of French missionaries in Canada.

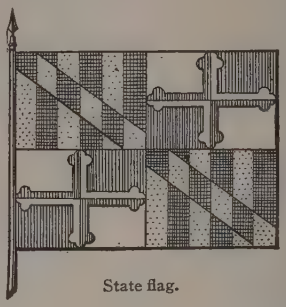
MARY STUART. See MARY (QUEEN OF SCOTS).

MARY TUDOR. See MARY I, queen of England; MARY OF FRANCE, consort of Louis XII of France.

MARYBOROUGH, mâr'ĭ-bŭ-rŭ, name of two towns in Australia. (1) In southeast Queensland, on the Mary River, 135 miles north of Brisbane, about 20 miles from the coast. It is a railroad and coal-mining center, the town containing railroad shops and foundries. Besides coal, there is a considerable trade in livestock, lumber, grains, and sugar. The seaport for Maryborough is at Urangan, 29 miles to the northeast. Pop. (1949 est.) 15,500. (2) Municipality, in the central part of Victoria, in Talbot County, 85 miles northwest of Melbourne. Gold mining is carried on in the vicinity. It is a rail and commercial center for an agricultural area. There are also flour and knitting mills, and dairy plants. Pop. (1949) 6,510.

MARYBOROUGH or **PORT LAOIGHISE,** lā'ĭ-shĕ, Ireland, county town of Laoighis or Leix (formerly Queen's County), on the Triogue River 51 miles by rail southwest of Dublin. There is a considerable trade in agricultural produce. The town's charter dates from 1570. Some portions of an ancient castle still remain. Pop. (1947) 6,198.

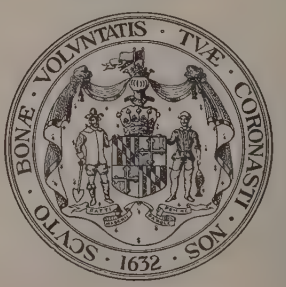
MARYLAND, mĕr'ĭ-lănd, one of the original 13 states of the United States. It is bounded on the north by Pennsylvania and Delaware, on the east by Delaware and the Atlantic Ocean, on the south by Virginia and West Virginia, and on the west by West Virginia. Maryland was named in honor of Queen Henrietta Maria, wife of King Charles I of England.



State flag.

Land area	9,881 square miles
Water area	696 square miles
Total area	10,577 square miles
Latitude	37°53′—39°43′ N.
Longitude	75°4′—79°33′ W.
Altitude	sea level to 3,340 feet
Population (1950)	2,343,001
Capital city—Annapolis; pop. (1950)	10,047
Ratified the Constitution	April 28, 1788
Bird	Baltimore oriole, designated 1947
Flower	Black-eyed Susan, adopted April 18, 1918
Motto—*Scuto Bonae Voluntatis Tuae Coronasti Nos* (With the Shield of Thy Goodwill Thou Hast Covered Us)	
Nicknames	Old Line State; Free State
Song	*Maryland, My Maryland*
Tree	No official tree

State seal: obverse.



State seal: reverse.

MARYLAND

1950 Total Population 2,343,001

Abell (H8) 400
Aberdeen (K2) 2,944
Abingdon (J3) 650
Accident (A7) 242
Accokeek (G6) .....
Adamstown (G6) 265
Aikin (K2) .....
Aireys (K6) 110
Allen (M7) 350
Alta Vista (A4) .....
American Corner (L5) 15
Andrews (K7) .....
ANNAPOLIS (H5) 10,047
Annapolis Jct. (H4). 322
Antietam (D3) 250
Antietam Station (D3) 50
Aquasco (G6) .....
Arbutus (H3) 4,000
Ardmore (C4) 500
Arlington (H3) 71,750
Baden (H6) 150
Baldwin (J3) 350
Balnew (H4) 1,500
Baltimore (H3) 949,708
Barclay (L4) 108
Barnesville (E4) 130
Barstow (H6) 151
Bartholows (F3) 100
Barton (C7) 695
Bayview (L2) .....
Beane (A4) 50
Beaver Creek (D2) .. 50
Bel Air ◉(J2) 2,578
Bel Alton (G7) 250
Bellevue (K6) 300
Beltsville (C3) 800
Benedict (H6) 250
Bengies (J3) 500
Bentley Spgs, (H2) ... 130
Berlin (O7) 2,001
Berwyn (B4) .....
Berwyn Hts. (C4) 674
Bethesda (A4) .....
Bethlehem (L6) .....
Betterton (K3) 314
Big Spring (C2) 125
Bigpool (C2) 175
Bishop (N7) 25
Bishops Head (K7) .. 300
Bishopville (O7) 375
Bivalve (L7) 270
Bladensburg (C4) 2,899
Bloomington (B8) 400
Blythedale (K2) 100
Boonsboro (D2) 1,071
Borden Shaft (C7) ... 419
Boring (G2) 130
Boulevard Hts. (B5) .....
Boweus (H6) 220
Bowie (G4) 860
Boyds (E4) 250
Bozman (J5) .....
Bradbury Hts. (C5) .....
Bradbury Park (C5) 500
Bradshaw (J3) 500
Branchville (B4) .....
Brandywine (G6) 1,000
Breathedsville (C2). 150
◉ County Seat

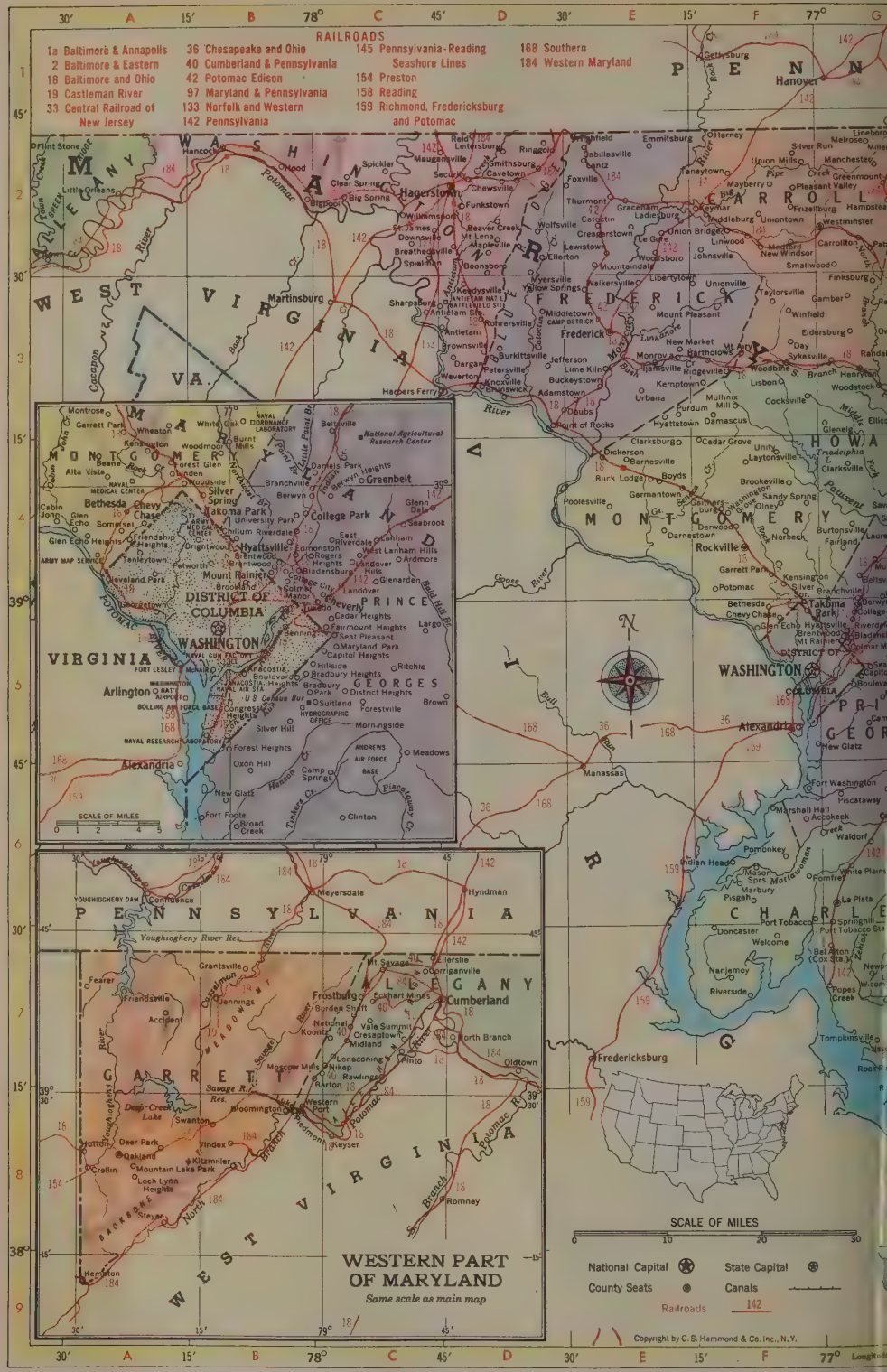
Brentwood (B4) 3,523
Bridgetown (L4) 16
Bristol (H5) 300
Broad Creek (B6) 50
Brookeville (F4) 117
Brookview (L6) 150
Brown (C5) 200
Brownsville (D3) 202
Brunswick (D3) 3,752
Buck Lodge (E4) 100
Buckeystown (E3) ...
Burkittsville (D3) 190
Burnt Mills (B3) 100
Burrsville (L5) 200
Burtonsville (G4) .....
Bushwood (G7) 300
Butler (H2) 57
Cabin Creek (L6) ....
Cabin John (A4) 2,000
California (H7) 250
Calvert (K2) 150
Cambridge ◉(K6) .. 10,351
Camp Spgs. (C6) 315
Capitol Hts. (C5) 2,729
Cardiff (J2) 325
Carney (H3) 1,523
Carrollton (G2) 180
Castleton (J2) 343
Catoctin (E2) 300
Catonsville (H3) 29,638
Cavetown (D2) 300
Cecilton (L3) 510
Cedar Grove (F4) 200
Cedar Hts. (C5) 788
Cedartown (N8) 50
Cedarville (G6) 200
Centreville ◉(K4) 1,804
Chance (L8) 400
Chaptico (H7) 350
Charlestown (L2) 551
Charlotte Hall (H7) 150
Chase (J3) 900
Cheltenham (G6) 500
Cherry Hill (L2) 300
Chesapeake Beach (J6) 504
Chesapeake City (L2) 1,154
Chester (J5) 1,100
Chestertown ◉ (K4) 3,143
Chesterville (L3) 36
Cheverly (C4) 3,318
Chevy Chase (A4) 1,971
Chewsville (D2) 180
Childs (L2) 90
Chillum (B4) .....
Choptank (L6) .....
Church Creek (K6) 187
Church Hill (K4) 271
Churchton (J5) .....
Churchville (J2) .....
Claiborne (J5) 150
Clara (L7) 200
Clarksburg (E4) 367
Clarksville (G4) 200
Clear Spring (C2) 558
Clements (G7) 300
Clinton (C6) 500

Cockeysville (H3) 3,000
College Park (C4) .. 11,170
Collington (G5) .....
Colmar Manor (B4) 1,732
Colora (K2) 190
Compton (H7) 500
Conowingo (K2) 500
Cooksville (F3) 150
Cordova (K5) 500
Cornersville (K6) 100
Corriganville (D7) ...
Cottage City (B4) ... 1,249
Crapo (K7) .....
Creagerstown (E2).. 325
Crellin (A8) 500
Cresaptown (C7) 2,000
Crisfield (L9) 3,688
Crocheron (K8) .....
Crownsville (H4) 350
Crumpton (L4) .....
Cumberland ◉ (D7) 37,679
Damascus (F3) 1,000
Dameron (J8) 250
Dames Quarter (L8) 450
Daniels (G3) 800
Daniels Park (C4) 750
Dargan (D3) 300
Darlington (J2) 500
Darnestown (E4) 200
Davidsonville (H5).. 900
Day (F3) .....
Deal Island (L8) 1,200
Deer Park (A8) 320
Delmar (M7) 1,328
Denton ◉(L5) 1,806
Derwood (F4) 300
Dickerson (E4) 300
District Hts. (C5) 1,735
Doncaster (F7) .....
Doubs (E3) 250
Downsville (C2) 210
Drayden (J8) 300
Dublin (J2) 250
Dundalk (J3) 40,182
Earleigh Hts. (H4) ... 400
Earleville (L3) 42
E. New Market (L6) 264
E. Riverdale (C4) 1,200
Easton ◉(K5) 4,836
Eastport (J5) .....
Eckhart Mines (C7) .. 2,350
Eden (M7) 150
Edgemere (J3) 6,000
Edmonston (C4) 1,190
Eldersburg (G3) 300
Eldorado (L6) 79
Elk Mills (L2) 300
Elkneck (L2) .....
Elkridge (H4) 3,000
Elkton ◉(L2) 5,245
Ellerslie (D7) 850
Ellerton (D2) 41
Ellicott City ◉(G3) .. 1,500
Elliott (L7) 130
Emmitsburg (E2) 1,261
Essex (J3) 35,000
Ewell (K9) 400
Fair Hill (L2) 150

Fairbank (J6) 300
Fairland (G4) .....
Fairlee (K4) 240
Fairmount (L8) 600
Fairmount Hts (C5) 2,097
Fallston (J2) 300
Farmington (K2) 50
Fearer (A7) 50
Federalsburg (L6) 1,878
Ferndale (H4) 2,500
Finchville (M6) 3
Finksburg (G3) 500
Fishing Creek (J7).. 700
Flint Stone (A2) 170
Forest Glen (B4) .....
Forest Hts. (B5) 1,125
Forest Hill (J2) 300
Forestville (C5) 1,500
Fort Foote (B6) 75
Fort Howard (J4) 1,000
Fort Washington (G6) 210
Foxville (E2) 150
Frederick ◉(E3) 18,142
Freeland (H2) 200
Friendship (H6) 300
Friendship Hts.(A4) 315
Friendsville (A7) 607
Frizellburg (F2) 193
Frostburg (C7) 6,876
Fruitland (M7) 1,028
Fullerton (J3) 2,500
Funkstown (D2) 879
Gaithersburg (F4) 1,755
Galena (L3) 259
Galestown (L6) 100
Galesville (H5) 900
Gamber (G3) 600
Gambrills (H4) 500
Garrett Park (A3) 524
Garrison (G3) 1,000
Germantown (E4) 200
Girdletree (N8) 200
Glen Burnie (H4) 8,000
Glen Echo (A4) 356
Glen Echo Hts.(A4) 600
Glenarden (C4) 492
Glenarm (J3) 350
Glenelg (G3) 40
Glenn Dale (C4) 625
Glyndon (G3) 500
Golden Hill (K7) .....
Goldsboro (L4) 198
Golts (L3) 100
Graceham (E2) 325
Granite (G3) 600
Grantsville (B7) 461
Grasonville (K5) 1,200
Greenbelt (C4) 7,074
Greenmount (G2) 200
Greensboro (L5) 1,181
Hagerstown ◉(C2) 36,260
Halethorpe (H4) 5,000
Hall (G5) 195
Hampstead (G2) 677
Hancock (B2) 963
Hanover (G4) 1,000
Harmans (H4) 200
Harney (F2) 142
Havre de Grace (K2) 7,809

Hebbville (G3) 150
Hebron (M7) 723
Helen (H7) 125
Henderson (L4) 106
Henryton (G3) 600
Hereford (H2) 310
Highfield (E2) 1,000
Hillsboro (L5) 179
Hillside (C5) 3,000
Hobbs (L5) 95
Hollywood (H7) 800
Hood (B2) 11
Hoopersville (K7) 300
Hopewell (L8) 200
Howardville (G3) ....
Hudson (J6) 200
Hughesville (G6) 550
Huntingtown (H6) 438
Hurlock (L6) 944
Hutton (A8) 350
Hyattstown (E3) 135
Hyattsville (B4) 12,308
Ijamsville (E3) .....
Ilchester (G4) 200
Indian Head (F6) 491
Ingleside (L4) 150
Ironshire (O7) 100
Ironshire Station (N7) 25
Island Creek (H7) ... 250
Issue (G7) 160
Jacksonville (H2) 75
Jarrettsville (H2) 250
Jefferson (E3) 275
Jennings (B7) 300
Jesterville (L7) 175
Johnsville (F2) 200
Keedysville (D3) 417
Kempton (A9) 260
Kemptown (E3) 200
Kennedyville (L3) 180
Kensington (A4) 1,611
Keymar (F2) .....
Kingston (M8) 50
Kingsville (J3) .....
Kitzmiller (B8) 652
Knoxville (D3) 750
Koontz (B7) .....
La Plata ◉(G6) 780
Ladiesburg (E2) 126
Lakesville (K7) 37
Landover (C4) 1,175
Landover Hills (C4) 1,661
Lanham (C4) 1,133
Landsdowne (H3) 7,500
Lantz (E2) 75
Largo (C5) 100
Lauraville (H3) .....
Laurel (G4) 4,482
Lawsonia (L9) 800
Laytonsville (F4) 132
Le Gore (E2) 400
Leeds (L2) 40
Leitersburg (D2) 250
Leonardtown ◉(H7) 1,017
Leslie (L2) .....
Level (K2) 450
Lewistown (E2) 350
Lexington Park (J7) 6,000
Liberty Grove (K2). 210

MARYLAND


RAILROADS
1a Baltimore & Annapolis
2 Baltimore & Eastern
18 Baltimore and Ohio
19 Castleman River
33 Central Railroad of New Jersey
36 Chesapeake and Ohio
40 Cumberland & Pennsylvania
42 Potomac Edison
97 Maryland & Pennsylvania
133 Norfolk and Western
142 Pennsylvania
145 Pennsylvania-Reading Seashore Lines
154 Preston
158 Reading
159 Richmond, Fredericksburg and Potomac
168 Southern
184 Western Maryland
WESTERN PART OF MARYLAND
Same scale as main map
SCALE OF MILES
National Capital
State Capital
County Seats
Canals
Railroads
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...s are numbered as per ac-
...list, making possible quick
...e identification of each line.

MARYLAND (Continued)

Total Population 2,343,001

Libertytown (E3)..... 600
Lime Kiln (E3)..... 185
Linden (A4).....
Lineboro (G2)..... 200
Linkwood (L6)..... 125
Linthicum Hts. (H4)..3,500
Linwood (F2).....
Lisbon (F3)..... 150
Little Orleans (A2).. 300
Loch Lynn Hts.(A8) 415
Lonaconing (C7).....2,289
Long Green (H3)....
Lothian (H5).....
Love Point (J4)..... 120
Loveville (H7)..... 500
Lower Marlboro (H6) 135
Luke (B8)..... 820
Lusby (J7)..... 225
Lutherville (H3).....2,800
Lynch (K3)..... 97
Mackall (H7).....
Madison (K6).....
Madonna (H2)..... 25
Magnolia (J3)..... 500
Manchester (G2).....1,027
Manokin (L8)..... 400
Mapleville (D2)..... 175
Marbury (F6).....
Mardela Spgs. (L7). 428
Marion Station (M8) 475
Marshall Hall (F8).. 50
Marydel (L4)..... 110
Maryland Line (H2) 202
Maryland Park (C5) 1,500
Mason Springs (F6). 50
Massey (L3)..... 125
Maugansville (D2)... 725
Mayberry (F2)..... 108
Mayo (H5)..... 583
Mc Daniel (J5)..... 197
Meadows (C5)..... 350
Mechanicsville (H7) 500
Medford (F2)..... 125
Melitota (K4)..... 100
Melrose (G2)..... 150
Middle River (J3)....
Middleburg (F2)..... 150
Middletown (E3)..... 936
Midland (C7)..... 889
Milestown (H7)..... 400
Millers (G2)..... 225
Millersville (H4)..... 250
Millington (L3)..... 356
Monie (L8)..... 250
Monkton (H2)..... 105
Monrovia (E3)..... 112
Montrose (A3)..... 200
Morningside (C5)....1,520
Moscow Mills (B7). 300
Mt. Airy (F3).....1,061
Mt. Lena (D2)..... 150
Mt. Pleasant (E3).....
Mt. Rainier (B4)....10,989
Mt. Savage (C7).....2,094
Mt. Vernon (L8)..... 400
Mt. Washington (H3) 4,153

Mountain Lake Park (A8) 891
Mountaindale (E2).. 175
Muirkirk (G4)..... 400
Mullinix Mill (F3).. 25
Myersville (D3)..... 250
Nanjemoy (F7)..... 264
Nanticoke (L7)..... 650
National (C7)..... 348
Neavitt (J6).....
New Glatz (B6)..... 50
New Market (E3).... 301
New Windsor (F2).... 707
Newark (N7)..... 500
Newport (G7).....
Nikep (C7)..... 275
Norbeck (F4)..... 500
Norrisville (J2)..... 100
N. Beach (J6)..... 314
N. Branch (D7)..... 280
N. Brentwood (B4).. 833
N. East (L2).....1,517
Oakland ◉(A8).....1,640
Ocean City (O7).....1,234
Odenton (H4).....1,059
Oella (G3).....1,500
Oldtown (D7)..... 500
Olivet (J7)..... 250
Olney (F4).....1,000
Orangeville (H3)..... 300
Oraville (H7)..... 300
Oriole (L8)..... 268
Owings (H6)..... 230
Owings Mills (G3)...1,500
Oxford (K6)..... 757
Oxon Hill (B6)..... 280
Palmers (H8)..... 300
Park Hall (J8)..... 400
Parkton (H2)..... 500
Parkville (H3).....6,500
Parole (H5).....1,032
Parran (H6).....
Parsonsburg (M7).... 350
Pasadena (H4).....1,500
Patapsco (G2).....
Perry Hall (H3).....1,000
Perryman (K3)..... 300
Perryville (K2)..... 679
Petersville (D3)..... 250
Phoenix (H2)..... 150
Pikesville (G3).....15,000
Piney Point (H8).....1,000
Pinto (C7)..... 275
Piscataway (G6)..... 77
Pisgah (F6)..... 450
Pittsville (N7)..... 497
Pleasant Valley (G2) 170
Plum Point (J6).....
Pocomoke City (M8) 3,191
Point of Rocks (E3) 361
Pomfret (G6)..... 500
Pomona (K4)..... 35
Pomonkey (F6)..... 200
Poolesville (E4)..... 161
Popes Creek (G7)... 75
Port Deposit (K2).....1,139
Port Republic (J6)... 50
Port Tobacco (F6)... 125

Port Tobacco Station (Springhill) (G7). 150
Potomac (F4)..... 250
Powellville (N7)..... 350
Preston (L6)..... 353
Price (L4)..... 245
Prince Frederick ◉ (H6) 500
Princess Anne ◉ (L8) 1,407
Principio Furnace (L2) 250
Providence (L2)..... 300
Purdum (E3)..... 175
Quantico (M7)..... 250
Queen Anne (K5).... 396
Queenstown (K5).... 316
Randallstown (G3)..1,550
Rawlings (C7)..... 500
Reid (D2)..... 50
Reids Grove (L6).... 45
Reisterstown (G3)...1,500
Relay (H4).....1,000
Reliance (L6)..... 30
Revell (J4)..... 100
Rhodes Point (K9).. 150
Riderwood (H3).....
Ridge (J8)..... 400
Ridgely (L5)..... 834
Ridgeville (F3)..... 150
Ringgold (D2)..... 212
Rising Sun (K2)..... 668
Ritchie (C5)..... 200
River Springs (G8).. 300
Riverdale (B4).....5,530
Riverside (F7)..... 150
Rock Hall (K4)..... 786
Rock Point (G7)..... 200
Rocks (J2).....
Rockville ◉(F4).....6,934
Rogers Hts. (C4).....2,000
Rohrersville (D3)..... 165
Roland Park (H3)..12,000
Rosaryville (G5)..... 100
Rosedale (H3).....3,000
Rowlandsville (K2)..
Royal Oak (K6).....
Rumbley (L8)..... 113
Ruthsberg (L4)..... 25
Rutland (H5)..... 300
Ruxton (H3).....
Sabillasville (E2)..... 300
St. Augustine (L3).... 50
St. Inigoes (J8)..... 400
St. James (C2)..... 100
St. Leonard (J7).....
St. Martin's (D7).....
St. Michaels (J5).....1,470
Salem (L7)..... 42
Salisbury ◉(M7)....15,141
Sandy Spring (F4)... 650
Sassafras (L3)..... 100
Savage (G4).....1,238
Savage Station (G4) 25
Scotland (J8)..... 300
Seabrook (C4).....2,500
Seat Pleasant (C5)..2,255
Secretary (L6)..... 344
Security (D2)..... 300
Severn (H4)..... 250

Severna Park (H4)...1,000
Sharpsburg (C3)..... 866
Sharptown (M6)..... 680
Shawsville (H2)..... 50
Shelltown (M9)..... 28
Shipley (H4).....1,500
Showell (O7)..... 100
Silver Hill (B5).....1,000
Silver Run (F2)..... 325
Silver Spring (B4)....
Smallwood (F2)..... 160
Smithsburg (D2)..... 641
Snow Hill ◉(N8).....2,091
Solomons (J7)..... 270
Somerset (A4)..... 430
Sparrows Point (J4) 12,000
Spickler (C2)..... 85
Spielman (C2)..... 202
Springhill (G7)..... 150
Stemmers Run (H3)1,260
Stevensville (J5)..... 350
Steyer (A8)..... 55
Still Pond (K3)..... 290
Still Pond Station (K3) 4
Stockton (N8)..... 500
Street (J2)..... 200
Sudlersville (L4)..... 347
Sudley (H5).....
Suitland (C5).....2,500
Swanton (A8)..... 242
Sweetair (H2)..... 35
Sykesville (F3)..... 941
T. B. (G6)..... 100
Takoma Park(B4).13,341
Taneytown (F2).....1,420
Taylors Island (J7).. 300
Taylorsville (F3)..... 125
Templeville (L4)..... 82
Texas (H3).....
Thomas (J6)..... 200
Thurmont (E2).....1,676
Tilghman (J6).....1,250
Timonium (H3).....1,300
Toddville (K7)..... 330
Tolchester Beach (J4) 4
Tompkinsville (G7). 510
Town Creek (A2)..... 50
Town Point (L3)..... 25
Towson ◉(H3).....11,000
Trappe (K6)..... 325
Trappe Station (K6) 35
Trenton (G2)..... 100
Tunis Mills (K5)..... 100
Tuxedo (C5).....1,000
Tyaskin (L7)..... 150
Union Bridge (F2)... 840
Union Mills (F2)..... 300
Uniontown (F2)..... 265
Unionville (F3)..... 150
Unity (F4)..... 82
University Park(B4)2,205
Upper Fairmount (L8) 824
Upper Falls (J3)..... 200
Upper Marlboro ◉ (H5) 702
Upperco (G2)..... 150
Urbana (E3).....

Vale Summit (C7).... 450
Valley Lee (H8)..... 300
Venton (M8)..... 100
Vienna (L7)..... 414
Vindex (B8)..... 175
Waldorf (G6).....1,100
Walkersville (E3).... 761
Warwick (L3).....
Washington Grove (F4) 400
Waterview (L8)..... 50
Welcome (F7)..... 200
Wenona (L8)..... 300
W. Annapolis (H4)..
W. Lanham Hills (C4) 1,200
W. River (H5).....
Western Port (B8)....3,431
Westminster ◉(G2).6,140
Westover (M8)..... 400
Wetipquin (L7)..... 500
Weverton (D3)..... 150
Whaleysville (N7).... 350
Wheaton (A3).....
White Hall (H2)..... 300
White Marsh (J3)..... 500
White Oak (B3)..... 50
White Plains (G6).... 700
Whiteford (J2)..... 300
Whitehaven (L7)..... 95
Wicomico (G7)..... 225
Willards (N7)..... 464
Williamsburg (L6)... 150
Williamsport (C2)...1,890
Williston (L5)..... 100
Willows (H6).....
Winfield (F3).....
Wingate (K7).....
Wittman (J5).....
Wolfsville (D2)..... 96
Woodbine (F3).....
Woodlawn (H3).....5,000
Woodmoor (B4)..... 500
Woodsboro (E2)..... 427
Woodside (B4).....
Woodstock (G3)..... 100
Woolford (K7)..... 150
Worton (K3)..... 150
Wye Mills (K5)..... 125
Wye Mills Station (K5) 100
Wynne (J8)..... 300
Yellow Springs (D3)
Zion (L2).....

DISTRICT OF COLUMBIA

Anacostia (B5).....
Benning (B5).....
Brightwood (B4).....
Brookland (B4).....
Cleveland Park(A4)
Congress Hts. (B5)..
Georgetown (A5).....
Petworth (B4).....
Tenleytown (A4).....
WASHINGTON, D. C. (B5).....802,178

◉ County Seat

Physical Characteristics. — *Topography.* — The state is divided by Chesapeake Bay into two parts, the Eastern Shore and the Maryland Main or western shore. There are three principal physiographic regions: the coastal plain, the piedmont plateau, and the Appalachian region. The coastal plain encompasses the entire Eastern Shore and the western shore as far inland as the fall line. The fall line may be represented by a line drawn from Washington through Baltimore and Elkton. Between this line and the Blue Ridge Mountains to the westward lies the piedmont plateau. This region, as well as most of the coastal plain, is composed of rich farm lands. The Appalachian region, particularly Allegany and Garrett counties, is rough terrain and not well adapted to agriculture. The highest point in the state is Great Backbone Mountain in Garrett County.

Maryland's geological foundations present a wide spread. The state is part of one of the longest exposed areas of the earth's surface. Tertiary formations predominate on the Eastern Shore, Mesozoic and Tertiary on the western shore coastal plain. In the lower piedmont, crystalline rocks of igneous origin prevail; further west Paleozoic rocks are most frequently found. The Blue Ridge is composed largely of Cambrian and Lower Silurian deposits. The main rocks of the Appalachian chain are of Upper Silurian and Devonian formation. Soils on the Eastern Shore are light loam. On the western shore, sandy loam prevails. Western Maryland soils are derived principally from limestone and sandstone.

Rivers.—Both shores of Chesapeake Bay are broken by rivers which are in reality tidal estuaries. The entire course of the Potomac River, except for that portion in the District of Columbia, is in Maryland. The Susquehanna River enters the head of Chesapeake Bay. Eastern Shore rivers are the Elk, the Sassafras, the Chester, the Choptank, the Nanticoke, the Wicomico, and the Pocomoke. Maryland Main rivers emptying into the bay are the Gunpowder, the Patapsco, the Magothy, the South, the Patuxent, and the Potomac. Tributary from Maryland to the Potomac are the Monocacy, Great Pipe Creek, the Antietam, and the Conococheague. The Youghiogheny alone, a tributary of the Monongahela, drains away from the Atlantic.

Climate.—The mean monthly temperature for Maryland varies from 34°F. for January to 75° for July. The annual mean is 48°F. for the west, 57° for the south, and 54° for the state as a whole. Zero temperatures are rare. The state's mildest climate is found in Worcester, the only county facing upon the Atlantic Ocean; and the most rigorous winter climate comes to Garrett, the westernmost county. Average annual rainfall varies from 25 to 55 inches, with most parts of the state receiving 38 inches or more. Average annual snowfall is 66 inches at Oakland and 16 inches in Easton.

Political Divisions.—*Cities and Counties.*—Baltimore City is the center of Maryland's culture and economy. It is an old city, built largely without plan, and too absorbed with its thriving industry to give adequate attention to its civic and physical needs. It is picturesque and, in many ways, unique. Characteristic are the highly-scrubbed white stone steps of the countless row houses. Baltimore Street has been called the "character" street, and Charles the "quality" street. Mount Vernon Place, a small park in the middle of Charles Street leading up to the Washington Monument, is as well designed a bit of town planning as one may find. The Washington Monument is a towering monolith with a stairway inside and a gallery at the top. The city is a mecca for those interested in the arts. Early in the last century it rivaled New York as a theatrical center. Today the music department of Peabody Institute, known as the Conservatory, is the center of most musical activity. The Walters Art Gallery, donated to the city in 1931 is one of the best of its kind. The city, as well as the whole state, is noted for its good cookery. Oliver Wendell Holmes dubbed it "the gastronomic metropolis of the Union." The city's metropolitan character is in the clearest evidence when one sees its harbor. Here one has little doubt that he is visiting a great industrial city.

The seat of Baltimore County is Towson, an unincorporated suburb of Baltimore City. There is an intense county consciousness throughout Maryland. Near Baltimore the towns are suburban in composition, but many of them are distinctive. Ellicott City, built in a narrow valley, reminds one of a European city. Away from Baltimore and Washington, most of the villages are quaint and quiet. The state's second city is Cumberland, the seat of Allegany County. It is built on the mountains where they are divided by the Potomac. The city's economy is sustained by lumber, coal, and the surrounding regions of Maryland, West Virginia, and Pennsylvania. Hagerstown, the seat of Washington County and the third city in size, was laid out by Jonathan Hager in 1762. It is in a fertile farming area and contains numerous industries. Near Hagerstown is Antietam Battle Ground National Park. Also in Washington County is the place where the Potomac and the Mason-Dixon Line almost meet, leaving the state scarcely two miles wide. Frederick and Montgomery counties in central Maryland contain rich farm lands. The town of Frederick boasts the Barbara Fritchie House and the home of Roger Brooke Taney. Thomas Johnson, the first governor of Maryland, lived in Frederick.

Prince Georges and Montgomery counties border upon the District of Columbia. The existence of the federal district has greatly stimulated the surrounding areas in Maryland. The towns of Cheverly, Bladensburg, Hyattsville, Riverdale, College Park, Mount Rainier, Takoma Park, Silver Spring, Bethesda, and others are clearly a part of the metropolitan community. Many federal institutions, such as the Naval Academy at Annapolis, the model housing community at Greenbelt, and the Navy Hospital at Bethesda, have contributed marked impetus to economic life. Southern Maryland, south from Annapolis and away from the Washington-Baltimore strip development, is the least changed part of the state. The people are almost exclusively English in origin, and there is a strong element of old aristocracy. Annapolis, the capital, is one of the most individual small towns in America. Its population, according to one observer, is composed of five parts: state politics, navy, county, St. John's College, and plain townspeople.

The Eastern Shore is a place apart. Its people are vigorous, unbeholden, and keenly conscious of politics. Its economic expansion began when the refrigerator car became practical, and has continued steadily. Salisbury is the principal city and distributing point: it is the region's true

economic center. Worcester is the ocean county. Ocean City, Maryland's seaside resort, is patronized principally by Marylanders. Cambridge, on the Choptank, is the shore's second city; sizable packing and processing industries are maintained there. Crisfield lays its claim as the "Seafood Capital of the World." Smith Islanders, who inhabit a group of islands off the coast from Crisfield, are individualists par excellence. Elkton, near the head of the bay, was formerly known as a place to marry in haste; legislation enacted in 1938, however, requires a notice of 48 hours. The Eastern Shore is connected to the Maryland Main by ferries to Baltimore and Annapolis See back of state map for population of cities and towns.

Maryland architecture has been conservative. The formal Georgian influence is clearly evident. The ground rent system and other factors have led to the building of numerous row houses in Baltimore and to a lesser extent in other Maryland cities. Throughout the state there are many beautiful old houses. One of the best examples of architecture of the period of George III is the Hammond-Harwood house in Annapolis. Another famous old Annapolis house is the Chase Home, built by Samuel Chase in 1769. Doughoregan Manor in Howard County was built by Charles Carroll of Carrollton. A charming piece of architecture is Homewood on the Johns Hopkins campus in Baltimore; it was built by Charles Carroll of Carrollton for his son in 1800. Not far from Easton is Wye House, the leading old house on the Eastern Shore. At Wye Mills in Talbot County is the Wye Oak, estimated to be four hundred years old. Not far way is Wye Chapel, consecrated in 1721. Many other old houses have been preserved on the Eastern Shore and in southern Maryland.

The state's 23 counties and their county seats are as follows:

County	County Seat
Allegany	Cumberland
Anne Arundel	Annapolis
Baltimore	Towson
Baltimore City	
Calvert	Prince Frederick
Caroline	Denton
Carroll	Westminster
Cecil	Elkton
Charles	La Plata
Dorchester	Cambridge
Frederick	Frederick
Garrett	Oakland
Harford	Bel Air
Howard	Ellicott City
Kent	Chestertown
Montgomery	Rockville
Prince Georges	Upper Marlboro
Queen Annes	Centerville
St. Marys	Leonardtown
Somerset	Princess Anne
Talbot	Easton
Washington	Hagerstown
Wicomico	Salisbury
Worcester	Snow Hill

The People.—Only six states in 1950 had a denser population than Maryland. In 1940, 83.4 per cent of the state's population was white and 16.6 per cent was Negro. The percentage of other races was negligible. Native born Americans constituted nearly 96 per cent of the state's population. Most of the foreign-born lived in Baltimore City and Baltimore County. Of all native Marylanders living in the United States in 1940, 20.4 per cent were living in other states; on the other hand, 25.1 per cent of the residents of Maryland were born in other states. Maryland population continues to grow; in the 1920's it increased by 12.5 per cent, in the 1930's by 11.1 per cent, and in the 1940's by 521,757 inhabitants (28.6 per cent) to a total of 2,343,001. The percentage of urban residents in 1950 was 69 and of rural residents, 31.

It is difficult to characterize the people of a state in a nation with a population as fluid as that of America. And yet the Marylander feels the distinction. Perhaps Hulbert Footner in his book *Maryland Main and the Eastern Shore,* was right in ascribing this individuality to toleration and tobacco—toleration is traditional in Maryland and pipe smokers are a mellow sort of men. Pride in the state's history, its old houses, and its traditions is everywhere apparent. The spirit of localism is a moving force in Maryland. It is not without significance that Maryland's nickname "Free State," originating in the 1920's, has become widely used.

The pattern of Maryland culture clearly was set by the English. Besides those of English ancestry, the largest group of Maryland citizens is the Negroes. Slavery was a flourishing institution in early Maryland, but its incidence diminished after tobacco ceased to be a profitable crop. The leading Maryland abolitionist was William Lloyd Garrison, who published the paper, *The Genius of Universal Emancipation,* in Baltimore in 1829. Segregation of Negroes is not so general in Maryland as in other places. There is no segregation in transportation. Separate schools are maintained for Negroes. Segregation is effected by custom in housing, restaurants, hotels and theaters. Negroes play little part in Maryland politics. The proportion of Negroes to total Maryland population is now considerably smaller than it was at the time of the first federal census. Other national stocks which have served as a base for present-day Maryland are the Irish and Germans. The Irish settled principally north and east of Baltimore. Although Germans came from the earliest days, the greatest numbers arrived in the first half of the 19th century. German immigration, especially to Baltimore and central Maryland, had a marked effect. Indeed, the constitution of Maryland, until amended in 1944, provided for the advertisement of proposed constitutional amendments in a German-language newspaper in Baltimore. Other nationalities which have contributed in lesser measure to Maryland are French, Polish, Czech, Italian, Russian, and Lithuanian.

Religion.—Although there has been religious toleration in Maryland from the beginning, there have been several developments affecting it. The earliest settlers were Catholics, but toleration for all Christians was the rule. Catholicism was outlawed briefly under the Puritan regime. The Church of England was established in 1692, and supported by a poll tax; the established church was continued until 1776, although other religions were tolerated. It was during this period that legislation was passed requiring the marriage ceremony to be religious; this requirement continues today (1948). Official religious intolerance finally was dealt its death blow in 1825, when the oath of public office was amended to permit Jews to hold office. The Catholic Church has been strong from the earliest days. The Right Reverend John Carroll was consecrated as bishop of Baltimore in 1789, and his see was raised to an archbishopric in 1808. He was the first prelate to hold episcopal office in the Roman Catholic

hurch in the United States. Maryland church emberships, according to the religious census of 936, are in some respects unique. Catholics held 5.2 per cent of the state's church memberships, compared with a national average of 35.7 per nt. In Baltimore City, 52.3 per cent of the urch memberships were Catholic, and in the nall county of St. Marys 87 per cent belonged to at church. The Methodist Episcopal Church as second largest in memberships. The first ethodist services held in the United States were nducted by Robert Strawbridge in Carroll unty in 1761. In 1936, 17.3 per cent of Maryand church memberships were held in the various anches of this church. The Lutheran Church likewise strong in Maryland. The German-eaking settlers of the middle 18th century ought this church to the state. In 1936, 75 per nt of all Maryland Lutheran church member-ips were held in Frederick and Washington unties and Baltimore City. Quite numerous so are Protestant Episcopal church member-ips. The Right Reverend Samuel Claggett was nsecrated in 1789 as bishop of Maryland, the st Protestant Episcopal bishop in the United ates. The preponderance of Jewish church mberships are held in Baltimore City and ltimore County. Other sizeable church mem-rships in 1936 (latest official census) were held the Presbyterian, Southern Baptist, Evangeli-, and Reformed, and Negro Baptist churches. mberships in the latter were concentrated in ltimore City.

Famous Men and Women.—Thomas Stone harles County, 1743–1787), Samuel Chase omerset County, 1741–1811), William Paca ear Abingdon, 1740–1799), and Charles Carroll Carrollton (Annapolis, 1737–1832), were all ners of the Declaration of Independence. miel of St. Thomas Jenifer (Charles County, 3–1790) was a pre-Revolutionary leader and ner of the Constitution of the United States in 7. A few of the native Marylanders who de names for themselves in the United States vernment are: Roger Brooke Taney (Calvert unty, 1777–1864), United States attorney gen-l and chief justice of the United States Su-me Court; William Pinkney (Annapolis, 1764–2), lawyer, statesman, and diplomat; Reverdy nson (Annapolis, 1796–1876), constitutional wyer and diplomat; Charles Joseph Bonaparte altimore, 1851–1921), lawyer, United States orney general; and William Wirt (Bladens-g, 1772–1834), lawyer, United States attorney neral, and also author of the best seller, *The ters of a British Spy.*

Among the state's better known authors may found: Henry Louis Mencken (Baltimore, 0–), editor and satirist, modern Maryland's st important literary figure; Francis Scott Key rederick County, now Carroll County, 1779–3), lawyer, and author of *The Star-Spangled ner;* Mason Locke Weems (Anne Arundel unty, 1759–1825), clergyman and author, often ed Parson Weems; John Leeds Bozman (Tal-County, 1757–1823), historian and lawyer; n Pendleton Kennedy (Baltimore, 1795–1870), elist; Lizette Woodworth Reese (Baltimore unty, 1856–1935), author of autobiographical ks and volumes of poetry; Upton Beall Sin-r (Baltimore, 1878–), writer and politician, rded Pulitzer Prize in 1943 for *Dragon's th;* James Mallahan Cain (Annapolis, 2–), journalist, author of *The Postman Always Rings Twice;* Charles Fulton Oursler (Baltimore, 1893–1952), journalist, playwright, and fiction writer; Frederick Arnold Kummer (Catonsville, 1873–1943), writer of fiction and plays; Ryder Randall (Baltimore, 1839–1908), journalist and song writer, author of *Maryland, My Maryland.*

A few native Marylanders in the field of art are: Charles Willson Peale (Queen Annes County, 1741–1827), portrait painter; James Peale (Chestertown, 1749–1831), miniaturist; Raphael Peale (Annapolis, 1774–1825), miniaturist and painter of still life; Charles Yardley Turner (Baltimore, 1850–1918), outstanding muralist; Camelia Whitehurst (Baltimore, 1875–1936), known for her portraits of children; R. McGill Mackall (Baltimore, 1889–), muralist and portrait painter; and William Henry Rinehart (near Union Bridge, 1825–1874), sculptor.

Several of the leading figures in American Negro history were natives of Maryland. Benjamin Banneker (1736–1806), mathematician, published an almanac in 1792 and became known in Europe as an astronomer. Frederick Douglass (1817?–1895), born a slave on an Eastern Shore plantation, became an abolitionist, orator, journalist, and served as minister to Haiti. Harriet Tubman (1821?–1913) was a fugitive slave, abolitionist, and the foremost leader of the Underground Railroad. Francis E. Watkins Harper (1825–1911) was born of free parents in Baltimore. She was well known as a poet, novelist, lecturer, and abolitionist leader.

Natural Resources.—*Flora.*—Wild flowers most frequently found are clematis, honeysuckle, Virginia creeper, trailing arbutus, violets, wild roses, mountain laurel, clover, black-eyed Susan, golden aster, and goldenrod. There is very little virgin timber. Black and white oak and beech are sometimes found in pure stands, but more often in mixed forest. Other trees are poplar, locust, hickory, ash, gum, elm, hackberry, persimmon, pine, spruce, and hemlock.

Fauna.—Most large mammals have disappeared, although there are perhaps some bobcats and bear in the mountains. Deer, foxes, opossums, raccoons, squirrels, and rabbits are found in various places in the state. The seventeen-year locust and the Japanese beetle are the most destructive insects. The only poisonous snakes in Maryland are the timber rattler and the copperhead. The diamondback terrapin is plentiful on the Eastern Shore. Water and shore birds are abundant in the Chesapeake Bay region and many kinds of ducks frequent the state's waters. The Chesapeake Bay retriever, used for hunting waterfowl, is a native Maryland breed. Bald eagles, hawks, herons, and owls are frequently found. The principal song birds are the orioles, thrushes, finches, warblers, and whippoorwills.

Minerals.—See section under *Production and Manufactures.*

Parks, Forests, and Refuges.—*Parks.*—Fort McHenry National Monument, with an area of 47 acres, was made a national park in 1925. The Francis Scott Key Monument, near the Fort Avenue entrance to the park, commemorates the birthplace of the *Star-Spangled Banner.* The Antietam National Battlefield and cemetery, with an area of about 183 acres, commemorate one of the most sanguinary one-day battles of the Civil War (Sept. 17, 1862). The Catoctin Recreational Area contains approximately 12,000 acres and is a project of the federal government

The state parks include Fort Frederick (188 acres), erected in 1756 for defense against the French and Indians; Patapsco State Park (1,116 acres), wooded hills and a favorite camping spot; and the Washington Monument State Park (32 acres), which contains a copy of an earlier monument built in 1827 and used as a Union signal station.

Forests.—There are no national forests in Maryland, but there are state forests. Their names and acreage are: Cedarville, 3,510; Elk Neck, 3,762; Green Ridge, 22,016; Pocomoke, 1,732; Potomac, 10,564; Savage River, 17,825; and Swallow Falls, 5,905.

Refuges and Fish Hatcheries.—The Bear Creek Fish Hatchery is run by the state conservation department and stocks Maryland streams with brook and rainbow trout. The largest fish hatchery in Maryland is the one located at Lewistown. The Patuxent Wildlife Research Refuge is administered by the United States Fish and Wildlife Service and covers about 2,623 acres. Established by the federal government in 1931, Blackwater Migratory Bird Refuge contains approximately 10,500 acres of marsh situated on the Big and Little Blackwater rivers. Quail are raised at the Wicomico State Game Farm.

Production and Manufactures.—*Agriculture.*—There were in 1940, 42,110 farms in Maryland. Of these, 10,994, or 26.1 per cent, were operated by tenants, and the rest by full owners, part owners, or managers. The average size of the 1940 Maryland farm was 99.7 acres, somewhat smaller than that of thirty years before. The value of the average Maryland farm was $6,506 in 1940 as compared with $4,941 in 1910. The staple crop in colonial Maryland was tobacco. Shortly after the Civil War, it declined in relative importance, and now is grown almost exclusively in southern Maryland. The leading acreage in farm plantings for many years has been in corn, although the number of acres declined steadily in the decades before 1940. The second largest acreage is devoted to wheat. Next comes hay, as might be expected in the dairy farm region surrounding large cities. Oats, barley, and rye are also extensively planted in the state. In the vegetable crops, the largest acreage is planted in tomatoes. Next in order of acreage planted in 1939 came sweet corn, Irish potatoes, beans, sweet potatoes, peas, canteloupe, watermelons, cucumbers, and spinach. The acreage planted in Irish potatoes declined considerably in the three decades preceding 1940. The same is true of cherries and grapes, while the production of apples and peaches steadily increased. Large quantities of strawberries are raised in the Chesapeake Bay region. There had been a decline since 1910 in the number of horses and sheep raised in Maryland, while the number of cattle and chickens had grown. Wool production was reduced by more than half in the three decades before 1940, whereas the production of milk and eggs increased rapidly.

Practically all areas of Maryland are well adapted to farming except the swamp areas of Dorchester County and the mountains of western Maryland. Frederick County (as of 1947) produces more wheat, hay, milk, and livestock. Carroll County leads in corn and poultry. The Eastern Shore concentrates on truck farming and canning. Somerset County raises more strawberries, and Somerset and Worcester produce most of the state's Irish potatoes. Wicomico County raises more sweet potatoes than any other county. Dairy farming is the principal agricultural pursuit in Baltimore, Harford, and Montgomery counties. In general, agriculture in Maryland is profitable. Land is fertile, huge markets are near, and both rail and water transportation are easily accessible. All state agriculture agencies are concentrated at the University of Maryland The university's Board of Regents serves also as the state board of agriculture. The agricultural experiment station operated by the United States Department of Agriculture at Beltsville is one of the largest of its kind.

Fisheries.—Seafood is a thriving business in Maryland. Principal fish caught in the bay are shad, menhaden, croakers, sturgeon, and sea trout. Shellfish are oysters, crabs, and clams, ranging in supply in the order named. State conservation officials have been concerned with supply and artificial culture, particularly of oysters.

Forests and Forest Products.—There is practically no virgin timber left in Maryland. Lumber and lumber products have definitely contributed much toward the development of the state's economy. There are some hardwoods in Maryland, particularly oak. Chestnut and walnut have almost disappeared.

Minerals.—Maryland is not a leading state in mineral production. In 1939 Maryland ranked thirty-third among the states in the value of mineral industry products. The leading products were coal and sand and gravel, constituting between them 75 per cent of the value of the total product. Other minerals produced were limestone, granite, basalt, sandstone, slate, marble, kaolin, clay, shale, and asbestos. Of the 142 active mining concerns in the state, 59 were in Allegany County and 25 were in Garrett County. These two counties contain the Maryland coal deposits. Most Maryland coal miners are of native American stock, and there are few typical mining camps. Large mineral industries are located in Baltimore, particularly steel mills and copper smelting and rolling; most of the minerals processed, however, are shipped in from outside the state.

Manufactures.—By far the greater portion of Maryland's manufacturing industry is located in Baltimore. There is extensive vegetable canning and processing on the Eastern Shore. Cumberland has a large Celanese plant and a tire factory. In Hagerstown there is an aircraft plant and a sizable machine tool industry. It is in Baltimore that nearly 90 per cent of the state's manufacturing is concentrated. The city's industries, already thriving, received tremendous impetus from the two world wars. Almost every kind of manufacturing has come to Baltimore. The Baltimore establishments of the American Smelting and Refining Company (copper), the Bethlehem Steel Company, and the Glenn L. Martin aircraft enterprises are among the largest of their kind. Shipbuilding, one of the state's earliest industries, still is thriving. Large factories are devoted to oil refining, spice manufacture, sugar refining, meat packing, and canning. Clothing made in Baltimore is sold throughout the nation. A large distillery and a large Western Electric plant are located near the city's outskirts. Other products are chemicals, fertilizer, machinery and machine tools, and printing. As in any other thriving metropolis, building and construction concerns employ more persons than does any other branch of industry. In addition to its tremendous factory

product, the city ranks high in the nation as a wholesale and retail mart.

Transportation.—Two factors have largely shaped the development of Maryland's transportation system. First is the existence of Chesapeake Bay, which has made available cheap water transportation. Second is the fact that the main line of rail traffic southward from New York transverses the state. Both the Baltimore and Ohio and the Pennsylvania railroads operate main lines from New York to Washington, by way of Baltimore. The Baltimore and Ohio also swings westward to serve western Maryland. The Western Maryland Railway also serves that section. The Pennsylvania operates down the Eastern Shore. There are many bus lines serving all parts of the state, with all lines converging in Baltimore and Washington. The main airlines serving the state at Washington and Baltimore are Pennsylvania-Central, Eastern, and American. At Baltimore, ships can come farther inland than at any other port on the eastern seaboard. Baltimore is the second leading port in the United States. There are ferries plying across the bay, and regular steamboat connections are maintained with Wilmington, Philadelphia, and other ports. The port of Baltimore has some 350 wharves and piers.

Economic and Financial Factors.—*Banks.*—As of June 30, 1947, there were 106 state banks and trust companies. The total assets of these banks were $916,050,309.79 and the total deposits, $845,674,692.05. At the same time there were 9 mutual savings banks in operation. Their total assets were $436,173,535.81 and total deposits, $391,873,195.00. As of Dec. 31, 1946, there was a total of 63 national banks, with total assets of $753,889,000 and total deposits of $703,772,000.

Finances.—Following is a statement of finances for the fiscal year 1946–47:

Balance in state treasury, beginning of fiscal year 1946–47	$ 33,998,718.47
Receipts, all sources, 1946–47	93,286,760.21
Total	$127,285,478.68
Disbursements, 1946–47	96,746,063.21
Balance, beginning of fiscal year 1947–48	30,539,415.47
State indebtedness on June 30, 1947, totaled	16,895,000.00

Taxation.—Tax collection is not centralized. The principal sources of revenue are the income tax, the property tax, racing taxes, licenses, and the sales tax, effective July 1, 1947. There is no poll tax.

Government.—Maryland has been a political entity for over 300 years. Still in use is its capitol building which was built before the Revolutionary War. The present constitution, the state's fourth, dates from 1867. By its provisions, the question of a new constitutional convention is submitted to the voters each twenty years. Initiative is not used, and referendum is used only for constitutional amendments and, upon petition, for approval or nullification of any act of the General Assembly not involving an appropriation.

Executive.—The principal policy branches of the government are the governor and the General Assembly. Elections are held in even-numbered years in which there is not a presidential election. The governor is elected for four years and is indefinitely re-eligible. Governor Albert C. Ritchie served for four terms. The governor's inauguration is the second Wednesday in January following his election. There is no lieutenant governor, succession going to the president of the Senate and the speaker of the House of Delegates. The governor is assisted by an advisory council composed of the principal elected and appointed department heads. The governor's veto of legislation may be overridden by a vote of three fifths of the members elected to each house. Although the political and executive capital is Annapolis, the administrative capital is Baltimore. Practically all of the state's extensive administrative establishments are maintained in the larger city.

The following is a list of the state governors:

LORDS PROPRIETARY OF MARYLAND

Cecilius Calvert, 2d Lord Baltimore	1632–1675
Charles Calvert, 3d Lord Baltimore	1675–1715
Benedict Leonard Calvert, 4th Lord Baltimore	1715
Charles Calvert, 5th Lord Baltimore	1715–1751
Frederick Calvert, 6th Lord Baltimore	1751–1771
Henry Harford	1771–1776

PROPRIETARY GOVERNORS OF MARYLAND

Leonard Calvert	1634–1647
Thomas Greene	1647–1649
William Stone	1649–1654
Commissioners. Settlers appointed by Parliamentary Commissioners or by Provincial Court	1654–1658
Josias Fendall	1658–1660
Philip Calvert	1660–1661
Charles Calvert	1661–1676
Cecilius Calvert	1676
Thomas Notley	1676–1679
Charles, 3d Lord Baltimore	1679–1684
Benedict Leonard Calvert	1684–1688
William Joseph (president of council)	1688–1689
Protestant Associators	1689
Convention of Freemen and John Coode, Commander in chief	1689–1690
Nehemiah Blakistone	1690–1692

ROYAL GOVERNORS

Sir Lionel Copley	1692–1693
Sir Thomas Lawrence	1693
Sir Edmund Andros	1693–1694
Col. Nicholas Greenbury	1694
Sir Thomas Lawrence	1694
Francis Nicholson	1694–1699
Nathaniel Blakistone	1699–1702
Thomas Tench	1702–1704
John Seymour	1704–1709
Edward Lloyd	1709–1714
John Hart	1714–1715

PROPRIETARY GOVERNORS (RESTORED)

John Hart	1715–1720
Charles Calvert	1720–1727
Benedict Leonard Calvert	1727–1731
Samuel Ogle	1731–1732
Charles, 5th Lord Baltimore	1732–1733
Samuel Ogle	1733–1742
Thomas Bladen	1742–1747
Samuel Ogle	1747–1752
Benjamin Tasker	1752–1753
Horatio Sharpe	1753–1769
Robert Eden	1769–1776
The Convention and Council of Safety	1776–1777

STATE GOVERNORS OF MARYLAND

Thomas Johnson		1777–1779
Thomas Sim Lee		1779–1782
William Paca		1782–1785
William Smallwood		1785–1788
John E. Howard	Federalist	1788–1791
George Plater	"	1791–1792
James Brice	"	1792
Thomas Sim Lee	"	1792–1794
John H. Stone	"	1794–1797
John Henry	"	1797–1798
Benjamin Ogle	"	1798–1801
John F. Mercer	Republican	1801–1803
Robert Bowie	"	1803–1806
Robert Wright	"	1806–1809
Edward Lloyd	"	1809–1811
Robert Bowie	"	1811–1812
Levin Winder	Federalist	1812–1815
Charles Ridgely of Hampton	"	1815–1818
Charles Goldsborough	"	1818–1819
Samuel Sprigg	Republican	1819–1822
Samuel Stevens, Jr.	"	1822–1825
Joseph Kent	"	1825–1828
Daniel Martin	Anti-Jackson	1828–1829
Thomas K. Carroll	Jackson-Democrat	1829–1830
Daniel Martin	Anti-Jackson	1830–1831

George Howard	Whig	1831–1833
James Thomas	"	1833–1835
Thomas W. Veazey	"	1835–1838
William Grayson	Democrat	1838–1841
Francis Thomas	"	1841–1844
Thomas G. Pratt	Whig	1844–1847
Philip Francis Thomas	Democrat	1847–1850
Enoch Louis Lowe	"	1850–1853
Thomas Watkins Ligon	"	1853–1858
Thomas Holliday Hicks	American	1858–1862
August W. Bradford	Unionist	1862–1865
Thomas Swann ...Unionist, later	Democrat	1865–1868
Oden Bowie	Democrat	1868–1872
William Pinkney Whyte	"	1872–1874
James Black Groome	"	1874–1876
John Lee Carroll	"	1876–1880
William T. Hamilton	"	1880–1884
Robert M. McLane	"	1884–1885
Henry Lloyd	"	1885–1888
Elihu E. Jackson	"	1888–1892
Frank Brown	"	1892–1896
Lloyd Lowndes	Republican	1896–1900
John W. Smith	Democrat	1900–1904
Edwin Warfield	"	1904–1908
Austin L. Crothers	"	1908–1912
Philips L. Goldsborough	Republican	1912–1916
Emerson C. Harrington	Democrat	1916–1920
Albert C. Ritchie	"	1920–1935
Harry W. Nice	Republican	1935–1939
Herbert R. O'Conor	Democrat	1939–1947
William Preston Lane	"	1947–1951
Theodore R. McKeldin	Republican	1951–

Legislature.—The General Assembly meets on the first Wednesday in January of odd-numbered years. Members of both houses serve for four years. There is one senator from each of the 23 counties and from each of the six legislative districts in Baltimore City, a total of 29. The House of Delegates is composed of six delegates from each of the Baltimore City districts and of two to six delegates from each county, a total of 123. The chambers are equal in power, and the governor, especially when he is a Democrat, exercises a substantial leadership in legislative matters. The General Assembly is assisted by the department of legislative reference. It is at the service of the governor, any committee or member of the General Assembly, or the head of any state department. Its regular establishment is in the City Hall at Baltimore, where it serves the city as well as the state. During legislative sessions it maintains an office in Annapolis to be available for bill drafting. The director of the department is secretary of the legislative council. The legislative council is composed of ten senators and ten delegates who function between sessions of the legislature to study and recommend new legislation. The council's recommendations carry great weight in the assembly, frequently even on controversial issues.

The comptroller and the attorney general are popularly elected. The treasurer is chosen by the General Assembly. Other state administrative officials are appointed. Although there was substantial administrative reorganization under Governor Ritchie in 1922, boards and commissions are still more numerous than is the case in most other states. The state service operates under a merit system of long standing and universal acceptance. There is also an active state planning commission. Budgeting and central purchasing are performed by the department of budget and procurement.

Public Health and Welfare.—Programs in the fields of health and welfare are operated by the state in the counties. Unemployment and industrial accident insurance programs are well devised. Eleemosynary and correctional institutions are concentrated principally in the piedmont and western shore areas.

Courts.—The administration of justice is performed in the 23 counties by seven circuit courts. At the same level in Baltimore City is the supreme bench of 11 judges. There are four appellate circuit courts, one of which serves Baltimore City alone, and the high court, the court of appeals at Annapolis. Judges are elected for long terms.

Elections.—The state is usually (1947) Democratic rather than Republican. There have been only two Republican governors of Maryland since 1900, and these for single terms. Two counties, Allegany and Garrett, are nearly always Republican. There is usually also a strong Republican vote in Anne Arundel, Baltimore, Carroll, Frederick, Montgomery, Somerset, and Washington counties. Although it does occasionally elect a Republican mayor, Baltimore City is predominantly democratic. In President Franklin D. Roosevelt's last campaign, sixteen of the state's twenty-three counties went Republican. Of the large counties, only Prince Georges went Democratic. And yet the large Democratic majority in Baltimore City carried the state comfortably for Roosevelt. Of the state's six congressmen, seldom more than one is Republican. Both houses of the legislature are traditionally Democratic, although the Republican minority is usually large enough to make itself felt. Republican governors find it difficult to accomplish a full measure of legislative leadership. Party candidates are nominated in primaries, with run-off primaries in the absence of a majority. Voting machines are used in Baltimore City.

Local.—Local government is extensively controlled by the state. Baltimore City, which is not in a county, has the right to draw its own charter, but its logical governmental preserve is frequently invaded by special legislation. Although counties may by an elaborate process draft home rule charters, only Montgomery and Wicomico have moved in this direction. County government is the usual traditional commission system, except for Anne Arundel, which, in 1947, was authorized to employ a manager. Cities as well as counties depend upon the assembly for grants of authority. Greenbelt, the model town, has a manager. Cumberland and a few other smaller towns have the commission form of government. All others have mayor-council systems. Special governmental districts are necessary in the metropolitan areas of Baltimore and Washington (part of which lies in Maryland). Legislation enacted in 1947 definitely started the state along the path of sharing taxes with counties and cities. With numerous special exceptions, local government debt is limited by law to a proportion of assessed property valuations.

Education. — *Public and Private.* — During early colonial years there were no schools in Maryland. In 1694 duties were levied on selected commodities to support free schools. King William School was established at Annapolis in 1696. In 1723 the assembly provided for a grammar school in each county. These were the only state-supported schools until well after 1800. Religious schools, particularly Catholic, were quite numerous from early years. Public schools were organized for Baltimore in 1829. A uniform public school system was provided for the whole state in the constitution of 1864. A compulsory school attendance law was enacted in 1911. Schools are now (1947) administered on a county-wide basis, with state aid forthcoming to maintain a minimum program in each county. The governor appoints county school boards, which in turn select and control the county superintendents.

Baltimore City schools are controlled by a board of school commissioners, which is appointed by the mayor. The state department of education supervises the elementary and secondary schools in the 23 counties and the state teachers colleges at Towson, Frostburg, and Salisbury for white students and at Bowie for Negroes. Baltimore City operates the Coppin Teachers College for Negroes. Negro schools are maintained separately.

There are several well-known private secondary schools in Maryland. Some of the boys' schools are the McDonough School, West Nottingham Academy, the Gilman County School and the Boys' Latin School. Some of the girls' schools are Hannah Moore Academy, Notre Dame Preparatory School, Bryn Mawr School, Girls' Latin School, Mount Saint Agnes, Roberts-Beach, St. Timothy's, Greenwood, and Garrison Forest School. Most of these schools are in and around Baltimore.

The Maryland School for the Blind is maintained in the outskirts of Baltimore. The school for the colored deaf and blind is located on the same premises. The Maryland School for the Deaf is located in Frederick.

The first Maryland institution of higher learning, Washington College at Chestertown, was established in 1782 and is still in operation. It was the first college named for George Washington. It granted him the honorary degree of Doctor of laws, and another was granted to Franklin D. Roosevelt in 1933. St. John's College at Annapolis, which combined with the older King William School, was chartered in 1784. This college undertook in 1937 a revolutionary curriculum based upon the world's great books. It is for men only and is nonsectarian. George Washington Parke Custis, Francis Scott Key, and Reverdy Johnson are among its distinguished alumni. There are four Roman Catholic colleges in Maryland: in Baltimore are Loyola (1852) and College of Notre Dame of Maryland (1896); and in Emmitsburg are Mount St. Mary's (1808) and St. Joseph's (1909). Western Maryland College was established at Westminster in 1868. In Baltimore is Goucher College for girls, established by the Methodists as the Woman's College of Baltimore in 1886. It later became nonsectarian.

By far the most distinguished of the private institutions in Maryland is the Johns Hopkins University in Baltimore. It was incorporated in 1867, after being endowed with a bequest of $3,500,000 by the man whose name it bears. Upon his death in 1873, Hopkins left the university and the hospital an additonal $7,000,000. The university has been outstanding in many fields, particularly science, history, political science, and medicine. The medical school has, along with the University of Maryland Medical School, made of Baltimore one of the country's medical meccas. The publication of philosophical studies has brought great renown to Johns Hopkins. Woodrow Wilson was one of its early fellows. The undergraduate college has never been large. The engineering school receives its major support from state appropriations. In exchange, the university gives free scholarships to a certain number of Maryland students. Other schools which grant scholarships in exchange for state appropriations are St. Johns, Washington, and Western Maryland, mentioned previously, and Charlotte Hall School and St. Mary's Female Seminary, both in St. Marys County. The University of Maryland derives from two sources: the University of Maryland, established in 1812, comprising principally the school of medicine which served as a nucleus for the other professional schools arising later, and Maryland Agricultural College at College Park, chartered in 1856 and made the land-grant college in 1862. The two branches were merged by law in 1920, with the main university at College Park and several of the professional schools still in Baltimore.

Morgan College in Baltimore was taken over by the state in 1939 and became Morgan State College. It is the state's leading Negro college. Princess Anne College at Princess Anne on the Eastern Shore is the Negro land-grant college. Whereas Morgan State College specializes in teacher-training, Princess Anne emphasizes agriculture, home economics, and the mechanic arts. The Marbury Commission for the study of Maryland higher education adjudged Morgan State College in 1947 to be the most nearly adequate of the Negro schools.

Following World War II, several junior colleges arose in the state. Some of these are Montgomery Junior College at Chevy Chase, Hagerstown Junior College, and Baltimore Junior College. These colleges were organized principally as night schools and made use of high school facilities already available.

Literacy.—According to the census of 1940, of the 1,054,688 persons 25 years old and over, 29,702 did not complete any school years. There were 325,893 persons who had completed grammar school, 122,497 who had completed high school, and 50,371 who had completed four years of college or more. The average school years completed was eight. The percentage of persons 25 years old and over finishing less than five years of school was 15.3.

Libraries.—In addition to the libraries of the various educational institutions, there are extensive public libraries in Maryland. Chief among these is the Enoch Pratt Free Public Library, established in 1882 with a gift to Baltimore City of $1,200,000 by Enoch Pratt. It has since received large grants of Carnegie funds. It is housed in a magnificent building on Cathedral Street. The leading county library is the Washington County Free Library. Libraries have been authorized in other counties, but not all have been established. The city library in Baltimore has been merged with that of the department of legislative reference in the City Hall.

History.—The first evidence of the possibilities of colonization in Maryland derived from the reports of Capt. John Smith, who left Jamestown in 1608 to explore Chesapeake Bay. He found Indians, principally Algonquins, living in the territory which is now Maryland. The leading tribes on the Maryland Main were the Piscataway, the Nanjemoy, and the Patuxent; on the Eastern Shore were the Nanticoke. These tribes were agricultural, living in clearings and raising corn, potatoes, and tobacco. Near the head of the bay lived the Susquehannocks (Susquehanna), of the Iroquois nation. Except for occasional raids by the Seneca from the north and later troubles in western Maryland during the French and Indian War, there was never much Indian trouble in Maryland. In general, the Indian was treated well, and the Maryland tribes gradually and peaceably withdrew. After the Smith expedition,

Virginians began trading freely with the Indians in the bay region, principally in furs. William Claiborne, representing a trading company of London, established a trading post on Kent Island in 1631. Claiborne was active in Virginia politics, and for many years contested the rights of the Lords Baltimore to Maryland.

The 1st Lord Baltimore was Sir George Calvert. He retired from active politics because he had become a Roman Catholic, after having served as secretary of state for England. He was interested in establishing a colony in America, and received from the king a grant of land in Newfoundland. The rigors of the Newfoundland climate proved discouraging, and the project was abandoned. He visited Virginia and was so pleased with it that he besought from the king a grant in the same neighborhood. The territory of Maryland was granted to him in much broader terms than he was ever able to reduce to possession, partially because of conflict with the duke of York over what is now Delaware and with William Penn over the boundary line between the two colonies of Maryland and Pennsylvania. The boundaries of the colony, as stated in the grant, would have run from Watkins Point, at the head of Chesapeake Bay, due east to the Delaware River, up the river to the fortieth parallel, west along this parallel to the meridian of longitude which passed through the headwaters of the Potomac River, south along that meridian and eastward and southward along the southern bank of the Potomac to Cinquack, near the mouth of the Potomac in Virginia, thence due northward to Watkins Point. If these boundaries had been maintained, the cities of Philadelphia and Wilmington and goodly portions of their respective states would now be in Maryland. All Englishmen, under the charter, could move to Maryland and enjoy their rights as free men. The charter granted to the proprietor the right to make laws with the consent of the freemen or their delegates. He tried originally to exercise the lawmaking power in town meeting fashion; but by 1638 the assembly had assumed the power to initiate laws, and by 1650 a regular bicameral legislature was in operation exercising full legislative powers.

The 1st Lord Baltimore died before the charter could be granted, and the charter was granted to his son Cecilius Calvert, the 2d Lord Baltimore, on June 20, 1632. Although Cecilius Calvert never saw Maryland, he supervised its growth carefully until his death in 1675. Under the leadership of Leonard Calvert, the brother of Cecilius and the first governor of Maryland, the *Ark* and the *Dove* sailed from England in 1633 and landed on St. Clements Island (or Blakistone Island) in Chesapeake Bay on March 25, 1634. This date is celebrated in Maryland as *Maryland Day*. The two ships carried more than 200 persons, both Catholics and Protestants. The first settlement was made at St. Marys in southern Maryland. It became the first capital and remained so for about 60 years, when the capital was moved to Annapolis. The state's first two counties were St. Marys in southern Maryland and Kent on the Eastern Shore.

From the beginning, difficulties beset the proprietor, Cecilius Calvert. Opposition from Claiborne and his settlers on Kent Island and from Virginians, both in the colonies and in England, continued for many years. He never came to America, but in England he worked assiduously toward the goal of securing the full development of the colony. While he was a Catholic, he sought the establishment of no church and was always disposed to separate church and state. His principal aim was to provide an asylum for persons of his faith. In 1649 the assembly enacted the "Act Concerning Religion" guaranteeing religious toleration. The Puritan Revolution caused repercussions in Maryland. Several violent episodes occurred, but they were finally terminated after 1656, when Oliver Cromwell indicated his willingness for Lord Baltimore to keep the colony. The general unrest was not settled, however, until Philip Calvert arrived with a new commission as governor from King Charles II, after the Restoration. Charles Calvert, later to become 3d Lord Baltimore, served as governor from 1661 to 1675. He was the first of the proprietors to live in the colony.

Meanwhile settlements had spread. The fur trade very soon declined in importance, and agriculture took its place. Wheat and corn were important crops, but tobacco early became the staple crop and remained so long after the colonial period was past. Indentured white servants at first did most of the hard labor, but they were gradually supplanted by Negro slaves. A group of Puritans from Virginia settled on the banks of the Severn and established the town of Providence, later to become Annapolis. They named their new county Anne Arundel, after the wife of Cecilius Calvert. Calvert County was formed in 1654 and Charles County in 1658. Prior to the death of Cecilius Calvert in 1675, the Eastern Shore saw considerable development, with the establishment of Talbot, Somerset, and Dorchester counties. At the head of the bay, Cecil and Baltimore counties were also formed.

Charles Calvert, 3d Lord Baltimore, became proprietor in 1675. His troubles were quite as serious and numerous as those of his father. The most perplexing Indian disturbances occurred within his first ten years, with the Susquehannocks, Iroquois, Senecas, and Onondagas. A crown patent granted to William Penn in 1681 conflicted with the Maryland grant, precipitating what was to be a long and acrimonious boundary conflict between the two colonies. The duke of York was Penn's patron, and when he ascended the throne in 1685 as James II, Charles' difficulties were intensified. A rebellion in the colony in 1689 displaced the proprietor. Shortly thereafter the crown took over political authority, and Maryland became a crown colony; Lord Baltimore's property rights, however, were reserved to him. The first royal governor arrived in 1692. Under the royal government the town of Annapolis became the capital; laws were codified; the lower house of the assembly grew in prestige and power; and the Anglican Church was established and a poll tax of forty pounds of tobacco was levied for its support. During this period the proprietor sent as his property agent Charles Carroll, who founded one of Maryland's leading families. The royal regime lasted until 1715, when the colony was restored to the proprietor after Benedict Leonard Calvert succeeded to the title and renounced Catholicism. During the royal period two new counties, Queen Annes and Prince Georges, were created and named for the queen and her husband. About 1700 the movement toward western Maryland began. Tobacco and slavery did not spread westward. Occasional Indian troubles vexed the western settlers. By

1730 a town had been settled on the present site of Cumberland.

Benedict Leonard lived only a short while after his succession to the title. His son Charles became the 5th Lord Baltimore and the fourth lord proprietary. Although Charles' proprietorship was presumably identical to that of the first proprietors, the years of public rule had left their mark, and he came to be considered as little more than an absentee landlord. He visited the province in 1732–1733. His son Frederick served as the last proprietor from 1751–1771; he never came to Maryland. In 1723 the General Assembly authorized the establishment of a free school in each county. Catholics were disfranchised and repressed for the remaining provincial years. The town of Baltimore was settled on the Patapsco in 1729. German settlers penetrated western Maryland from Pennsylvania. Charles' visit to Maryland in 1732 was primarily to settle the perplexing Pennsylvania boundary dispute. His concessions served as a basis for the surveying of the boundary by Charles Mason and Jeremiah Dixon in the years 1762 to 1767. Maryland, throughout its history, lost heavily in boundary disputes. Worcester County on the Atlantic was organized in 1742; Frederick County was established in 1748. The conclusion of the French and Indian War marked the end of Maryland's Indian troubles. The last proprietor, Frederick, died in 1771, bequeathing the colony to his illegitimate son, Henry Harford. Harford County was named for him; Caroline County, likewise established before the American Revolution, was named for the wife of Governor Robert Eden.

Agitation for independence was as plentiful in Maryland as elsewhere in the colonies. Maryland was represented at the Stamp Act Congress. Conventions were called to protest against the Townshend Acts; after these laws were repealed, Maryland felt only mild disturbances. With the departure of Governor Eden for a brief visit to England in 1774, the informal protest organization, known as the convention and composed of five delegates from each county, began to assume the proportions of a regular government; it chose delegates to the Continental congresses and appointed a committee of safety vested with interim powers; later it enlisted troops and exercised many other governmental powers. There was considerable loyalist sentiment in conservative Maryland. The influential royal governor, Eden, fought valiantly for a losing cause. Advocates of independence centered in Baltimore and Frederick. Principal leaders were Samuel Chase, Charles Carroll of Carrollton, Samuel Tilghman, and William Paca. The Maryland Convention resolved as late as May 1776 that it was not too late to compose differences. Late in June, however, the convention authorized the Maryland delegates to vote for independence. Governor Eden left immediately for England. On July 3 the Maryland Convention declared independence and set about the preparation of a state constitution. The Maryland signers of the Declaration of Independence were Charles Carroll of Carrollton, Samuel Chase, William Paca, and Thomas Stone.

The convention met to form Maryland's first constitution on Aug. 14, 1776. The constitution was proclaimed, without submission to the voters, on Nov. 8, 1776. The new document provided a bill of rights, a governor's council, a bicameral legislature with a House of Delegates elected annually and a Senate chosen by an electoral college for five-year terms, and a governor chosen annually by the legislature. High property qualifications were established for the suffrage and even higher for office holding. The first state governor was Thomas Johnson. In 1776, Frederick County was divided into three counties: the central county retained the old name, the southern portion became Montgomery County, named for the revolutionary general, Richard Montgomery, and the western portion became Washington County. The new government of Maryland gave full support to the American Revolution. Maryland troops were commanded by Gen. William Smallwood. Other famous officers were Gen. Mordecai Gist and Col. John Eager Howard. Dr. James McHenry was one of General Washington's aides; he later became secretary of war under Presidents Washington and Adams. The bravery of Maryland troops during the revolution earned for the state its nickname, the Old Line State. Maryland refused to ratify the Articles of Confederation until those states claiming western lands agreed to cede their claims to the central government. The Continental Congress met in Annapolis in 1783 and 1784. It was there that General Washington resigned his commission on Dec. 23, 1783, and Congress ratified the treaty terminating the revolution on Jan. 15, 1784.

Maryland actively supported the move toward a constitutional convention. Commissioners from several states met at Annapolis in 1786 and agreed to meet the following year in Philadelphia. Maryland delegates to the Constitutional Convention were Luther Martin, John Francis Mercer, James McHenry, Daniel Carroll, and Daniel of St. Thomas Jenifer. Martin and Mercer refused to sign the Constitution. The other three, however, did sign. A Maryland convention elected for the purpose approved the federal Constitution on April 28, 1788. In 1791, Maryland and Virginia ceded to the national government the territory known as the District of Columbia. The Virginia portion of the district was later returned to the state, so that now the entire district is former Maryland territory. In 1796 Allegany County was formed of the western part of Washington County.

In the years following the adoption of the Constitution, Maryland prospered. Commerce grew rapidly. Even the Napoleonic wars and the War of 1812 did little lasting injury to the state's prosperity. After the war with England was over, Baltimore business men concerned themselves with western trade routes, and the Baltimore and Ohio Railroad was established. During the War of 1812, British troops made several landings in Maryland. A sizeable expedition landed on the banks of the Patuxent in August 1814, and moved toward Washington. A battle was fought at Bladensburg, the American forces were routed, and the British proceeded to burn the government buildings in Washington. The British then moved toward Baltimore and tried unsuccessfully to reduce Fort McHenry. It was during this attack that Francis Scott Key, a Marylander held on board a British ship, wrote *The Star-Spangled Banner*. Fort McHenry has been restored to its appearance as of 1814 and is now a national park.

The assembly enacted a law in 1818 requiring all banks maintaining main offices outside the state to print their bank notes on special taxed paper. This legislation was aimed directly at the

United States Bank. The act was held unconstitutional by the Supreme Court in the famous case of *McCulloch* v. *Maryland*. William Wirt, a Baltimore lawyer, was nominated for the presidency in 1832 on the anti-Masonic ticket. Carroll County was established in 1836 out of portions of Frederick and Baltimore counties; it was named for Charles Carroll of Carrollton, who, at the time of his death in 1832, was the last surviving signer of the Declaration of Independence. During the presidency of Andrew Jackson, a Maryland lawyer, Roger B. Taney, served as attorney general, secretary of the treasury, and was appointed as chief justice of the Supreme Court. He served in the latter position until 1864. A violent contest in state politics in 1837 and 1838 resulted in constitutional amendments providing for popular election of the governor and the Senate and the abolition of the governor's council.

Maryland's second constitution was adopted in 1851 and lasted until 1864. It provided few major changes in governmental structure. At the time of its adoption, Howard County was created out of a part of Anne Arundel, and Baltimore City was separated from Baltimore County. In the decade before the Civil War there was considerable unrest in the state, particularly in Baltimore. In 1860 the Baltimore police force was placed under state control, and from that date on the state government has not been reluctant to interfere in the city's affairs.

Considerable distress was felt in Baltimore and throughout the state during the Civil War. Maryland was a border state, and its sympathies were clearly divided. Most influential in keeping Maryland officially on the Union side was Reverdy Johnson, one of the nation's leading lawyers for many years and one of Maryland's most illustrious sons. Johnson earlier had served as attorney general under President Taylor and as United States senator. Later he defended President Johnson in the impeachment proceedings brought against the president. Another prominent Marylander of the period was Montgomery Blair, who was postmaster general under Lincoln and who was forced out of the cabinet for political reasons. A riotous attack in Baltimore in 1861 upon Massachusetts troops proceeding through the city resulted in several deaths and led to military control of the city throughout the war. Marylanders fought in both armies. In 1862 the armies of Generals Lee and McClellan fought the Battle of Antietam in Washington County. The passage of Gen. Stonewall Jackson's troops through Frederick during this campaign gave rise to the poem *Barbara Frietchie*. The Confederate armies crossed the state again in proceeding to and from the Battle of Gettysburg in 1863, and in 1864 the two armies again met on Maryland soil at the Battle of the Monocacy. During the war James R. Randall wrote *Maryland, My Maryland* to encourage those of Southern sympathies.

In 1864, Maryland's third constitution was adopted; its principal new features were abolition of slavery, a system of public education, and the disfranchisement of Confederate sympathizers. The fourth constitution, adopted in 1867 and still in effect, resembled that of 1864 closely except that it did not contain repressive features. It provides for a popular vote for every twenty years on the question of a new constitutional convention. The constitution established Wicomico County out of portions of Dorchester and Somerset. In 1872 the western part of Allegany County became Garrett County, named for the president of the Baltimore and Ohio Railroad.

Maryland prosperity reached new heights in the postwar period. It was the period of political dominance by the transportation interests. Arthur Pue Gorman, president of the Chesapeake and Ohio Canal Company, dominated Maryland politics, state and national, from 1880 until his death in 1906. One of the prime battles of the era was over machine or boss politics. Continued efforts brought improvement but never complete eradication of this evil. The adoption of the Australian ballot in 1890 was a step in the right direction. The Baltimore and Ohio Railroad went into the hands of receivers in 1896, but it was returned to its stockholders three years later. In 1896 the state went Republican in the presidential election and all districts returned Republican congressmen. President McKinley called to his cabinet as postmaster general, James A. Gary, a Baltimore manufacturer. After 1900 machine politics still existed but its importance steadily declined. Charles J. Bonaparte of Baltimore served in the Cabinet of President Theodore Roosevelt as secretary of the navy and attorney general. Joseph I. France became Maryland's first popularly-elected United States senator in 1912. Maryland's contributions to World Wars I and II, both military and industrial, were great. The opportunity for a greater share in the war efforts derived in part from proximity to the capital.

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MARYLAND, University of. It dates back to 1807, when the College of Medicine of Maryland was founded in Baltimore. In 1812, the state General Assembly authorized the college to take the name University of Maryland and to add a faculty of law. A department of dentistry was added in 1882, and a nursing school in 1889. In 1904, the university absorbed the Maryland College of Pharmacy and, in 1923, the Baltimore College of Dental Surgery. The present state university was created in 1920 by merging the University of Maryland with Maryland State College, founded in College Park in 1856. The graduate school, undergraduate colleges, and agricultural experiment station are located in College Park, and the professional schools in Baltimore. In 1948, the university plant was valued at $19,738,349, and the endowment was $2,587,599. There were 1,426 teachers and 14,067 students, including 3,237 women.

MARYLAND YELLOWTHROAT, one of the most familiar of North American warblers (*Geothlypis trichas.*) It is about 5.5 inches

in length, migratory, makes a neatly concealed nest on the ground, almost always in a swamp or near a stream, and lays pink-white eggs delicately dotted with red. The plumage is bright yellow above, duller toward the tail; wings and tail greenish; under parts nearly white; and a characteristic jet-black mask across the face and on the sides of the head. The summer cry is a sharp questioning *"What of it? Where'd ye get it?"* The genus contains several related and similar species, but the Kentucky warbler (*Oporornis*) is no longer included.

MARYPORT, mâr'ĭ-pōrt, an urban district in England, on the Cumberland coast, 28 miles southwest of Carlisle on Solway Firth at the mouth of the Ellen River. It is a seaport, exporting coal, coke, creosote, and tar, and manufacturing chemicals, shoes, and electric goods. The development of Maryport's harbor dates from 1857, and its activity has been largely influenced by the fortunes of the nearby collieries. Pop. (1951) 12,237.

MARYSVILLE, mâr'ĭz-vĭl, city, California, seat of Yuba County, 40 miles north of Sacramento at the confluence of the Yuba and Feather rivers, on state and federal highways, and the Southern Pacific, Western Pacific, and Sacramento Northern (electric) railroads. Altitude 61 feet. A county airport supplements the city's transportation facilities. The surrounding country is predominantly agricultural, with tracts of timber and areas of mineral deposits. The city is a trade center for the farms and orchards that constitute its environment, and engages in the processing of fruits and vegetables. The original city hall, built in 1855, was representative of the brick buildings of its time. Other notable structures include two lodge buildings, the Nagler Building, and the new city hall.

The name Marysville honors Mary Covillaud, wife of one of the founders of the settlement. In 1842 the site of the present city was occupied by a trading post on the California-Oregon Trail. In 1849 a townsite was platted and the city was incorporated in 1851. It has a mayor-council form of government. Pop. (1950) 7,826.

MARYSVILLE, city, Kansas, seat of Marshall County, 70 miles northwest of Topeka, on the Big Blue River, the Union Pacific Railroad, and two federal highways. Located in an agricultural region, it is an active market for dairy products and poultry and its industries include poultry packing, flour milling, and bottling.

Marysville was a former ferry crossing on the Oregon Trail and was incorporated in 1861. It has a mayor-council form of government. Pop. (1950) 3,866.

MARYSVILLE, village, Ohio, seat of Union County, 27 miles northwest of Columbus on state and federal highways and the New York Central Railroad. Altitude 999 feet. It is an agricultural community producing dairy products and seeds and manufacturing heating equipment, chairs, and tile. A Carnegie library and a state reformatory for women are located here. Citizens of Marysville contributed the log cabin symbol and song to the Harrison-Van Buren presidential campaign of 1840.

Settled in 1816, the community was laid out in 1820. A mayor and council administer its government. Pop. (1950) 4,256.

MARYVILLE, mâr'ĭ-vĭl, also -v'l, city, Missouri, seat of Nodaway County, 40 miles north of St. Joseph on U.S. Highway 71 and the Chicago, Burlington, and Quincy, and the Wabash railroads. Altitude 1,036 feet. A trading center for the northwestern corner of the state, it is surrounded by fine farming country producing grains, dairy products, hogs, and poultry. The city's industrial products are lightning rods, tire chains, tools, and cement blocks. It has a standard public school system and is the seat of the Northwest Missouri State College, which has a farm cultivated by students in orcharding and agriculture. The school was established in 1905.

Settled as seat of the newly organized county of Nodaway in 1845, Maryville was named for Mrs. Mary Graham, wife of Amos Graham, who, when only half a dozen families lived there, was its one-man government. The city has a commission form of government. Pop. (1950) 6,834.

MARYVILLE, city, Tennessee, seat of Blount County, 15 miles south of Knoxville on federal highways and the Southern and the Louisville and Nashville railroads. Altitude 1,150 feet. It is near the Great Smoky Mountains National Park, in a timber, quarry, and farm area producing lumber, tobacco, cattle, grain, marble, limestone, slate, dolomite, and sandstone. Manufactures include textiles, coffins, and processed foods. Maryville College (Presbyterian), founded in 1819 as Southern and Western Theological Seminary, is located here. The school was rechartered and given its present name in 1842.

The community grew up around Fort Craig after 1785. In 1790 it received its first charter and was named for the wife of Gov. William Blount. Sam Houston moved to Maryville in 1807, was the proprietor of a store and taught school near the village. Maryville was rechartered as a town in 1907 and became a city in 1927. It has a commission form of government. Pop. (1950) 7,742.

MARYVILLE COLLEGE, a coeducational, liberal arts institution in Maryville, Tenn., affiliated with the Presbyterian church but nonsectarian in curriculum. Its campus covers 385 acres and includes the college woods and a college dairy farm. Founded in 1819 as the Southern and Western Theological Seminary, it became Maryville College in 1842 and 15 years later dropped the theological school.

Maryville grants the degrees of A.B. and B.S. in liberal arts and home economics, and offers several scholarships and student assistance funds for those who otherwise could not meet the enrollment and living costs. The Lamar Memorial Library is one of the largest libraries in Tennessee, with a collection of 55,072 bound volumes (1951).

MASACCIO, mä-sät'chō (real name Tommaso Guidi, gwē'dē), Italian painter: b. San Giovanni, Tuscany, Dec. 21, 1401; d. Rome, about 1428. He went while very young to Rome, where he painted in the church of Saint Clemente a series of frescoes, the finest of which represents Saint Catherine and the doctors before Maxentius. In 1421 he was admitted into the guild of the Speziali at Florence.

Among the works of Masaccio are the frescoes in the Brancacci Chapel of the Carmine, the *Expulsion from Paradise; Saint Peter's Sermon;*

the *Tribute; Saint Peter Baptizing;* and the *Raising of the King's Son,* the last of which was partly painted by Filippino. Consult Knudtzon, *Masaccio og den florentiniske malerkonst* (Copenhagen 1875); Delaborde, *Les oeuvres et la manière de Masaccio* (Paris 1876); Schmarsow, *Masaccio Studien* (Cassel, Ger. 1895).

MASAI, mä-sī', an East African race, speaking a language of Hamitic origin, and living in Kenya Colony, east of Lake Victoria. The Masais are men of large stature and fine physique. They are a warlike people and live mostly in military kraals, eating nothing but meat and drinking nothing but milk. The labor is done by women and children. They are to a certain degree nomadic, live in huts constructed of boughs, and enclose their villages with huge thorn fences. Because of the climate they are better clothed than tribes of the warmer regions. Consult Thomson, *Through Masai Land* (London 1885); Hollis, A. C., *The Masai: Their Language and Folklore* (Oxford 1905); Merker, M., *Die Masai,* 2d ed. (Berlin 1910).

MASAN, a Korean port at the head of Chinhai Bay on the south coast, with a screen of picturesque hills for background. It has a superb view of the bay, and is considered a salubrious resort. In the 16th century the Korean admiral, Li Shunsin (Yisunsin), defeated the Japanese fleet of Hideyoshi here along the Chinhai Bay. Old Masan is ancient and thoroughly Korean; New Masan is westernized with regularly laid-out streets. Masan is 25 miles by rail from Samnangjin on the main line of Pusan-Seoul, and lies between Pusan (Fusan) and Chinju. Pop. (1946) 82,175.

MASANIELLO, mä-zä-nyĕl'lō, the commonly used name of Tommaso Aniello, Italian revolutionist: b. Amalfi, 1623?; d. Naples, July 16, 1647. He was a fisherman at Amalfi, and in 1647 roused and led an insurrection in Naples against the Spanish viceroy, the duke of Arcos. He was successful and obtained the abolition of unjust taxes and the revocation of an order to establish the Inquistion at Naples. The fruit taxes were abolished and the old civic rights restored. But the people soon rose against him, and he was assassinated. An opera, music by Auber, libretto by Scribe and Delavigne, based on his career, was presented in 1828 in Paris as *La Muette de Portici,* and in 1829 in England, in English, as *Masaniello.* Consult Saavedra, *La insurrección de Napoli en 1647* (Madrid 1849).

MASARYK, mä'sä-rĭk, **Jan Garrigue,** Czechoslovak statesman: b. Prague, Bohemia, Sept. 14, 1886; d. there, March 10, 1948. Only son of the Czech nationalist leader, Tomáš G. Masaryk (q.v.) and an American mother, he was educated in Prague. In 1906, before completing his studies at Charles University, he left Austria to visit the United States, where he studied at Boston University, and worked as an ironworker and pianist in a motion picture theater. As an Austrian subject he was forced to serve in the army through World War I. He joined his father in Prague in 1918 and aided in the establishment of the republic of Czechoslovakia. Chargé d'affaires at Washington in 1919, two years later he became private secretary to Eduard Beneš (q.v.). After service in the Ministry of Foreign Affairs, he was appointed minister to Great Britain in 1925, resigning in 1938 in protest aganst the French and British surrender at Munich. Reporting his resignation to Lord Halifax, he closed his note with the words: "The nation of St. Wenceslas, John Huss, and Thomas Masaryk will not be a nation of slaves." He was appointed foreign minister of the government in exile organized by Beneš in July 1940, and later deputy prime minister. He was still foreign minister at the time of the Communist coup d'état of Feb. 27, 1948. He did not resign, perhaps hoping that the loss of Czech liberties was not irretrievable. Six hours after his death, the government announced that he had committed suicide by jumping from a third-floor window of the Foreign Ministry Building. Whether his death resulted from suicide or defenestration will perhaps never be known. An elaborate state funeral was decreed. The government explained the asserted suicide as motivated by his anguish over the reproaches of anti-Communist friends for remaining a member of a Communist government.

MASARYK, Tomáš Garrigue, first president of Czechoslovakia: b. Hodonín, Moravia, Mar. 7, 1850; d. Prague, Sept. 14, 1937. A Slovak by birth and the son of poor parents, he was apprenticed to a blacksmith after receiving an elementary education. Becoming a teacher, he studied philosophy at the universities of Vienna and Leipzig, and in 1879 began lecturing on philosophy at Vienna. Professor at the new Bohemian university in Prague (1882), he became noted as an interpreter of modern political and social tendencies and through his efforts to reconcile and reunite Serbs and Croats. Elected to the Austrian Parliament in 1891, he boldly criticized the government's policy toward Bosnia-Hercegovina, resigning his seat in 1893 in protest against the negative policy of Czech nationalists. For several years he edited the critical review *Athenaeum* which he founded in 1883, and later *Naše doba* (*Our Epoch*), founded in 1893. He married an American and as a political economist was well known in the United States. His many writings include: *Suicide and Modern Civilization* (1881); *Blaise Pascal* (1883); *The Philosophical and Sociological Foundation of Marxism* (1898); *Russia and Europe* (1913); *The New Europe* (1918); *The Making of a State* (1925), and his autobiography *President Masaryk Tells His Story,* recounted by Karel Capek (1935).

Among these historical and philosophical writings, his powerful criticism of Marxian socialism and the great work on Russia and Europe stand foremost. In 1907 he was re-elected to the Austrian Parliament. During the Friedjung trial in 1909 he helped to expose the forgeries upon which Count Aehrenthal based his annexation of Bosnia and Hercegovina. When World War I broke out he remained in Prague until December 1914, when he escaped to Italy and thence to England in time to avoid arrest. He then became lecturer in the School of Slavonic Studies at the University of London. On Dec. 6, 1916, the Austrian clerical organ, *Reichspost,* announced that Professor Masaryk had been sentenced to death *in contumaciam* for high treason. Meanwhile, the condemned man was rapidly gaining wide recognition among the Allies as the leader of the national struggle for Czechoslovak independence. Together with Dr. Beneš and

Colonel Stefanik, he formed the triumvirate which was ultimately recognized by the Allied governments as the trustee for the future government of Bohemia. In the spring of 1917, Professor Masaryk was called to Russia by Professor Milyukov, but soon realized the hopelessness of the Russian situation and devoted strenuous efforts to organizing the Czechoslovak Army. He preceded this force to Vladivostok and went on to Tokyo and Washington. He had several audiences with President Wilson and addressed many public meetings. The Republic of Czechoslovakia was recognized by Italy on April 23, 1918; by Great Britain on Aug. 13, 1918; by the United States on Sept. 2, 1918; and by Japan, Sept. 9, 1918. The Declaration of Independence was formally published at Washington on Oct. 18, 1918, and the republic was formally proclaimed at Prague on October 28. The constitution was drafted in Geneva by Nov. 2, 1918. On Nov. 14, 1918, Masaryk was elected first president of the republic. In his first message to the members of the National Assembly on Dec. 26, 1918, in the presence of representatives of the Allied governments, the president expressed the "gratitude and unshakable fidelity" of the republic toward the Allies. He was re-elected president on May 27, 1920, and again in May 1927 and in May 1934. He resigned in December 1935 and was succeeded by Dr. Edward Beneš.

MASAYA, mä-sī'ä, Nicaragua, town, in the western part, about 12 miles north of Lake Nicaragua and near Masaya volcano, which is 3,000 feet in height. The town is connected by railroad with the cities of Leon, Managua and Granada. Masaya is situated in an agricultural region, of which tobacco is one of the principal productions. Coffee, sugar and rice are also grown in the vicinity. The inhabitants are mostly Indians. Pop. 13,000.

MASBATE, măs-bä'tā, Philippines, an island of the Philippines in the eastern part of the Visayan Sea, south of Luzon and northwest of Samar; greatest length, 82 miles northwest to southeast; width, 45 miles; area, 1,236 square miles. It is very mountainous, the central chain being semi-circular in shape, extending from southwest to southeast, and there are several rivers of considerable size. Communication between towns and villages is mostly by water, as there are few roads or even trails. The staple products are sugarcane, cotton, chocolate and hemp; tobacco of a strong quality is also raised. One of the chief industries is that of stock-raising (cattle, horses and hogs); over 1,000 head of cattle are ordinarily shipped monthly to other parts of the Philippines, mostly to Manila. This industry has been menaced in recent years by the rinderpest. Other important industries are the manufacture of sugar sacks from the buri palm, the manufacture of palm mats of superior workmanship and coloring, weaving, lumbering and fishing; there is also an active trade with Manila. In March 1901 the island was united with Ticao (140 square miles), Burias (258 square miles) and the small adjacent islands, to form the province of Masbate; area of the whole province 1,732 square miles. Civil government was inaugurated in 1901. The inhabitants are nearly all Visayans, but there are over 2,000 Bicols and about 580 Tagalogs. Pop. of province 43,000; Masbate and Ticao (q.v.) 30,000.

MASBATE, Philippines, a pueblo and the capital of Masbate province, situated in the northeastern part of the island of Masbate on a peninsula dividing Palánog Port from Mobô Bay. It is a port of entry, and has a considerable trade. It has a church, a school and some well-constructed buildings. Pop. 2,900.

MASCAGNI, Pietro, pē'ā-trō mäs-kän'yē, Italian composer: b. Leghorn, Tuscany, Dec. 7, 1863; d. Rome, Aug. 2, 1945. He was educated at the Milan Conservatoire and in 1890 his opera *Cavalleria Rusticana* brought him immediate recognition in the musical world. From 1895 to 1903 he was director of the Rossini Lyceum at Pesaro. His songs and ballads became popular and his successful career as a composer was further aided by his operas *L'Amico Fritz* (1891); *I Rantzau* (1892); *Guglielmo Ratcliff* (1895); *Silvano* (1895); *Zanetto* (1896); *Iris* (1898); *Le Maschere* (1901); *Amica* (1905); *Isabeau* (1911); *Parisina* (1913); *Lodoletta* (1917); *Il Piccolo Marat* (1919), and *Nerone* (1935). In 1902 he visited the United States on an operatic tour, and in 1911 made a similar trip throughout South America.

MASCAGNITE, măs-kăn'yīt, or **MASCAGNINE,** a native sulphate of ammonium, occurring notably at Sasso in Tuscany, where it was discovered by Mascagni, from whom it was named.

MASCARA, Algeria, fortified town and capital of an arrondissement in the province of Oran, 45 miles southeast of the city of that name, at the base of the Little Atlas Range. The town stands on the site of a Roman colony, is surrounded by walls, but has few ancient remains. It is purely of the French colonial type. For two centuries down to 1800 it was the capital of a Turkish beylik; in 1832 it became the capital of Abd-el-Kader; in 1835 it was ravaged by the French, but was reoccupied by Abd-el-Kader in 1838 only to fall finally to the French in 1841. Wine, cereals and oil are the principal items of trade. Pop. 28,693.

MASCARENE (măs-ka-rēn') ISLANDS, a collective name for the islands of Bourbon, Mauritius and Rodriguez, named after Mascarenhas, a Portuguese navigator, who discovered Bourbon in 1545.

MASCARON, Jules, French preacher: b. Marseilles, 1634; d. Agen, 1703. He became a member of the Congregation of the Oratory and soon established a great reputation as a preacher in the provincial cities. He preached at court in 1666 and thereafter he was a favorite of Louis XIV. Mascaron was consecrated bishop of Tulle in 1671 and eight years later was translated to the more important diocese of Agen. He still continued to preach at court and in 1675 delivered his greatest oration at the funeral of Marshal Turenne. His principal sermons were edited by a member of the congregation, Father Borde, in 1704. Consult 'Œuvres de Mascaron' (Paris 1828).

MASCART, Eleuthère Elie Nicolas, French physicist: b. Quarouble, Nord, 1837; d. 1908. He received his education at the École Normale Supérieure and in 1872 became professor at the Collège de France. From 1878 to 1907 he was director of the Government Central

Meteorological Bureau. He was also member of the International Bureau of Weights and Measures; was elected to the Academy of Sciences in 1884 and became its president in 1904. He was made commander of the Legion of Honor in 1889. Mascart's investigations were mainly confined to spectroscopy, electricity and terrestrial magnetism. He published 'Eléments de mécanique' (1866); 'Traité d'électricité statique' (1876); 'Leçons sur l'electricité et le magnétisme,' with Joubert (1882); 'Méthode de mesures et applications' (1882); 'Traité d'optique' (1889); 'Traité de magnétisme terrestre' (1900).

MASCHERONIANA. The 'Mascheroniana' of Vincenzo Monti (1754–1826) is an unfinished epic «vision» in five cantos of *terza rima*. It represents the third of four periods into which Monti's intellectual and artistic life may be divided. The first is the period of the Arcadian lyrics and the tragedies; the second that of the 'Bassvilliana' (1793), a diatribe against the French Terror; the third, that of the Napoleonic poems, the 'Prometeo' (1797), the 'Mascheroniana' (1801) and the 'Bard of the Black Forest' (1806); the fourth (1815–19) that of the «Austrian» poems, the 'Mystic May,' the 'Return of Astrea', the 'Invitation to Pallas,' the classic translations and the critical works.

Monti's permanent and most interesting distinction is that, as a man thoroughly permeated with the culture and mental traits of the Old Régime, he lived through the Revolutionary period without understanding any aspect of it. In the course of his life he assumed with equal sincerity the position of each dominant party. He assailed the Revolution and then accepted it. He hailed Napoleon the liberator, and then Napoleon the despot. Italians like to find in all these gyrations a thread of consistency: the concept of resurrected Italy. Unfortunately, however, Monti also embraced and sang the Austrian restoration.

This mental confusion, not to say moral perversity, has its counterpart in Monti's poetry. He is fundamentally an Arcadian, who vaguely perceives the emotions and the character of a new age, without visualizing them clearly as an artist and without finding for them an appropriate formal expression. In a sense this makes his poems extremely interesting; for wholly in the Arcadian manner, they are admirably calculated to show the limitations of that manner. The 'Mascheroniana,' which owes its popularity in Italy to its nationalistic spirit, aims to project the miserable Italy of the revolution upon the great Italy of the past and a greater Italy of the future, of which to be sure Napoleon is to be the artisan. Here is a trite theme but one of potentiality. Monti, however, being Monti, transports it into the Arcadian world, a world by itself, apart from, perhaps superior to, any real world. It becomes «literature» through «plot» and «form.» As regards plot, Monti invents a vision of the Dante series: to commemorate a friend, he narrates the passing of the soul of Lorenzo Mascheroni, an eminent mathematician, from earth to heaven, bringing him, en route, in touch with the souls of Parini, Beccaria and others. These great Italians discourse on contemporary and past Italian conditions. Critics who like «literature» find, in the elaborate descriptions here, distinguished merits of vivacity and coloring. Then, as we pass to «form,» we get a wealth of allusion, classic and Italian; but especially great ingeniousness of metaphor, and a truly remarkable success in epigram and sententiousness. Here, indeed, we find those traits which give Monti kinship with the greatest writers and which by themselves give the 'Mascheroniana' a place in literary history. But that is all. Monti cannot solve the neo-classic paradox: he cannot bring his virtual poetic theme (nationalism or patriotism) into contact with his «plot» and his «form.» The theme remains undeveloped, and the plot and the form without poetic life. When Monti, for instance, wishes to denounce Robespierre, he pictures God shuddering on his throne and the angels gracefully hiding very beautiful heads under very beautiful wings. All this has nothing to do with Robespierre. The vice of neo-classicism is that it works on three parallel lines, one for the «plot,» another for the «form» (figure, allusion, episode, metaphor); and another for the animating poetic emotion. And the lines never meet. The 'Mascheroniana' is a classic poem; and it died, as a poem, with the school it represents, retaining an historical interest, for its characteristic defects, and as one of the records of Monti's intellectual reversals.

ARTHUR LIVINGSTON.

MASCOTS AND HOODOOS, a mascot is a person or thing supposed to bring good luck, while a hoodoo is an influence of evil. Another name for the hoodoo is Jonah, a term originating with superstitious sailors. The word mascot was first introduced into literature by means of the comic opera 'La Mascotte' written by Audran, but in France it appears to have been in common use for a long time previously among gamesters and sporting characters. It was used to signify some object, animate or inanimate, which like the luck-penny brought good fortune to its possessor. The word is traced back to the *patois* of Provence and Gascony, where a mascot is something which brings luck to a household. Etymologically the word is derived from masque (masked or concealed), which in provincial French is applied — as *né coiffé* is in more polished French — to a child born with a caul. Such a child was believed to be destined, not only to be lucky himself, but to be the source of luck to others. In most European countries there is a large trade in charms and talismans to bring good fortune.

The term hoodoo is a manifest corruption of African voodooism and is a modified superstition of the system of terrorism which has been cultivated for years by the voodoo priesthood with remarkable success. There is, however, no scientific foundation for belief in either hoodoos or mascots, any more than there is in a reliance upon dreams and visions. Natural laws are not to be set aside by touching a hunchback or carrying a rabbit's foot in one's pocket. It is a fact, however, that in every age of the world the goddess of chance has been worshipped under one name or another, and modern civilization has not destroyed this cult. The belief in the mascot for luck, or the hoodoo for ill-luck, is an indication of weakness and lack of decision. In the 'Iliad,' when Hector is told that «the birds are against him,» and all the omens unlucky, the Trojan hero makes answer:

"Without a bird his sword the true man draws; and asks no omen but his country's cause." See also OMEN; SUPERSTITION.

MASCOUTEN, a belligerent tribe of Algonquians, the French *Nation du Feu,* "Fire Nation," dwelling along the Illinois River. They were at constant warfare with their neighbors, and are first mentioned by the earliest French missionaries as inhabiting southern Michigan, whence, according to the traditions of the Ojibwas and Ottawas, they had been driven by the latter from the region around modern Mackinaw. In 1712, united with the Foxes and Kickapoo, they were almost exterminated, first by the French and afterward by the Pottawattomi and their allies. The remnants migrated westward and are last mentioned in 1779 as living with the Piankishaws and Kickapoos on the Wabash River. The name is derived from Mashkodainsug, "little prairie people," a title now borne by a tribe of Pottawattomi Indians resident in Kansas.

MASEFIELD, John, English poet and dramatist: b. 1875. In his youth he shipped before the mast on the *Conway,* in which he made several voyages. For a time also he was engaged as a farm laborer and in the 90's spent a short time as attendant in a Sixth avenue saloon in New York. These early experiences he later turned to account in his literary work. After his wanderings Masefield settled near London and became a regular contributor of prose and verse to the periodicals of the metropolis. He was awarded the Edmond de Polignac prize for poetry in 1912, and made Poet-Laureate in 1930. Masefield won literary fame mainly through his sea ballads and the narrative poems, 'The Everlasting Mercy' and 'The Widow in the Bye Street.' His verse is intensely realistic, full of pathos, although the verse form is often crude. His stories for boys represent his best efforts in prose and are reminiscent of Marryat at his best. His plays lack technique and are little suited to stage presentation, but give evidence of growing power. His works, in addition to those already mentioned, are 'Salt Water Ballads' (1902); 'A Mainsail Haul' (1905; 1913); 'A Tarpaulin Master'; 'Ballads'; 'Captain Margaret'; 'The Tragedy of Nan and other Plays' (1910); 'The Tragedy of Pompey the Great' (1910); 'Multitude and Solitude'; 'The Street of To-day'; 'Poems and Ballads'; 'William Shakespeare'; 'Dauber'; 'The Daffodil Fields'; 'Philip the King' (1914); 'Personal Recollections of John M. Synge'; 'The Faithful'; 'Sonnets and Poems'; 'The Locked Chest'; 'Melloney Holtspur' (1922); 'Sard Harken' (1924); 'Recent Prose' (1924); 'Odtaa' (1926), etc. Masefield edited 'The Voyages of Captain William Dampier' (1906); and wrote introductions to 'Hakluyt's Voyages' and 'The Voyages of Marco Polo.' The following plays have been produced: 'The Campden Wonder'; 'Nan'; 'Pompey the Great'; 'Sweeps of Ninety-Eight'; 'Philip the King'; 'The Faithful'; 'Mrs Harrison'; 'Good Friday'; 'The Trial of Jesus' (1925).

MASHAM, Abigail Hill, LADY, confidante and favorite of Queen Anne of England: b. London, 1670; d. 6 Dec. 1734. A cousin of Sarah Jennings, Duchess of Marlborough, and also related to Robert Harley, Earl of Oxford, she passed from the service of Lady Rivers, thanks to the influence of the Duchess of Marlborough, into that of Queen Anne, in whose favor she soon displaced her cousin, making every effort to turn the queen from the Marlboroughs and Whiggery to Toryism and even Jacobitism. She was married to Samuel Masham in 1707; had him made a baron in 1712; brought her kinsman Oxford into power, but soon turned him out; and, in short, was the power behind the throne, succeeding her cousin Marlborough. She retired after Queen Anne's death. She was a plain, homely, red-nosed woman, much bepraised by Swift and accused of vulgarity, meanness and covetousness by the Whigs. See ANNE, QUEEN OF ENGLAND.

MASHAM, Samuel Cunliffe Lister, 1ST BARON, English inventor: b. Calverly Hall, near Bradford, 1 Jan. 1815; d. Swinton Park, York, 2 Feb. 1906. In 1838 his father started Samuel and his brother John as worsted manufacturers in a mill at Manningham. About 1845 he perfected a wool-combing machine which revolutionized textile processes and made the inventor wealthy. He secured a profit of $5,000 on every machine sold. From 1855 to 1864 he spent huge sums in perfecting a silk-combing machine and at one time was perilously near bankruptcy. The machine was brought out in 1864 and enabled him to produce valuable yarn from the hitherto useless silk waste. Masham also perfected a velvet loom for piled fabrics, and after 1878 his income from his inventions exceeded $1,000,000 annually. He opposed free-trade because the American protective tariff seriously limited his business. He was created 1st Baron Masham in 1891. He wrote 'Lord Masham's Inventions' (1905).

MASHKODAINSUG. See MASCOUTEN.

MASHONALAND, mą-shō'ną-länd, South Africa, a province forming the northeastern portion of South Rhodesia, between the Zambesi and Matabeleland. It consists largely of open plains and table-lands, is well watered by the Umniate and other feeders of the Zambesi and is very fertile. The Mashonas belong to the Kaffir race and were formerly masters of the whole territory between the Limpopo and the Zambesi, but were cooped up within their present territory by the powerful Matabele, whom they were unable successfully to resist. They are a peaceful people, clever as smiths and as weavers of cotton fabrics. The country came under the management of the British South Africa Company in 1890. It is rich in gold, which has been mined here at some remote and unknown period, old workings being still visible, and Mashonaland is with some degree of probability identified with the biblical Land of Ophir. In 1923 it became part of Southern Rhodesia when that country became a British colony. The principal towns are Salisbury, Hartley, Gatooma, Umtali and Victoria. Salisbury is connected with Beira, Portuguese East Africa, by a railroad. From Salisbury north another railroad extends 580 miles through Buluwayo to the Victoria Falls, where there is a new bridge over the Zambesi. This road is a section of the Cape to Cairo Railway. For the antiquities, anthropology, history, etc., of Mashonaland, consult Bent, J. T., 'Ruined Cities of Mashonaland' (London 1892); Hall, R. N., 'Prehistoric Rhodesia' (Chicago 1910); id., 'Great Zimbabwe' (London 1905); Darter, A., 'Pioneers of Ma-

shonaland (London 1914); Randall-MacIver, D., *Mediaeval Rhodesia* (London 1906).

MASINISSA, măs-ĭ-nĭs'ą or **MASSINISSA,** king of Numidia: b. 238 B.C.; d. 148 B.C. He was at first ruler only of the east portion of the country, but latterly of the whole, having, by the help of the Romans during the Second Punic War, defeated Syphax, king of Western Numidia, taking him prisoner with his wife, Sophonisba, whose hand had formerly been promised to Masinissa. Masinissa now made her his wife, but Scipio Africanus, fearful of her influence, claimed her as a prisoner of Rome. Unable to resist, Masinissa sent her a poisoned chalice, of which she voluntarily drank. Masinissa commanded the Roman cavalry on the right wing at the battle of Zama, which ended the Second Punic War (201 B.C.). As a reward the Romans gave him the territory formerly held by Syphax. In peace he proved himself an efficient administrator.

MASK, a covering for the face, often shaped so as to form a rude representation of human or animal features. The study of masks, or false faces, forms an important chapter in anthropology as well as in the history of art. Evidence of the manufacture and use of masks appears in the Old Stone Age among pictures preserved on the walls of caverns in western Europe. Perhaps the best known of these is the figure of a dancing man in the cavern of Trois Frères, Ariège, France, painted in the Magdalenian period. The head of this figure is covered by the skull of a deer, the attached skin covering his body. A visitor to Indian villages in New Mexico and Arizona may still see among other masked dancers a so-called Kachina, strikingly reminiscent of this very ancient cave dancer, his body draped in the skin of a deer, his head hidden in a grotesque mask upon which are mounted the antlers of a deer.

The best surviving cave drawings of masked dancers, however, are to be seen in the cave of Mige in France (see Keith Henderson, *Prehistoric Man.*) The heads of these dancers are covered with the skulls of chamoislike animals, the attached skins of the original living creatures falling over the dancers' bodies. So well-drawn are these figures that one can almost see the vigorous movements of the dancers.

Drawings published by George Catlin (1796–1872), Maximilian zu Wied (1782–1867) and other early explorers of the Missouri River country show us Indians of the time dancing in masks representing the heads of bears and buffalo, with their bodies draped in the skins of these animals.

The transition from the primitive realistic use of animal heads to the manufacture of imaginative demon and dragon faces seems to have been made in early Neolithic times, appearing in the art of the most ancient civilizations of 6,000 and more years ago. These evidences of antiquity in the use of masks, and the survival of their uses among all primitive peoples of the world, justify the assumption that the use of masks is as universal as speech and almost as ancient in origin. Their function as a mode of expression is so fundamental that they are still used by the most civilized peoples. That they played an indispensable role in the early evolution of the stage is obvious.

Anthropologists consider one of the most universal interests of mankind to have been the observation and study of mammals, birds, and reptiles. Primitive man was intrigued by the mysterious behavior of animals, which was everywhere interpreted in terms of human experience. Cave man art suggests that, almost from the earliest times, man chose animal characters for his fictional narratives. Surviving folk tales collected from savage peoples and those handed down to us from our pagan European ancestors indicate that the bedtime story, Uncle Remus stories, and other such tales are as old as the human race. Drawings in caves indicate that dancing began with the impersonation of real living serpents and animals with masks and costumes, leading soon to imaging grotesque demons and saints, as the case might require.

While the use of masks in the abstract is ancient and universal, masks vary in style, technique, and art to such a degree that a world-wide collection of masks throws much light on human geography, history, and archaeology. Like stone tools, metalwork, and ceramics, their classification as to place and time affords one of the most satisfactory objective records of man's career upon the earth. Hence, they play a large role in museums of anthropology, history, and art. In fact it is difficult to conceive of any study of art, graphic or theatrical, not based objectively upon collections of masks. For example, the role played by masked animal gods in the tomb and temple paintings of Egypt, in the heroic sculptures of Ur, Babylon, and other ancient Asiatic cities, is extremely illuminating, and so is the part played by the masked gods of Tibet and China, who appear in religious festival folk dances. How empty and dreary would be the mere verbal narratives of ancient and surviving primitive peoples without collections of masks to use as illustrations!

The modern geographical distribution of masks is of interest. In the New World, the Indians show special regional styles in masks. The most elaborate development appears among the coastal Indians of British Columbia and southern Alaska, where large wooden masks are in use. These objects form a large part of museum collections from that area. Both animal and human heads are depicted in these masks; some of the heads representing birds and mammals are of extraordinary size, and by means of cords the wearer can roll their eyes about, and open and snap their jaws. Other heads are double or triplicate, opened out by the dancers at will, revealing entirely different faces within. Even the Eskimos of Alaska use masks, but Eskimo masks are smaller, not so complicated.

The Indians of the Southwest, the Apache, Navajo, and Pueblo tribes, use numerous highly colored masks of wood and textile materials to impersonate gods and other supernatural creatures.

The Plains Indians formerly supported a series of ceremonies in which some animal masks were worn, but, comparatively speaking, their mask culture was weak. The same thing is true of California Indians. East of the Mississippi, the chief mask area is among the Iroquois, whose false-face ceremonies are famous. Some of the Iroquois masks are woven of cornhusks, but the most conspicuous are those of wood;

fearful distortions of the human face used in an annual ceremony to drive away disease. In pre-Columbian Mexico, priests wore magnificent masks, decked with plumes. Warriors led their troops to battle arrayed in impressive plumed masks, as did the peoples of the Andean Highlands. The marginal peoples in both of the Americas presented far less developed mask practices, but rarely is a tribe found wholly ignorant of the art of using masks.

In the Old World, the development of masks is also uneven. Some masks were made in Africa, notably in central West Africa and in isolated parts of the Sudan, but, as a whole, the development of masks throughout the continent remained weak. India, also, has shown little interest in masks. On the other hand, the religious cults of Tibet, Siam, China, and the Malay countries reveled in the production and use of masks. New Guinea, Indonesia, and parts of Melanesia are conspicuous producers of masks and masked dancing. Polynesia, on the other hand made little use of such objects.

Australia is often thought of as devoid of crafts and arts, but often the chief actors in their elaborate ceremonies have masks built upon their bodies and faces, of almost unbelievable complexity and conceived on highly original lines. The likeness of some of these masks have been preserved by photography; usually they are destroyed in removing them from the body.

Siberia and Arctic America were weak in the use of masks. Europe saw a considerable development of masks in early times, but the Romans showed less interest in them. While the old religions of ancient Mediterranean civilizations show the use of masks, these objects found their way but moderately into pre-Roman Europe. Surviving folk festivals in Europe suggest that, in early pagan times, masks were important in clownish performances rather than in serious impersonations of supernatural beings.

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CLARK WISSLER.

MODERN MASKS

Masks to cover the face or head are used for playful disguising, as in masquerade and carnival; for dramatic effect or characterization, as in ballet, theater, and film; and for protection, as in sport, industry, and war.

Masquerade, carnival, and theater masks are descended from the primitive ritual falseface which identified the wearer, by mystic transference of properties and spirit, with the being represented by the mask. It is for this reason that a masker, even in this day, when a matter-of-fact attitude toward the supernatural has become common, still produces an uncanny effect.

At masquerades the domino, or halfmask, is generally worn. It covers the upper half of the face but leaves the mouth free. The halfmask, developed in the Italian masked comedy of the Renaissance, when mimes began to improvise speeches, became popular as a stock disguise in the streets at carnival time, and even fashionable as a sunshade and adjunct to coquetry. Often black, the halfmask may be colored as well; it is made of velvet, satin, or papier-mâché, shaped to fit over the forehead, cheeks, and nose, and is held on by cords or ribbons running from the sides around the head.

During carnival in Latin countries, many special masks are worn in parades and spectacles. Masks may have the form of gigantic heads, of humanized animals, or they may be fantastic. In Basel and other Swiss cities, there are masking societies which vie with each other in inventing caricatures with current application; such masks may comment upon political affairs. In the Tyrol, some carnival masks, clearly survivals of pagan times, represent demons and animistic spirits, while others are grotesques without historic models. In Mexico and Guatemala, some masks hark back to pre-Columbian times, some commemorate the coming of the conquistadores, and some are modern inventions. Carnival masks are often made of papier-mâché, and are discarded after being worn once; but some (as in the Tyrol) are of carved wood, or (as in Mexico) of tin or gesso-covered cactus pith.

Masks may be said to have an unknown tradition of use in the theater. Greek and Egyptian drama, arising from a religious ceremonial, were masked. At the height of its native development, about 100 B.C., Roman drama lost the mask, but regained it when Greek theater fashions came in at the time of Quintus Roscius. Traveling mountebanks of the Middle Ages played in masks; church drama had need of masks for the figures of God, angels, saints, and devils. In the day of Shakespeare, the court masque continued the medieval usage of players in vizors. Ballet dancers often wore masks, for ballet grew out of the court masque. The plays of the Roman playwright Terence (190?–?159 B.C.) were revived in masks when Goethe produced them at Weimar in the 18th century. English pantomimes and continental extravaganzas in the 19th century frequently used masked sprites, demons, and grotesques; a procession of "big heads," or players with oversized masks, was an expected feature of all such entertainments.

A revival of the mask in the theater at the beginning of the present century may be traced to Gordon Craig's writings in his magazine, *The Mask,* and to his mask designs. From 1910 on, V. E. Meyerhold in St. Petersburg, in his struggle against the realistic stage, used masks in his formalized productions of plays dealing with the fantastic and the subconscious. In 1914, Percy MacKaye used masks in vast open-air pageants such as his *Masque of St. Louis.* In the 1920's, there was a widespread experimentation with masks in the theatre. Edmond Dulac made masks for poetic dance-dramas by William Butler Yeats, in the manner of the classic masked Japanese drama. W. T. Benda's masks, which Benda first made for masquerades were worn by the dancer Margaret Severn. Pablo Picasso and Fernand Léger designed cubist masks for the ballet in Paris. Oscar Schlemmer made masks for mechanistic ballets at the Bauhaus in Dessau.

Eugene O'Neill, having written a scene of masked Fifth Avenue paraders for his play *The Hairy Ape* (1922), to show how the world looked through the eyes of a character in the play, devised a masked dramatization of Samuel Taylor Coleridge's *The Ancient Mariner,* then used masks for psychological effect in *Lazarus*

Laughed, and as symbols of character in *The Great God Brown.*

In 1920, Robert Edmund Jones designed a production of *Macbeth* in which the huge brooding masks of the Weird Sisters dominated the stage as part of the expressionistic scenery. Ernst Stern made masks for Max Reinhardt's productions in Germany. Norman Bel Geddes designed masks for the New York production of Reinhardt's *The Miracle.* Lee Simonson injected occasional masks into such Theater Guild productions as *The Adding Machine* by Elmer Rice, *Man and the Masses* by Ernst Toller, and *Back to Methusaleh* by George Bernard Shaw. For New York revues, John Held designed caricatures of film stars, and Jo Davidson made mask portraits of drama critics. James Light fitted masks to most of the characters in the Provincetown Playhouse production of August Strindberg's *The Spook Sonata* in 1924. Remo Bufano made masks for productions of *Alice in Wonderland,* Thornton Wilder's *The Skin of Your Teeth,* and Shaw's *Androcles and the Lion.* Masks are sometimes needed to give actors the look of realistic animals or of special characters; at other times, to give them an unrealistic appearance. A masked actor may change his stature or proportions; he approaches the physical fluidity of a marionette.

Protective masks of wire, leather-covered pads, and metal mesh are worn by fencers, baseball catchers, hockey guards, and other sportsmen. Eskimos and skiers wear halfmasks with goggles to keep snow glare from the eyes. Bandits wear handkerchiefs over the lower parts of their faces. Surgeons wear protective masks to maintain antiseptic conditions, or place them over patients to administer ether. A diver's helmet is a form of head mask. Wax-lined masks are placed over the skin for beauty treatments. Dust respirators and masks for paint sprayers, welders, and workers with acids are widely used in industry. Gas masks were provided in World War II, much as metal vizors were provided for the knights of the Renaissance.

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PAUL MCPHARLIN,
Late Chairman, The Puppeteers of America.

MASOCHISM, a term used in analytic psychology to denote a tendency, usual in infancy and early childhood but outgrown or sublimated in later life, to take pleasure in having pain inflicted upon oneself. The term is derived from von Sacher-Masoch, an Austrian novelist, in whose stories many of the main characters exhibited this trait in an excessive degree. A mild degree of masochism is evinced by many average men and women, particularly those who spend much of their time complaining about wrongs, injuries, pains, etc., suffered by themselves, the inference being that their unconscious masochism drives them to be occupied mentally with pain and the details of its effect upon themselves.

MASON, mā'sŏn, **Alfred Edward Woodley,** English novelist: b. May 7, 1865. He was educated at Oxford and among his works, the majority of which have been reprinted in the United States, are *A Romance of Wastdale* (1895); *The Courtship of Morrice Buckler* (1896, dramatized 1897); *The Philanderers* (1897); *Lawrence Clavering* (1897); *Miranda of the Balcony* (1899, dramatized in New York 1901); *The Watchers* (1899); *Clementina* (1901); *The Four Feathers* (1902); *The Truants* (1904); *The Broken Road* (1907); *The Turnstile* (1912); *The Four Corners of the World* (1917); *The Summons* (1920); *Running Water* (play, 1922); *The Winding Stairs* (1923); *The Three Gentlemen* (1932); *Fire Over England* (1936); and *The Life of Francis Drake* (1941).

MASON, Charles, English astronomer and surveyor: b. England, about 1730; d. Philadelphia, February 1787. He was for years assistant astronomer at the Greenwich Observatory and was sent on various expeditions in the service of science. In 1763 he was employed with Jeremiah Dixon to survey the boundary line between Maryland and Pennsylvania and they were engaged in this undertaking until 1767, the line established becoming famous in American history as the Mason and Dixon's Line. They returned to England and Mason was thereafter engaged in astronomical observations and researches until the time, the precise date of which is not known, when he returned to America. His work upon the lunar tables of Tobias Mayer which were published in London in 1787 under the title *Mayer's Lunar Tables Improved by Charles Mason,* enjoyed a high reputation for reliability. In 1860 many of his papers were accidentally discovered at Halifax, N. S.

MASON, Daniel Gregory, American composer and writer on music: b. Brookline, Mass., Nov. 20, 1873. In 1895 he was graduated from Harvard University; he studied music in Boston, New York and Paris. He was professor of music at Columbia University and is well known as a lecturer on music.

MASON, George, American statesman: b. Stafford (now Fairfax) County, in the "Northern Neck" of Virginia, 1725; d. Oct. 7, 1792. He spent his early life on a typical plantation. The same region produced his co-workers in the cause of the American Revolution, Richard Henry Lee and George Washington (qq.v.). Mason seems to have been tutored at home, being grounded in a knowledge of the classics both Latin and English. His younger brother Thomas, was sent to London to study law at the Middle Temple. George Mason was married in 1750 to Ann Eilbeck, who died in 1773. Of this union there were several children. He was married again in 1780 to Sarah Brent.

As a member of the Ohio Company he was identified with his friend, George Washington, in the initial stages of the French and Indian War. In 1759 the two entered the Virginia House of Burgesses together.

Mason drafted the Non-Importation Resolutions, which the Virginia Assembly adopted in 1769, and the Resolves, which were sanctioned by the Virginia Convention and reaffirmed by the Continental Congress in 1774. In these he outlined both a nonintercourse policy with Great Britain and the scheme of a general intercolonial congress. As a member of the Virginia Constitutional Convention of 1776, he is remembered as the author of the Bill of Rights which con-

stitutes so notable a part of the Virginia Constitution of 1776, and was probably the most complete and most advanced statement of man's rights up to that time. Mason was a member of the Virginia Assembly from 1776 to 1780 and from 1786 to 1788. In 1777 the legislature elected him to the Continental Congress but he declined to serve. In 1780 he outlined a plan which Virginia afterwards adopted for ceding to the federal government for claims to the Ohio territory. He was a member of the Constitutional Convention at Philadelphia in 1787 and took active part in discussing the Constitution. He refused to sign it because he held different views on slavery and the navigation acts. He, along with Patrick Henry, in the Virginia Ratification Convention of 1788, threw his influence against ratifications and proposed 20 alterations, some of which were afterwards adopted. He declined to serve as one of the first United States senators from Virginia. With Madison and Jefferson he succeeded in passing a law which disestablished the Episcopalian Church and protected all forms of worship. Thomas Jefferson describes George Mason as "a man of the first order of wisdom among those who acted on the theater of the Revolution."

MASON, James Murray, American legislator: b. Mason's Island, Fairfax County, Va., 3 Nov. 1798; d. near Alexandria, Va., 28 April 1871. He was graduated from the University of Pennsylvania in 1818, studied law and upon being admitted to the bar established a practice at Winchester, Va. He was in public office much of the time and in 1847 was elected to the United States Senate, representing Virginia, where he proved a consistent and strong adherent to the policies favored by his State. He was the author of the Fugitive Slave Law of 1850 and at the outbreak of the Civil War he resigned his seat in the Senate to enter the service of the Confederacy. He was sent to England with Slidell as Confederate commissioner, but was captured on the steamer *Trent* (see TRENT AFFAIR, THE) and taken to Boston where he was confined in Fort Warren until 1862 when he sailed for Europe and until the end of the war endeavored to secure recognition of the Confederacy. After the war Mason lived in Canada until 1868, being in fear of the Federal government, but returned to Virginia some years before his death.

MASON, Jeremiah, American lawyer and politician: b. Lebanon, Conn., 27 April 1768; d. Boston, 14 Oct. 1848. He was graduated at Yale in 1788, admitted to the bar in 1791, and began to practise law at Westmoreland, N. H. In 1794 he removed to Walpole, N. H., and in 1797 settled at Portsmouth, where he lived for 35 years. At the New Hampshire bar, then the most famous in the country, Mason soon reached pre-eminence, among his fellow members being Daniel Webster and Jeremiah Smith. In 1802 Mason was appointed attorney-general of New Hampshire and in 1813 became a United States senator. He was a strong Federalist and took a leading part in the senatorial debates on matters relating to the War of 1812, his speech on the Embargo, delivered in 1814, and that on the Conscription Bill, 1815, being notable among public utterances of the time. In 1817 he resigned his seat to resume his practice, but afterward served for several terms as member of the New Hampshire legislature and rendered great assistance in the codification of the State laws. He removed to Boston in 1832 and practised in the courts until he reached 70, when he retired, with reputation fully maintained, to the more private work of his profession.

MASON, John, American colonist, founder of New Hampshire: b. King's Lynn, Norfolk, England, 1586; d. London, December 1635. In 1610 he served in the navy against insurgents in the Hebrides; in 1616 went as governor to Newfoundland, of which, in 1620, he published a description and in 1626 a map. In 1617 he explored the coast of New England; obtained in 1622 a grant of region called Mariana (northeastern Massachusetts); in the same year, with Sir Ferdinando Gorges, procured a patent for the province of Maine; and in 1623 sent a colony to the Piscataqua River. In 1629 he obtained a patent for the New Hampshire colony, also taking one with Gorges for Laconia, a tract including Lake Champlain. Among various prominent positions which Mason held in England was that of judge in Hampshire 1635, and in the same year he was appointed vice-admiral of New England. In 1691 his rights in New England were sold to Gov. Samuel Allen. Mason was buried in Westminster Abbey. New Hampshire became a royal province 44 years after Mason's death. Consult Tuttle, 'Memoir of Captain John Mason, the Founder of New Hampshire,' in an edition of Mason's description of Newfoundland (Boston 1887).

MASON, John, American colonial commander: b. in England, about 1600; d. Norwich, Conn., 1672. Under Sir Thomas Fairfax he served in the Netherlands; in 1630 settled at Dorchester, Mass.; in 1633 was appointed to a military command at Boston; and two years later joined with others in founding Windsor, Conn. In 1637 he was given command of an expedition of English and Indians against the Pequots (q.v.), whom he almost annihilated, completing their destruction in a second movement a little later. He removed first to Saybrook, and afterward to Norwich. For 30 years he was a major of the Connecticut forces, was a magistrate for many years and deputy governor 1660–70. From 1642 to 1668 he served as judge of the colonial court. His 'Brief History of the Pequot War,' written at the request of the General Court, was reprinted by Increase Mather in his 'Relation of Trouble by the Indians' (1677, republished by Prince, Boston 1736). Consult Ellis, G. E., 'Life of John Mason of Connecticut' (in Sparks' 'Library of American Biography,' Vol. XIII, Boston 1864).

MASON, John Mitchell, American divine b. New York, 19 March 1770; d. there, 26 Dec. 1829. His father was pastor of an Associate Reformed Church, and the son was graduated at Columbia College in 1789, and after studying theology under his father's care for one year went in 1791 to the University of Edinburgh. He was recalled in 1792 by intelligence of his father's death, and became his successor in his pastoral charge in 1793. He planned a theological seminary to be under the authority of his denomination, and visited Great Britain for the purpose of obtaining contributions; his pulpit efforts abroad gaining him repute there as one

of the first preachers of the time. The seminary being established in New York City in 1804, he was appointed its first professor of theology. In 1806 he projected the *Christian's Magazine*, which he conducted for several years, and in which he carried on a controversy with Bishop Hobart. In 1811 he became provost of Columbia College, and by his talents and energy raised that institution to a higher character than it had ever before possessed. In 1821 he exchanged his pastorate for the presidency of Dickinson College, Carlisle, Pa., and the next year entered the Presbyterian ministry. He was one of the great pulpit orators of his day and his discourses on the deaths of Washington (1800) and Hamilton (1804) are masterpieces of their kind. Consult the 'Life,' by Van Vechten (New York 1856).

MASON, John Young, American politician: b. Greensville, Sussex County, Va., 18 April 1799; d. Paris, 3 Oct. 1859. He was educated at the University of North Carolina; was admitted to the bar in 1819; became a judge in State and Federal courts; served several terms in the Virginia assembly; and from 1831 to 1837 was a member of Congress. Then till 1844 he was judge of the United States court for the district of Virginia, and in that year became Secretary of the Navy in the Cabinet of President Tyler. Although he served temporarily as Attorney-General under Polk, he re-entered the Navy Department. President Pierce, in 1853, appointed him Minister to France, and until his death he continued to fill this diplomatic position. With James Buchanan and Pierce Soulé (qq.v.) he signed the Ostend Manifesto (q.v.).

MASON, Sir Josiah, English pen manufacturer: b. Kidderminster, 23 Feb. 1795; d. 16 June 1881. He was the son of a carpet-weaver and at an early age began to earn his livelihood by hawking cakes and fruits in the streets. At Kidderminster he successively tried his hand at shoemaking, baking, carpentering, smithing, painting and weaving. In the midst of his avocations he taught himself to read and write. He removed to Birmingham in 1814 where he became a toymaker. He set up a shop of his own in 1824, turning out split key rings by machinery invented by himself; prospering in this venture he added the manufacture of steel pens in 1829. In the latter branch of industry he became the largest producer in England. In 1874 he transferred his interest to a limited liability company. Mason was also interested in electro-plating, copper smelting and india rubber ring manufacture with George R. Elkington. In 1860 he established a great orphanage at Erdington, upon which he expended $1,500,000. He was knighted in 1872. Mason College, now part of the University of Birmingham, was founded by him with an endowment of $1,000,000. Consult Bunce, J. T., 'Sir Josiah Mason: A Biography' (London 1882).

MASON, Lowell, American musician: b. Medfield, Norfolk County, Mass., 8 Jan. 1792; d. Orange, N. J., 11 Aug. 1872. His general education was small; in music he was self-instructed and wonderfully adept even when a boy, being choir leader in Medfield when 16, and a teacher in Savannah, where he removed in 1812. He came to Boston in 1827, was president of the Handel and Haydn Society there, and in 1832 founded the Boston Academy of Music. He visited Germany in 1837 in order to acquaint himself with improved methods in teaching music. In 1821 he published a collection of psalm tunes based on Gardiner's 'Sacred Melodies,' but including some of Mason's own compositions. He is best known for his hymn tunes, notably Cowper "There is a Fountain," and missionary hymn "From Greenland's Icy Mountains". Mason's more important publications were: 'Juvenile Psalmist' (1829); 'Lyra Sacra' (1837); 'The Psaltery' (1845); 'Carmina Sacra' (1841; new series 1852); 'Musical Letters from Abroad' (1853); 'Sabbath Hymn and Tune Book' (1859). Mason's musical library is now the property of Yale University.

MASON, Otis Tufton, American ethnologist: b. Eastport, Me., 10 April 1838; d. Washington, D. C., 5 Nov. 1908. He was graduated from Columbia University in 1861 and from 1861–84 was at the head of its preparatory school. From 1884–1908 he was curator of ethnology at the United States National Museum. He was a member of various scientific societies and published 'Cradles of the American Aborigines' (1889); 'Woman's Share in Primitive Culture' (1894); 'The Origin of Inventions' (1895); 'Indian Basketry' (2 vols 1904). He was coeditor of the 'Standard Dictionary' and edited the anthropological department of the *American Naturalist.*

MASON, Rufus Ogden, American physician: b. Sullivan, N. H., 22 Jan. 1830; d. New York, 1903. He was graduated from Dartmouth College in 1854 and from the College of Physicians and Surgeons in New York in 1857. During the Civil War he was an acting assistant surgeon. He was almost as well known as an author as he was a physician and among his books are 'Sketches and Impressions, Musical, Theatrical and Social, Including a Sketch of the Philharmonic Society of New York' (1887); 'Telepathy and the Subliminal Self' (1897); 'Hypnotism and Suggestion in Therapeutics' (1901).

MASON, Stevens Thomson, American politician: b. Leesburg, Va., 27 Oct. 1811; d. New York City, 4 Jan. 1843. He was the son of Gen. John T. Mason of the noted Mason family of that State. He received his education at Transylvania University, Lexington, Ky., to which place his father had removed in 1811. On 12 July 1831, when not 20 years of age, he was appointed secretary and acting governor of the Territory of Michigan, a position he continued to occupy until 8 Sept. 1835. The death of George B. Porter, the territorial governor during his term, left Mason for several years the actual governor. Although vigorously opposed by the people of the Territory at the time of his appointment on account of his minority, his stand in the controversy with Ohio known as the Toledo War, brought him such popularity that he was unanimously chosen governor by the people upon the adoption of the constitution by the State on 2 Nov. 1835, a position to which he was re-elected in November 1837. In 1840 he removed to New York City to take up the practice of law. On 4 June 1905 under the authority of the Michigan legislature his remains were transported from New York

and reinterred in Capitol Park, Detroit, the site of the first capitol of the state.

He is known in the history of Michigan as the "Boy Governor," as he was the youngest person ever appointed to so important an executive position in the history of the nation.

MASON, Walt, American humorist and poet: b. Columbus, Ont., Canada, May 4, 1862; d. La Jolla, Calif., June 22, 1939. He came to the United States in 1880 and, after joining William Allen White on the Emporia (Kans.) *Gazette,* he became well known for his prose poems, which appeared daily in more than 200 newspapers. His principal works were *Uncle Walt* (1910); *Horse Sense* (1915); *Terse Verse* (1917); *Walt Mason, His Book* (1918).

MASON, William, American musician: b. Boston, Jan. 24, 1829; d. New York, July 14, 1908. He was the son of Lowell Mason and studied music extensively abroad. Having toured Europe and America as a pianist, he established in 1855, with Theodore Thomas and others, the Mason and Thomas recitals of chamber music, which were continued until 1868. Among his works are many piano compositions and several nstruction methods.

MASON, William, English poet: b. Hull, Feb. 12, 1724; d. York, April 7, 1797. He was educated at Cambridge and his first publication was *Isis,* a poem satirizing the Jacobitism and the high church principles which prevailed in the University of Oxford. In 1752 he published *Elfrida,* a tragedy with choral odes on the ancient Greek model. Having taken orders in the church, he was appointed chaplain in the rectory of Aston in Yorkshire in 1754, a position which he resigned in 1773. In 1759 appeared *Caractacus,* another drama on the model of Greek tragedy. Some years afterwards, he was made precentor and residentiary canon at York.

One of Mason's principal works, the poem, *English Garden,* appeared between 1772 and 1782 and was translated into French and German. In 1775 he published the poems of his friend Thomas Gray, with memoirs of his life. His principal subsequent publications were *Odes; Life of William Whitehead,* with his poems (1788); and *Essay on Church Music* (1795).

MASON, city, Michigan, seat of Ingram County, 12 miles south-southwest of Lansing on U.S. Highway 127 and the Michigan Central Railroad. Altitude 886 feet. Situated in a farming area, Mason produces beans, cabbage, and dairy products, and manufactures pharmaceuticals. The city has a public library, and a historical museum is maintained in the courthouse. Nearby is a state game farm.

Mason was named for Stevens Thomson Mason, the first governor of Michigan. Settled in 1837, Mason was incorporated as a village in 1840, and became a city in 1868. It has a mayor-council form of government. Pop. (1950) 3,514.

MASON AND DIXON'S LINE (also Mason-Dixon Line), in American history, the boundary line in lat. 39° 43′ 26.3″ north, between Maryland and Pennsylvania, surveyed by Charles Mason and Jeremiah Dixon between 1763 and 1767 in settlement of the dispute between the Baltimore and Penn families, respectively, the proprietors of Maryland and Pennsylvania. Before the Civil War the line came to designate the boundary or division line between the free and the slave states east of the Ohio. Popularly, it has come to mean the dividing line between the North and the South.

MASON BEES, a name given to the small wild bees of the genera *Osmia* and *Chalicodoma,* which construct their nests with sand or gravel, agglutinated together by means of a viscid saliva, and fix them on the side of walls, under stones, within the hollows of plant stems whence the pith has been removed, or avail themselves of some other cavity for that purpose. The mason bees, like the carpenter bees, leaf cutters and other allied forms of the family Megachilidae, are solitary in habits, not living in communities, although groups of cells are usually found near together, made by the same mother bee, and each containing a single egg and food—a mixture of honey and pollen.

MASON CITY, city, Iowa, seat of Cerro Gordo County, 65 miles northwest of Waterloo on Lime Creek at the junction of U.S. Highways 18 and 65. The following railroads serve the city: Chicago Great Western; Chicago, Milwaukee, St. Paul, and Pacific; Chicago, Rock Island, and Pacific; Chicago and North Western; Minneapolis and St. Louis; and Mason City and Clear Lake. A municipal airport also provides airline service. At an altitude of 1,130 feet, Mason City is in a grain, dairy, and livestock region. Beet fields in the surrounding area are cultivated by hand, to a great extent by Mexican laborers. Nearby are clay, shale, and limestone deposits. The chief industrial products are portland cement, brick and tile, processed meat, and beet sugar. Other industries include creameries, fertilizer and refrigerator manufacture, and some machine shops.

Nine miles west of Mason City is Clear Lake State Park, a scenic resort with a lake seven miles long and three miles wide. The Mason City Junior College (1918) was the first such school in the state and has a music department noted for the excellence of its band and orchestra. The city maintains a $300,000 public library in a seven-acre wooded tract.

The first settlement here was by freemasons in 1853. Laid out in the following year, the community received its first charter in 1870, became a city in 1881, and received its present charter in 1916. A mayor and council administer the government. Pop. (1950) 27,980.

MASONIC FRATERNITY (Freemasonry or Ancient Free and Accepted Masons), generally conceded primacy among fraternal orders, is disseminated over the civilized world. It has no central authority, being divided into more than one hundred grand jurisdictions, each autonomous, in addition to which there are several large and widespread concordant orders or so-called "higher degrees." The main stem, variously referred to as "Ancient Craft Masonry," "Ancient York Masonry," "Symbolic Masonry," or the "Blue Lodge" consisting of three degrees, the Entered Apprentice, Fellow Craft and Master Mason (and, historically, the essentials of the Royal Arch, though the latter is not now generally considered included), is probably directly descended from the fraternity and lodges of operative stonemasons and cathedral builders of the Middle

Ages, which gradually at first, but, definitely and permanently in the early 18th century A.D., became exclusively speculative in character. Freemasonry is cosmopolitan and democratic, bearing upon its rolls the names of the nobility, statesmen, scholars, and others of high rank but a much larger number of the middle class. It admits men of every nationality, religion, creed and political persuasion, the qualifications for membership being few, such as belief in God as the Great Architect of the Universe, good moral character, a fair degree of intelligence, and absence of maim or defect in body which would prevent the candidate from performing his duties as a Mason. By long-continued custom, the society refrains from solicitation of candidates; all who enter must do so unbidden and of their own free will and accord. The essential teachings of the craft are few and simple, illustrated by the symbolism of the working tools such as the plumb, square, level, compasses and other symbols, though many embellishments and refinements have been adopted in the so-called higher degrees and are often embraced in Masonic literature, so that, to some, the doctrine has become highly spiritual, though the fraternity rejects all suggestion that it is a religion or rivals any religious sect.

Antiquity.—During the 18th and first half of the 19th century, Masonic writers laid great stress upon the possible origin of the society in the remote ages of the past. Absolutely without any historical basis of record as were most of these theories, yet men of learning loaned their influence to perpetuate the fables extant concerning the fraternity. Some asserted (1) that the history of the race was the story of Masonry, beginning with the migration from the Garden of Eden; others (2) that it sprang from the Patriarchal period; and still others contended (3) that the society was the successor of the ancient mysteries of the Orient; (4) that the Temple of Solomon was its cradle; (5) that the Crusaders and the Knights Templar carried it forward from their times; (6) that the Roman colleges of artificers and builders of the Middle Ages handed down the craft to posterity; (7) that the civil strifes in Great Britain of the 15th and 16th centuries, and subsequent political events, made the institution possible; (8) and a later class of writers placed the origin to the credit of the Rev. James Anderson, D.D. and the Rev. John Theophilus Desaguliers, L.L.D., F.R.S. and their compeers of «The Revival of 1717 A.D.» Several of these authors changed their views later in life; and, during the past 50 years, the intelligent Masons of Great Britain and the United States have attempted to build up from the broken fragments of the past—contained in fugitive lodge records and old constitutions extending back more than three centuries—a reasonable history of the «operative» Masonry of the British Isles and the continent of Europe, as well as that of the present «speculative craft.» In this effort, assistance has been rendered by scholars not connected with the fraternity. The critical reader will note in the enumeration above that many plausible theories might be founded, both on history and legend, but the strongest factor in the appeal to antiquity, nevertheless, is the «Legend of the Third Degree.» In one form or another, the allegory of the fall of man, the sacrificial redemption of the race, the doctrines of the resurrection and immortal life, permeated the peoples of every age and became the motive of many migrations. When, therefore, a society arose which claimed to solve some of these mysteries—nay, even to have descended from those periods—it is not singular that the order should have attracted disciples; especially when shielded from public gaze by a veil of secrecy, the universality of the printed page not having yet been established.

Origin in Great Britain.—The majority of modern opinion holds that Freemasonry of the present day, that is to say, that of the symbolic or «blue lodges,» had its origin in the British Isles, probably in medieval times and, therefore, peculiar interest centers in the history, legends, and constitutions of the fraternity in that quarter. The heyday of the operative cathedral builders rapidly waned after the Lutheran reformation of 1517 by reason of the decline in the construction of church edifices, so that our first glimpse into lodges in Scotland follows by some three quarters of a century the culmination of operative prosperity, though the Old Constitutions of the English Freemasons carry our knowledge back some two centuries further. The earliest lodge minutes in Scotland are those of the Lodge of Edinburgh for July 1599, and those of the following year show that the lodge had already begun to admit «accepted» Masons, that is, gentlemen or theoretic Masons, not of the stonemasons' trade or of any trade but of the gentry and nobility. Other lodge records show the presence of this class in Scotland variously between 1652 and 1696. The earliest English lodge records we know of are those of Alnwich Lodge of 1701 and York Lodge for 1705, though the existence of other lodges is attested by extraneous evidence; for example, the diary of Elias Ashmole, a prominent scholar and antiquary of that day, who records that he was made a Mason at Warrington in Lancashire in 1646, and Dr. Plot's statement in 1686 that the society was spread more or less over the nation. Fortunately, there have been preserved a most informative group of old parchments, some in book form and some in rolls, containing the fundamentals of the English craft, that is, the legends and charges. These are the «old charges» or «Gothic Constitutions,» the oldest of which, the Regius or Halliwell MS., lay in the British Museum for many years cataloged as «A Poem on Moral Duties.» It is undated but antiquaries ascribe it to about the year 1390. The next oldest, also in the British Museum, is the Matthew Cooke MS. of early 15th century production. About eighty similar MSS. are preserved, some dated, others evidencing origins through the 16th and 17th centuries. They have been classified into families, each family including those either copied one from the other or evidencing close relationship. Though variations exist amongst families, and to a lesser extent amongst those of the same family, the framework and substance of all are the same, the differences being much as though the contents had been committed to memory and transmitted orally, so that, when occasionally reduced to writing, faulty memories produced divergent results. Each consists of three main parts: (1) the invocation, (2) the legends, and (3) the charges.

The invocation or declaration of faith is usually of Christian character, the following being an example contained in a version of 1583

in possession of the United Grand Lodge of England:

The mighte of the Father of Heaven and y^e^ wysdome of ye glorious Soone through y^e^ grace & y^e^ goodnes of y^e^ holly ghoste, y^t^ bee three psons & one God, be w^h^ vs at o^r^ beginning and give vs grace so to govrne vs herein or lyving that wee maye come to his blisse that nevr shall have ending. AMEN.

The legendary portion purports to account for the origin of Geometry or Masonry, (those terms being used synonymously), before the Flood and the preservation of the science by its having been written on two pillars, one of which would not burn in fire and the other of which would not drown in water. It was then carried into Egypt where Euclid espoused and taught it to the Egyptians. Pythagoras is said to have made much use of it. The building of King Solomon's Temple and the part played by Masons and Masonry is recorded; (whence the Temple legend and allegory in modern rituals). The science is next said to have been carried into France where it came under the protection of Charles Martel, and thence it was carried into England in the time of St. Alban. This apocryphal history then recites that the Masons received the patronage of Prince Edwin and King Athelstan, the latter of whom called a national assembly of the craft at York where he gave them charges (a charter) authorizing yearly assemblies.

The charges vary in number, sometimes 15 for the Masters and a like number for the workmen, in other MS, 25 for all without discrimination, and various other numbers and arrangements. These charges enjoin adherence to the church, honor and morality, discharge of just obligations, the performance of honest work for fair wages, loyalty to the King and abstinence from plots and conspiracies, secrecy of counsel within and without the lodge, mutual respect, aid and assistance amongst the craftsmen, seven years apprenticeship, certain standards of character and bodily integrity as prerequisites for apprenticeship, abstinence from gaming or lewd company, attendance upon the annual assembly, and other provisions of like kind, all with some variety of language and arrangement amongst the various MSS. Most of the known copies are of English origin and, while they do not afford the same insight into the lodges as do the minutes of lodges in the North, the oldest are approximately two centuries anterior and are generally accepted as the formulae used in the ceremonies of admitting apprentices to the lodge. They also form the basis, as closely as speculative uses permit, of the present day rituals, customs and laws of the society.

The credit for the conception of the Gothic structures which abound throughout the British Isles and Western Europe, and which were erected in the 400 years between the 11th and 16th centuries, as well as the identity of the architects thereof, has never been settled. Even the application of the name Gothic to this style of architecture is unaccounted for, every nation of that name having disappeared several centuries before the first example was erected. Old records, more recently discovered, and examined in the light of present-day research, have led Masonic writers to revise their formerly accepted assertion that the cathedrals and other public edifices of the Middle Ages were planned by church dignitaries. The opinion now obtains that the Master Masons of that period were the architects. Performing the work under the guidance of the Master and closely guarding the mystery of the craft were the Fellows and Apprentices. Each workman placed his mark upon the stone fashioned by him so that it could be identified and his wages paid accordingly. Innumerable examples of these marks are found in structures of the period. The early records indicate that the living quarters or tiled lodges were used as places of instruction and communication of the mystery of the craft, strict secrecy being enjoined to preserve the monopoly and particularly to prevent encroachment by «cowans,» that is, masons of meaner accomplishments such as brick and rough masons and possibly even including some of more eminent ability who did not conform to the charges or, as it was expressed in Scotland, who lacked the «Mason Word.» The status of the «accepted» or gentlemen Masons during the years of operative pre-eminence is not clear, but it is certain that the practice of admitting them was by no means exceptional during the 16th and 17th centuries and that, by the beginning of the 18th century, the lodges contained a considerable theoretic element which, in some instances, predominated. It has been shown that, of those named by Elias Ashmole as present in the lodge at Warrington in 1646, not one was a working stonemason. To this peculiar custom is unquestionably due the preservation of the society during the period of transition from operative to speculative Masonry, a period of more than a century, during which English lodges diminished in number (we positively know of only six or seven with intimations of four or five more in the early years of the 18th century), and during which the lodges in Scotland, though keeping up their existence, had been reduced in importance and activity. It was these «accepted» or theoretic Masons who conceived and carried through the speculative reorganization of the society in 1717. The term «speculative» is not confined to those who founded the Grand Lodge of England or their successors, for they were of the same kind and in some instances the same individuals who were «accepted» prior to that event. We do not know, however, to what extent they had theretofore indulged in the study of symbolism or moral science. While lodges of the ancient period were chiefly operative, there were even then speculative members. According to the old Masonic MSS., Prince Edwin was «of the Speculative part, a Master,» and the Regius MS. of about 1390 mentions lords, dukes, earls, barons, knights and squires, as members. Probably due to decline in cathedral building, the operative element diminished and the speculative feature grew until, at the Revival of 1717, the latter was greatly in the ascendant. Prior to and even for a time following that event, there seems to have been some rivalry between the two elements, but the trend of events favored the speculatives and they soon became entirely predominant, the operative membership gradually disappearing. We do not know to what extent signs, tokens, words, and other modes of recognition were used prior to 1717, but some of the old MSS. indicate that they had a place. Also, the «benefit of the Mason Word» appears in the Scots records, and the Melrose MS. of 1581 (known to posterity by the transcript of 1674) refers to «ye privilege of ye compass, square and level, and ye plum-rule.» Extraneous documents refer to secret modes of

recognition, and Dr. Plot, writing in 1686, mentions their existence quite positively. Despite lack of evidence, persistent efforts, entirely fanciful, have been made repeatedly to identify Freemasonry in some more or less close association with the Rosicrucians, the Alchemists, and the Hermetic philosophers. It can only be said that many secret societies have, from time to time, sprung up, some imitating and some pretending to rival the Masonic institution, but if there is a character of the order stronger than any other, it is its consistent aloofness from association with, or recognition of, any other order or organization, and its persistent repugnance to innovations.

The Grand Lodge Era.—In 1716, as we are informed by Dr. James Anderson, the «historian of the Grand Lodge,» the members of four old London lodges, together with some old brethren, met and, having put into the chair the oldest Master Mason, they constituted themselves a Grand Lodge pro tempore, forthwith, revived the quarterly communication of officers of lodges, and resolved to hold the annual assembly and feast, and then to choose a Grand Master. Accordingly, on St. John Baptist's Day, 24 June 1717, at the assembly and feast, Anthony Sayer, gentleman, was installed Grand Master. In 1721 the Duke of Montague, Grand Master, instructed Dr. Anderson, with a committee of 14, to collect all the old documents of the craft and digest them in a new and better method. This work, consisting of an elaboration of the old legends, the revised «Charges of a Free Mason» and a code of General Regulations, which had been adopted in 1722, was completed, approved, and published in 1723 and is usually known as «Anderson's Constitutions of 1723.» This movement, though called the «Revival of 1717,» because it was the asserted reinstatement of the legendary General Assembly mentioned in the Gothic Constitutions, was something more; it was also a reorganization. The Grand Lodge assumed jurisdiction over existing lodges in and about London and Westminster which accepted the new regime, and forbade the formation of new lodges by its adherents without its consent; stated annual and quarterly communications were scheduled; the lodges abandoned all efforts to regulate the building trade and devoted themselves to speculative moral science; degrees, rituals and lectures, theretofore rudimentary, were formulated or perfected; the old charges were revised and unified; elaborate regulations were adopted, and lastly, the exhortation in the Ancient Constitutions «to love God and Holy Church» was modified by obligating the Mason only «to that religion in which all men agree, leaving their particular opinions to themselves; that is to be good men and true, men of honor and honesty.» Two clergymen, Dr. James Anderson (b. Edinburgh, 5 Aug. 1684) and Dr. John Theophilus Desaguliers F.R.S. (b. France, 12 March 1683), the third Grand Master, together with George Payne Esq., who occupied the position for the second and fourth years of the organization, are supposed to have been the most influential in the movement, though none of them are known to have instigated the step. Dr. Anderson, 15 years later, published his «Constitutions of 1738.» From the time of its creation, the premier Grand Lodge flourished, many new lodges were formed, its scope of jurisdiction gradually expanded, and applicants in increasing numbers knocked at the doors of the lodges. There was not abse however, a considerable dissenting element a hering to the old customs and distrusting the n order and also several rival and disparagi orders which enjoyed but short existences unc the names of Antediluvian Masons, Honora Masons, Apollonian Masons, Real Masons, Mo ern Masons, Philo-Musicae et Architecturae S cietas Apolloni, Scald Miserable Masons, t Ancient Noble Order of the Gormogons, t Order of Gregorians and the Noble Order Bucks. York Masonry, by reason of the leger ary first General Assembly, called there by Ki Athelstan, enjoyed some pre-eminence in repu tion, which was possibly the inducement for Yo Lodge, in 1725, to meet not only as a priva lodge but also as a «General Lodge.» It cho a Grand Master and called itself the «Gra Lodge of All England.» This ambitious ente prise was tolerated by the premier Grand Lod but became dormant after about 20 years. R vived in 1761, it lived for about 30 years mo during which, in 1779, it constituted a disaffect branch of Lodge of Antiquity the «Grand Lod of England South of the River Trent,» whi survived only until 1790. In 1770, a «Supre Grand Lodge» was formed, it is thought by Sco Masons, but expired about 1775. By far t most important of the dissident bodies arose 1752 in the «Grand Lodge of England Accordi to the Old Institutions,» commonly called t «Ancient» Grand Lodge, or «Athol» Gra Lodge, because of the long Grand Mastershi of the two Dukes of Athol, father and son. Th movement, for many years, ranked as the «Gre Masonic Schism,» but more recent investigatio have shown that it was instituted by Irish M sons residing in London, few of its members, any, having belonged to the older branch, up which the name «Moderns» became firmly a tached. The Ancients steadfastly asserted, main through their energetic and contentious Gra Secretary, Laurence Dermott, throughout the years of their separate existence, that the Mo erns had departed from the «Landmarks» of t Craft and, therefore, that the former was t true and ancient rite. The changes alluded t though of minor character, were sufficient to p the premier Grand Lodge on the defensive, a the Ancients, conferring in their lodges the Roy Arch Degree, a very popular working, we through the latter part of the 18th centu rapidly overtaking the older rival in both Gre Britain and America, and actually seemed to preferred by the Grand Lodges of Ireland a Scotland. Traces of this divergence are st found in America and elsewhere, some Gra Lodges bearing the name Free and Accepte Masons while about an equal number, Ancie Free and Accepted Masons, although these nam do not always indicate the line of descent, beir sometimes chosen as a matter of taste. At a times painful to the leaders of each of the tw branches, the estrangement was brought to happy ending on St. John's Day, 27 Dec. 18 by their most harmonious merger into th «United Grand Lodge of Ancient Freemasons England,» the governing body of English Fre masonry at the present day. It was, thereupo declared «that pure Ancient Masonry consis of three degrees and no more, viz., those of th Entered Apprentice, the Fellow Craft, and th Master Mason, including the Supreme Order the Holy Royal Arch.» The inclusion of the la

amed was a victory for the Ancients, because he Moderns, though conferring the degree in a Chapter,» did not recognize it as part of the raft degrees. In time, however, the Royal Arch as separated from the Grand Lodge and administered under the jurisdiction of the chapter, nough its three principal officers are identical ith those of the Grand Lodge.

In Scotland.—The honor of seniority mongst lodges has been the subject of much ispute in Scotland, the determination by the rand Lodge first giving Lodge of Edinburgh ie rank of No. 1. Later, «Mother» Kilwinning odge was preferred but, in order not to disturb ie numbering of other lodges, the rank of No. 0 as accorded it. Meanwhile, other old lodges ad also been designated as No. 1, and for like easons suffixes were added so that we have odge of Melrose St. John No. 1 (bis) and odge of Aberdeen No. 1 (ter). The oldest inutes now extant of these four lodges are ated: Edinburgh 1599, Kilwinning 1642, Aberen 1670, and Melrose 1674, but extraneous cords show all of them to be much older, some ssibly reaching back to the 12th century. Other d lodges are: Scoon and Perth No. 3; Glasw St. John No. 3 (bis); Atcheson-Haven xtinct in 1866); and Ancient Lodge No. 49 Dundee, all antedating 1650. The lodges in cotland were all operative in character, but merous records through the 17th century stify to the admittance of nonoperative mems. On St. Andrew's Day, 30 Nov. 1736, the ample set in England and Ireland was followed by the formation of the Grand Lodge of cotland, though several lodges maintained their dependent existence long after that date. Lodge Glasgow St. John No. 3 (bis) not only deined to join the Grand Lodge for many years, it refused to admit nonoperative Masons until 42. The first Grand Master, Baron William Clair of Roslin (Earl of Orkney and Caithss), was followed by the Earl of Cromarty. cotland's «Masonic gem» is the «Prentice's Pilr» in the chancel of Roslin Chapel, Edinburgh.

In Ireland.—Traces of the craft in Ireland e few and obscure prior to 1726, though extraious references demonstrate that it was well own as early as 1688. The earliest minutes are ose of 8 Dec. 1726, in a book recording the oceedings both of a private lodge at Cork and a Grand Lodge in the Province of Munster. he London *Journal*, 17 July 1725, mentions an ish Grand Lodge and, in that year, Anderson's onstitutions were advertised for sale by Dublin okstores. The Grand Lodge of Ireland was rmed at Dublin apparently 3 Feb. 1728, though earliest minutes were destroyed under circmstances never satisfactorily explained. Lord ingston, who had been Grand Master of Engnd in 1729, was made Grand Master of the ish Grand Lodge in 1730, and again in 1735 d 1745. From 1747, Irish Masonry prospered ore than formerly. A curious tale, accepted some, doubted by others, has it that The on. Elizabeth St. Leger, then a girl of 20 ars, who afterwards married Richard Aldorth, having been discovered spying upon a asonic lodge, was initiated in order to assure r retention of the secrets. The tale arose some ars after the supposed event, the scene is laid in rious lodges, and the character of an initiation not specified, but a portrait of the lady, clothed a Freemason, hangs in many Irish lodgerooms, and her apron is preserved, thus assuring her standing in the opinion of some as the «only female Freemason.»

On the Continent.—Attempts to connect the building crafts of Continental Europe with speculative or symbolic Freemasonry have signally failed. Both the German *Steinmetzen* (stonemeasurers) and the French Masons produced works comparable to the Freemasons of Britain and maintained societies not unlike those in the Isles. Strangely enough, our first documentary introduction to the *Steinmetzen* (Constitutions of 1459 and Torgau Ordinances of 1462) closely approximates the dates of the earlier Gothic Constitutions and, more interesting yet, is the fact that the two are in substance quite similar, some precepts being in practically identical terms. Less is known of the French craft (Les Compagnons du Tour de France) virtually all of our information coming from the book published in 1841 by Agricol Perdiguier. It is possible that the disintegration of the German and French operative craft was followed by short-lived nonoperative societies but they did not develop into Masonic lodges, nor did York Rite Masonry, upon its introduction into the Continental countries (France about 1726 and Germany somewhat later) encounter any societies which were recognized as even remotely related to it. Freemasonry, as adopted into Germany, soon became divided into at least three Grand Lodges, one of them adopting Christianity as its doctrine, and all of them to some extent permeated by sectarian discord. Less peaceful yet was the career in France, where the Grand Orient, to the disheartenment of British and American Grand Lodges, subjected itself to criticism on five points: (1) its organization and degrees which included four above the three craft degrees; (2) a connection with Co-Masonry (female); (3) political disputes; (4) religious differences; and (5) invasion of other jurisdiction by chartering lodges therein. Up to 1849, the Grand Orient had made no declaration respecting a belief in Deity as a condition for membership, but followed Anderson's Constitutions of 1723, which were either negative or indefinite upon the subject. Yet, the Grand Orient was recognized as regular by all other Grand Lodges. On 10 Aug. 1849, that body declared that «Freemasonry has for its principles the existence of Deity and the immortality of the soul,» which remained in effect until 14 Sept. 1877 when the declaration was changed to read: «Masonry has for its principles mutual tolerance, respect for others and for itself, and absolute liberty of conscience.» Most British and American Grand Lodges, soon thereafter, severed fraternal relations with French Masonry, not, however, as sometimes stated, solely because of this action but rather because it was the culmination of a long series of irritations. For 20 years prior to the outbreak of the Second World War, there was much sentiment, particularly in England, for the restoration of concord with the Grand Orient. In Scandinavian countries, Freemasonry has taken on peculiar characters, though generally recognized as regular. Kings of these lands are the hereditary Grand Masters, the doctrine is Christian, and the rite is a peculiar combination of portions of the York and Scottish degrees.

In Russia, Freemasonry first appeared toward the end of the 18th century, the body of

its membership being composed of the aristocracy. Its influence is vividly set forth in Tolstoy's *War and Peace* dealing with the War of 1812 (Napoleon's invasion of Russia). During the reign of Czar Nicholas I (1825–55), Masonry was put under the ban because of religious and political difficulties, particularly the mutiny of the officers of the Guard, known as the Decembrists, in 1825, in which many prominent Masons participated. Thereafter, Masonry existed as an underground order until the 1860's. There has been no evidence of the order in Russia subsequently, though several times it has been suspected to exist.

In other European nations—Spain, Portugal, Italy, Greece, Austria, Poland, Czechoslovakia, and the Balkans—Freemasonry has often enjoyed periods of peace and prosperity and has attracted men of superior attainments only to have its career checked or interrupted by religious or political persecution, which, after all, is not unnatural in view of the wide gulf between Masonic liberality of belief and conscience and the diametrically opposed religious and political institutions established amongst those peoples long antecedent to the importation of Freemasonry.

In America.—Jonathan Belcher, governor of Massachusetts, was made a Mason on a visit to England in 1704 and is the first Freemason known to have been in the Western Hemisphere. Some of the first lodges in the colonies were held under the immemorial right of Freemasons under the Old Constitutions to meet in lodges anywhere that five or six brethren could be assembled, just as the similar right was acted upon in England by the Old or St. John Masons for some years after the formation of the Grand Lodge in 1717. Such a lodge seems to have been held at Fredericksburg, Va., as late as 22 Dec. 1753, conferring on that date both the Entered Apprentice and the Royal Arch Degrees. The primacy of lodges in the United States is disputed between Boston and Philadelphia, the contest revolving around questions not only of priority between duly chartered lodges but even as to the holding of lodges without charters under immemorial right. Boston claims an immemorial right lodge, without clear proof, as early as 1720, but it is well settled that such a lodge, perhaps several, existed at Philadelphia as early as 1730, for Benjamin Franklin was made a Mason there in February 1730. On 5 June 1730, Daniel Coxe of Burlington, N. J., was appointed by the Duke of Norfolk, Grand Master of the premier Grand Lodge of England, Provincial Grand Master for New York, New Jersey, and Pennsylvania. On 13 or 30 April 1733, Lord Montague, Grand Master of the Grand Lodge of England, issued a like deputation to Henry Price of Boston covering New England. There is no evidence that Coxe acted under his deputation at all, but it is clear that Price formed a Provincial Grand Lodge in Boston 30 July 1733, and the same day constituted the First Lodge of Boston which, some years afterwards, consolidated with two others and is now St. John's Lodge. The Pennsylvania Masons under the Grand Mastership of Benjamin Franklin petitioned Price, whose jurisdiction was reputed to have been extended over all of North America, for a charter for a Grand Lodge which was reported, probably incorrectly, as granted 21 Feb. 1735. The supposed superiority of chartered lodges as against the informal lodg held under the Old Constitutions or immemor right seems to depend upon the regulations the Grand Lodge of England approved 24 Ju 1721 forbidding the formation of a lodge witho the Grand Master's warrant, but regard must given to the fact that those regulations and, i deed, all the pretended jurisdiction of the Gra Lodge of England were expressly limited lodges in London and Westminster together wi such others as voluntarily joined the Gra Lodge. Several lodges in England and Scotla maintained their independent existence for so years after the formation of the Grand Lodg in the respective kingdoms. Hence, an i memorial right lodge in America may have be as legitimate as a warranted lodge, and the r spective claims of the Massachusetts and Pen sylvania brethren may be considered by othe a mixed question of law and fact still und termined. Charters for other lodges in t Americas, issued by both the Moderns and t Ancients were especially prolific after the midd of the 18th century. To these must be add charters issued by the Grand Lodges of Irela and Scotland, both of which were active in t spread of Freemasonry, not a little augment by army or regimental lodges in practically of the armed forces of the period. Among t many prominent men who belonged to the fr ternity in the formative period of the nati besides Franklin, were Washington who w made a Mason in the lodge at Fredericksbur Va., and became Master of the lodge at Ale andria, Va.; Monroe, Fulton, Montgomery, Bu Paine, Hamilton, Sherman, Rush, Whipp Gerry, Stark, Livingston, Warren, John Pa Jones, Witherspoon, Revere, Hancock, Lafayet Steuben, De Kalb; and later, Jackson, Pol Fillmore, Buchanan, Johnson, Garfield, McKi ley, Taft, Harding, Theodore Roosevelt, Fran lin D. Roosevelt and Harry S. Truman we identified with the craft.

In Other Countries.—Freemasonry, at va ous times, has spread into practically all civiliz nations, Grand Lodges now existing in the pro inces of Alberta, British Columbia, Ontari Manitoba, New Brunswick, Nova Scotia, Prin Edward Island, Quebec, and Saskatchewan, Canada; New Zealand, New South Wales, Vi toria, South and West Australia, Tasmani Queensland, the Philippines, Mexico, Puer Rico, Cuba, and Central and South America. the Continent of Europe during the Seco World War, Freemasonry was suppressed became virtually extinct, except in Swede Switzerland and possibly Portugal.

Statistics.—The United States stands pr eminent in its patronage of the society, havi 49 Grand Lodges with something over 15,5 subordinate lodges and approximately 2,500,0 members. In the rest of the world, there a some 60 Grand Lodges with about 11,000 su ordinate lodges and 1,000,000 members, not i cluding a score or more of Grand Lodges whic with their subordinate lodges, have been su pressed or extinguished on the Continent Europe, in the Philippine Islands, and in Chi These figures do not include the so-called high degrees of the York Rite or the Scottish Rite.

Supplemental Degrees and Orders. Within two decades following the formation the Grand Lodge of England, two classes of s called higher degrees began to be worke

(1) those apparently of English origin which ttached themselves to York or Craft Masonry, nd (2) those of Continental origin constituting he Scottish Rite, founded upon, but more or ess independent of, the British craft.

The first of these was the Holy Royal Arch, he essentials of which probably existed prior to 717. Though not recognized officially by the remier Grand Lodge, it came to be conferred y the lodges as a degree designed to complete he Third Degree, being conferred only upon Masters of lodges. The author and origin of he ritual are unknown but the Chevalier Anrew Michael Ramsey has been credited with its reation. Coming into the Masonic system someime between 1730–50 and before the Third Deree was worked in all lodges (those which conerred it being called «Master's Lodges»), the Royal Arch became very popular and the especial ride of the Ancients who considered it an inispensable part of the craft working. The Moderns, while not recognizing the degree as a art of Craft Masonry, conferred it in «Chapers.» The first lodge records showing the orking of the degree are those of Sterling Rock odge in Scotland for 30 July 1743 (their verity uestioned); and in America, the minutes of a odge at Fredericksburg, Va., in 1753. At the Union of the Ancients and Moderns in 1813, the Royal Arch was declared to be a part of pure ncient Masonry, though it was soon segregated nder the administration of the Grand Chapter, he principal officers of which are the same as hose of the Grand Lodge. The Mark Master, ast Master and Most Excellent Master Derees which are, in America, under the Royal rch Chapter, are of later origin, the last named ossibly the work of Thomas Smith Webb in merica. These several Chapter degrees are alled «Capitular Masonry.» The further derees of Royal and Select Masters are known s the «Council» or «Cryptic Masonry.» The rder of Knights Templar, the only avowedly hristian element in the whole galaxy of degrees, s theoretically derived from the Crusades and many attempts have been made to show an actual onnection, chief among which is the theory f the «Baldwin Encampment,» based on the ancied association of the Freemasons with the rusaders as builders of strongholds, priories, nd round churches of which the famous Temple hurch, London, is an example; then, the supposed flight of the surviving knights to the rotection of Freemasons in Scotland, following he martyrdom of Jacques de Molai, the last rand Master, executed 11 March 1314. But the ask of supplying the 400 years of history beween the dispersion of the Templars and the rst record of the modern order has proved impossible, so that the order must be deemed one f the additions made to the Masonic system in he latter half of the 18th century. The first ention of the Knights Templar in Masonic ecords occurs in the minutes (lodge warrant) f St. Andrew's Royal Arch Chapter, Boston, lass., 28 Aug. 1769; the earliest in England in hose of Phoenix Lodge No. 257, Portsmouth, 21 ct. 1778. On 8 Oct. 1779, the Earl of Eglinton, aster of Kilwinning Lodge (Scotland) warranted the «High Knights Templar of Ireland at ublin.» The records of the «Grand Lodge of ll England» at York show that in 1779 the oyal Arch and the Order of Knight Templar ere conferred as the 4th and 5th degrees, respectively. That order with the Order of the Red Cross and the Order of Malta comprise «Chivalric Masonry.» Of these supplemental York Rite degrees and orders, the Council degrees, the Past Master and Most Excellent Master Degrees and the Order of the Red Cross are not conferred in Great Britain and the «Commandery» is there the «Preceptory» not using the American rituals. Also the Mark Master is there not under the administration of the Royal Arch Chapter but constitutes a separate order. Such differences have led some to use the coined term «American Rite» to describe the working in the United States but without clear specification whether only the supplemental degrees or the whole Masonic system is included. The term seems to have originated with Dr. Albert G. Mackey, known for his dogmatic declarations, some of which were erroneous or disputative, e.g., his 25 «ancient, universal and immutable landmarks,» accepted by some but quite generally denied by others. The preferred authorities recognize the three symbolic degrees of the «blue lodge» in the United States as English or York Masonry and, hence, regular and legitimate Craft Masonry. The same is probably true of the Royal Arch Degree for it was so declared by the United Grand Lodge of England in 1813. The other degrees and orders of the Chapter, Council and Commandery may not be strictly so, but, by long usage, the term York has become fixed upon them. The name York Masonry became attached to English Freemasonry by reason of the legendary assembly, held there under the auspices of King Athelstan, and in the same way and quite as properly as the legend of King Solomon's Temple became a part of Masonic symbolism. The term is not to be confused with «Ancient York Rite» often used to imply that the working was there practiced prior to the Grand Lodge era, for it is not known with certainty what ceremonies were employed in any English lodge in the ancient period. Unlike the craft lodges, Capitular, Cryptic, and Chivalric Masonry are organized on a national basis. The General Grand Chapter of Royal Arch Masons of the United States was instituted by a meeting of delegates at Hartford, Conn., 24 Jan. 1798, and now has 49 Grand Chapters with some 3,500 chapters and approximately 500,000 members. In the rest of the world, there are about 3,000 chapters and 160,000 members. The General Grand Council of Royal and Select Masters has, in the United States under its Grand Councils, over 1,300 councils and 160,000 members. The Grand Encampment Knights Templar of the United States was organized at New York in 1816 and has some 1,600 commanderies and over 200,000 members.

The Scottish Rite, the other large branch of the supplementary Masonic system, is not, so far as known, Scottish, either in origin or character, but French as to both. Following the introduction of British Craft Masonry into France about 1725–26, the imaginative Latin temperament saw the possibility of elaborating upon the English rituals with the result that, by 1740, «Hauts Grades» or systems of higher degrees had begun to multiply, continuing to increase for a period of some 35 years. No complete list of them has ever been compiled but their number from first to last is said to have exceeded 200. Frederick the Great is asserted, with some disputation, to have been an active

Freemason and, if so, his connection was probably with the Hauts Grades, the 21st degree of which is called Naochite or Prussian Knight. The progress of the system was marked by numerous dissensions and disturbances largely the outgrowth of rivalry amongst the advocates of several groupings or systems and the contention of the votaries of the rite that they were possessed of advanced secret knowledge and, thus, superior to Masons of the symbolic degrees. The rite eventually came to dominate the Grand Lodge of France until the revolution of 1789 virtually eliminated Freemasonry in that nation. The French Scottish Rite never revived but was reformed and reorganized in America where it was carried by Stephen Morin under a patent of 27 Aug. 1761, giving him power to form lodges in the New World. Under various deputations from Morin, Lodges of Prefection were established at Albany, N. Y., in 1767; Philadelphia, Pa., in 1781; and Charleston, S. C., in 1783, followed by a Council Princes of Jerusalem at Charleston in 1788 and a Council Princes of the Royal Secret at the same place in 1797. On 31 May 1801, John Mitchell and Frederick Dalcho organized a Supreme Council 33d Degree at Charleston, which came to be recognized as the head of the Scottish Rite in the world. Through its deputy, François Auguste de Grasse Tilley, a Supreme Council 33d Degree was organized at Paris, France, in 1804, and almost at once became embroiled with the Grand Orient of France. The American bodies developed internal discord due largely to the uncontrolled creation of inspectorships and deputations and the private communications of degrees. Nonconforming groups sprang up, among which was the «Rite of Cerneau,» later merged into the Scottish Rite, Northern Jurisdiction, though offshoots of it possibly yet remain. The Charleston body, in 1813, authorized the Northern Supreme Council at New York, which subsequently removed to and is now located at Boston. The Southern Council moved to Washington, D.C., where it is now seated in the House of the Temple. Its title is «The Supreme Council (Mother Council of the World of the Inspectors General, Knights Commander of the House of the Temple of Solomon) of the Thirty-third and Last Degree of the Ancient and Accepted Scottish Rite of Freemasonry for the Southern Jurisdiction of the United States of America (whose See is at Charleston, in the State of South Carolina).» It is governed by a Grand Commander and not to exceed 33 deputies. There are in the United States belonging to the Supreme councils of the Northern and Southern jurisdictions some 204 consistories of the Scottish Rite with approximately 425,000 members. Supreme councils exist in England, Scotland, Ireland, Egypt, Canada, Mexico and in 13 Central and South American countries. In Europe and Turkey, some 15 Supreme councils were suppressed during the Second World War.

In addition to the foregoing, several other orders have from time to time arisen, not Masonic, but confining their membership to Freemasons or their relatives. Among the more prominent are or have been: the «Order of the Secret Monitor» which developed out of the «Brotherhood of David and Jonathan,» the «Royal Order of Scotland,» the «Tall Cedars of Lebanon» or the «Grotto,» the «Palm and Shell,» the «Sciots» and, lastly and best known, the «Ancient Arabic Order Nobles of the Mystic Shrine,» a social order often called the «playground of Masonry.» Organizations confining their membership to Freemasons and their female relatives are: the «Order of the Eastern Star,» the «Order of the Amaranth,» the «White Shrine,» and «Daughters of the Nile.» The «Order of DeMolay» is for boys and «Job's Daughters» for girls of Masonic parentage.

Organization and Doctrine.—Although the three and, for a time, the four Grand Lodges of the British Isles chartered lodges all over the world, frequently in competition, the spirit of concord with which Freemasonry has, on the whole, been blessed, long since resulted in Masonic comity by which each Grand Lodge came to recognize and respect the jurisdiction of the others. Each is, therefore, independent and sovereign in its accepted zone of influence usually, but not always, conforming to the boundaries of a state, province, nation, or other political subdivision. By reason of the intercolonial independence or even jealousy of the American colonies during the period which witnessed the introduction of lodges in America, a system of colonial and state organization, rather than national, evolved. This distribution of authority has, on the one hand, promoted harmony and, on the other hand, prevented the erection of any central power competent to represent the whole fraternity or any major portion of it, either as to administration, ceremonial or doctrine. Freemasonry is, therefore, viewed as a whole, less an organization than it is a system of philosophy and morality administered by many organizations. The York and Scottish Rites, in some measure, reflect the political institutions under which they grew up. The former, emerging from democratic surroundings, particularly those flowing from the English revolution of 1688, is administered by Grand Lodges which consist of certain officers, usually Masters and Wardens and often Past Masters of the subordinate lodges. Its tenets are based on the moral principles of brotherly love, relief, truth, temperance, fortitude, prudence, justice and fidelity. The Scottish Rite, on the other hand, arose within a monarchy and was the product of minds imbued with the themes of the approaching French Revolution of 1789: liberty, equality, and fraternity. Its administration is vested in self-perpetuating Supreme Councils of the 33d Degree which control the subordinate bodies, and its doctrine and literature, while not political, are, nevertheless, not oblivious to matters of church and state. Though founded upon Craft Masonry, the Scottish Rite is not so much a branch thereof as it is a separate system of Masonry; entirely so as to organization, and largely so as to doctrine. It is the predominant Masonic system in many foreign lands, particularly the Latin and Latin American countries, though it is also popular in the United States. While Craft or York Masonry is practiced in almost all countries, its greatest influence is amongst English-speaking peoples. The English rites are simple and teach elementary truths in terse phrases, the candidates participating in the working of the degrees, whereas in the Continental rite, the presentation consists of a more numerous series of elaborate degrees embracing lessons in morality, spirituality, philosophy, allegory and classical lore, many intricate in concept and all presented on stage with

rained casts and elaborate costuming and scenery, while the candidates and members in a large group observe from the floor. Probably no other system in the world portrays, to its votaries, its teachings with such pageantry and drama. The craft lodges are relatively numerous, localized and individualistic, there being few communities of 5,000 population, and often less, in England or in the United States without a "blue lodge," whereas the Scottish rite bodies are fewer and confined to the larger centers of population, their members residing in a large area. *Morals and Dogma of the Ancient and Accepted Scottish Rites* (1881), the work of Albert Pike, lawyer, scholar, linguist, philosopher and moralist, which is the textbook of the Scottish rite, is worthy of anyone's perusal and is unmatched by any production of other branches of the order.

Though widely disseminated and variously administered, and despite the absence of any central ruling body, Freemasonry faithfully retains its fundamental principles, teachings, legends, customs, and laws. This it does as a matter of pride in, and as a token of its descent from, the fraternity of cathedral builders of 500 and more years ago, and in conformity with an old precept that condemns innovations in the body of Masonry and prohibits deviations from the ancient landmarks of the craft. Notwithstanding the absence of any authority capacitated to define such landmarks, and even with an abundant diversity of opinion in enumerating them, their general nature and spirit are felt and observed.

It is to be remarked that, in what is commonly said to be a rapidly changing world, Freemasonry, though adhering to its old, liberal, and for the most part simple creed, should not only maintain but increase its popular appeal. Though it disavows any political ideas or preferences, its fundamental tenets of freedom of conscience and benevolence and charity toward all mankind necessarily identify it with the ideals of human liberty and constitutional government.

Charities.—None of the Masonic bodies have any insurance features or offer any fixed benefits; nor will the fraternity tolerate the use of its name or symbols in connection with any insurance or business enterprise. Nevertheless, in keeping with ancient principles of mutual aid and assistance springing even from the ancient Gothic constitutions, the lodges and grand lodges as well as most of the supplemental orders make large charitable contributions mostly for the aid and support of incapacitated Masons, their widows and orphans, and service boards are maintained in most large cities to care for distressed or unemployed members regardless of the lodge to which they may belong. The contributions to Masonic charities in England, though voluntary, are surprisingly large, and there, as well as in most of the American jurisdictions, Masonic homes and orphanages are maintained.

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MASONRY AND BUILDING.

The term masonry, from the French *maçonnerie*, is the art or work of building in stone. It originated in antiquity. Practically all the famous temples, the Pyramids and monumental structures of medieval times, extending down through the Rennaissance, were erected in stone. In the earliest period massive foundations and walls of granite blocks, amazingly cut and proportioned, were set without mortar which was then unknown. This is called dry masonry. Since the advancement of organized production, particularly in the present century, masonry has been subjected to striking changes. The utilization of modern machinery and up-to-date appliances points to progress commensurate to a degree with competitive industries. The more important stone works, facing higher labor and materials costs, and with emphasis placed upon speed and modern techniques, have found it necessary to subordinate or largely eliminate hand labor. The substitution to a considerable extent of steel and other materials for building stone is significant of economic and industrial pressures. Advances since the introduction of steel skeleton construction in the last quarter of the 19th century have resulted in the use of machinery to maintain masonry operations profitably. In the design of large commercial structures in the United States and Canada, high costs and requirements of industrial techniques make the matter of location, purpose of the building, and the adequacy of suitable materials a primary consideration.

Durability of building stone is essential. Classified as masonry materials are natural stones, brick, tile and terra cotta. Also used in masonry work are (1) reinforced concrete, a conglomerate of portland cement, crushed stone, water and sand, with steel rods or bars embedded

in the concrete to supply additional strength for resisting tensile stresses; (2) concrete blocks, made of portland cement, water and crushed stone or cinders, which are durable and fire resistant; these units minimize waste in construction. Artificial stone, cast in molds, is more economical than natural stone. When rubbed to a finish this product harmonizes with other structural effects by reason of a variety of colors. The ubiquity and abundance of materials for constructing masonry units, in contrast to the limited sources of supply of other building materials, assure that masonry will continue as an important form of construction for many centuries. (See also CEMENT.)

Building stones are grouped as (1) igneous rocks, including granite—hard, durable and strong, and for centuries basically a masonry unit; also traprock, an ingredient of concrete; (2) sedimentary rocks—limestone and sandstone "in various hues," and (3) metamorphic rocks; in this group are vari-colored marble and also slate. Marble takes a high polish. In the United States, building stone deposits are widely distributed (see also QUARRYING; BUILDING MATERIALS, EQUIPMENT AND TECHNIQUES). Great Britain has a wide variety of native stones, and in the Western Hemisphere, Canadian limestone (the Tyndall, the Trenton and other varieties) has been utilized during the last fifty years in the construction of buildings and also canals. Good practice calls for special care in the selection and placing of building stone. All building stones are affected by weather conditions—frost, temperature changes, and wind-driven rains, especially in cities. Sulphuric acid in the atmosphere deteriorates the stone.

Mortar (q.v.), among many cementitious materials, is selected for its particular purpose—workability. An aggregate of natural cement, sand, water and lime is used in laying brick and setting stone. For setting solid masonry foundations a mortar of greater strength, with portland cement, lime putty, and sand as components, is used. Structural wall strength and durability are indispensable. As the stone is strong, so should the mortar be.

Masons and Tools.—Employed in masonry construction are masons, stone cutters, workers on limestone and sandstone, workers on rubble walls, layers of paving slabs, joiners, fixers who place the stone, machinists, and the masonry draftsmen, also excavators, foundation workers, bricklayers, terra cotta and fireproofing unit workers, plasterers, metal workers, roofers and laborers. On masonry piers and bridge abutments or heavy tunnel construction, the cooperation of other trades is sometimes required. As of 1950–51, masonry construction of bombproof and gasproof underground shelters in cities and towns in the United States was evident for emergency use, in addition to existent shelter facilities provided by subways and steel frame office and apartment buildings.

Masons' tools (see illustration) in general include: the wooden mallet, steel hammers used severally by hard-stone masons, marble masons and granite masons; and the iron hammer used as a carver's tool. The pitching tool reduces the size of rough stones. Soft-stone masons use the dummy. The punch cuts surplus hard stones. The mallet-headed point furrows the stone. Chisels include the hammer-headed for granite, mallet-headed for drafting, the boaster for draft work, and the claw tool; also the patent cla with teeth for hard stone. Mallet-headed goug are used for hollow moldings; the batting to "surfaces" sandstone, the water-chisel cuts sc limestone, and the Lewising tool cuts mortise The driver is used for soft stone, and the quirki tool cuts grooves. The steel diamond jumper used for boring holes, and the mitre tool clea up molding intersections. (See also STONE-CU TING AND DRESSING.)

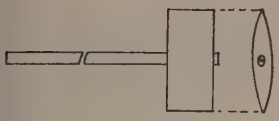
Machines.—The frame saw, in a swingi frame, saws stone into slabs. Cutting to si and shape is done by diamond-circular ste saw blades. Carborundum saws "joint off" ma ble and slate. The jointer saw is used for cu ting small dimensioned stones. Planing ar molding machines (two types) operate on co nices and plane surfaces; turning lathes sha columns and balusters. Hoisting appliances i clude nippers with hooked arms, and Lewis bol which are fitted into dovetailed mortises in t stone to be raised.

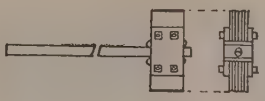
Stone Construction.—Strength of the fou dation walls is essential. Foundations now ge erally are composed of portland cement concret They should be evenly proportioned in order prevent any unequal settling of the buildin The footings are projecting courses at the wa base; they are sufficiently spread to distribu the load over as large as area as practicable. the supporting capacity of the ground selected not adequate, concrete piles and reinforced raf may be used; otherwise the area of the footing is extended. In Chicago, owing to the soft so grillage work is necessary in the construction many of the larger buildings. Granite is use when architectural appearance is essentia Limestone and sandstone are laminated and sp cial care is required in placing these stones the wall bed at right angles to the direction the thrust.

In masonry construction, stonework compris mainly ashlar, rubble, and trimming. Ashlar co sists of carefully worked and jointed stone block which form the outside facing of the wall. generally is stoneyard cut. The face of the sto may be plain, vertically tooled, truly worke reticulated, or rusticated, finished in any of se eral ways. All joints are dressed to plane The blocks vary from twelve to eighteen inch in depth, and from four to eight inches in thick ness. When of uniform size and laid in co tinuous courses (a course is a continuous lev range of masonry throughout the face of a build ing), the work is known as regular course as lar. The face of the stone may be plain or hav molded joints. When the blocks are laid in a ternate wide and narrow courses the wall facin is called alternate course ashlar. In course not continuous, and with stones of various size the wall face is called broken ashlar or rando ashlar. Rubble generally consists of irregula stones having one good face fit for an expose wall surface. These stones are seldom cut. The are taken usually as they come from the quarr When laid up in walls the interstices should b filled with pieces of broken stone and morta Coursed rubble stones are roughly quarry-square and leveled up in twelve to eighteen inch course

Trimming in masonry work includes: co nices, sills, quoins, door and window facing moldings, jambs, and copings. Ashlar facing ma be backed with brick, rough stone, hollow ter cotta, or concrete blocks. The *cornice* is th

TOOLS


AXE

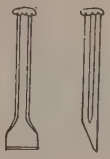

PATENT AXE

STEEL HAMMER

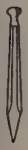
IRON HAMMER

DUMMY

MALLET


PITCHING TOOL

PUNCH


POINT

WASTER

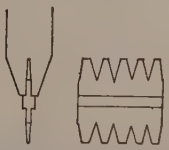
HAMMER–HEADED CHISEL

MALLET-HEADED CHISEL

BOASTER

CLAW TOOL

PATENT CLAW TOOL


LARGER DETAIL OF TEETH FOR PATENT CLAW TOOL

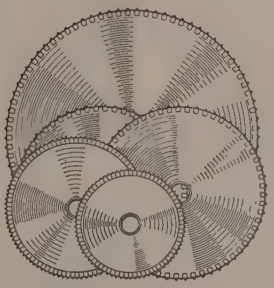
BATTING TOOL

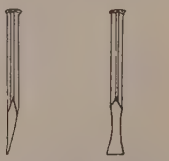
BENT TOOL

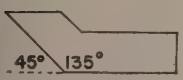
WOODEN–HANDLED CHISEL

DRIVER

GOUGE


DIAMOND SAW BLADES


LEWISING TOOL



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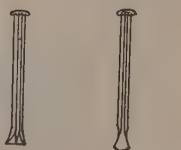
JUMPERS

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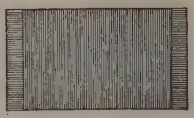
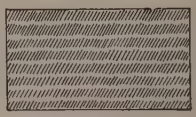
WALL STRUCTURE, ETC.

PITCHED FACED WITH TOOLED MARGINS

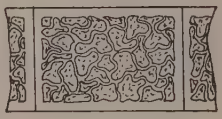


TOOLED



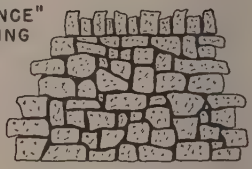
BOASTED

RETICULATED



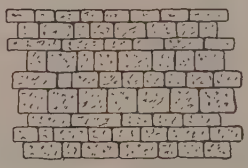
VERMICULATED

"FENCE" COPING

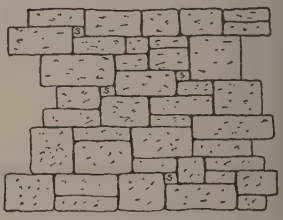


RANDOM OR ROUGH RUBBLE

RANDOM RUBBLE BUILT TO COURSES



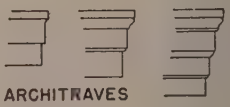
COURSED RUBBLE



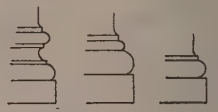
SNECKED RUBBLE

SKETCH SHOWING OBJECT OF THROAT

ALTERNATIVE TYPE OF THROAT



ARCHITRAVES



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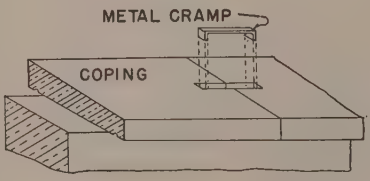
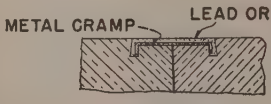
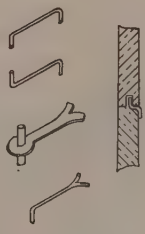


CAPS



METAL CRAMP



GROUP OF LIGHT WIRE CRAMPS USED CHIEFLY IN MARBLE WORK

CORNICES

CLASSIC MOLDINGS

All figures from "An Introduction to Masonry" by T. B. Nichols, courtesy English Universities Press Ltd.

projecting molded top course of the wall; the *gable* is the vertical wall at the end of a pitched roof. The *bed* is the lower surface upon which the stone rests; the *sill* is a broad stone at the base of a door or window; a *quoin* is a wedgelike stone at the intersection of two walls. The *coping* is the covering top course of a wall; a *molding* is a plane or curved decorative surface; a *jamb* is an upright stone at the side of an opening. The *plinth* is the lowest course of stonework projecting from the base of the main wall face. *Bond stones* in walls tie in masonry units as a whole, giving effective jointing and greater solidity. *Joints* are prepared surfaces for fitting into other stones butting against them. A *closer* is the last stone to be placed in a course. A *throat* is a groove cut under the coping or cornice to prevent rain from running down the face of the wall.

Arches generally span wall or bridge openings. In masonry they consist of wedge-shaped stones or other solid materials called voussoirs; and are usually curved. In placing such stones the layers should rest at right angles to the face of the arch. Joints between the stones radiate from the center. The weight the arch carries is, accordingly, distributed from stone to stone.

Brick Construction.—Building brick, classified as masonry units, include common brick of the kiln run; face brick, more uniform in size and shape than common brick; and glazed brick with decorative effects which are made by a special process. Common brick generally is employed to back up the masonry facing material; face brick is placed in exposed walls. Building brick, standardized in size, generally runs 2¼ x 3¾ x 8 inches. The brick is made from selected ground clay, mixed with water, molded and kiln-fired at from 1600 to 2000 degrees Fahrenheit. See also BRICKS; CLAY-WORKING AND BRICK-WORKING MACHINERY.) In brick wall construction it is customary to tie in the bricks with metal ramps, in order to provide a unified masonry mass and thus distribute the load over the whole area. This is a form of *bonding*.

Common bond, English bond, and Flemish bond are most frequently used. Common bond consists of five stretcher courses with headers (bricks laid with their ends toward the face of the wall) and stretchers (bricks laid with their length parallel to the face of the wall) in each course. The English and Flemish bonds are more expensive to lay than the common bond. The Flemish bond is frequently used to provide an attractive wall surface. There is also an English cross-bond with alternate courses of stretchers arranged with the joints below the middle of the bricks above. Skeleton steel frame construction provides support for the outer masonry walls at each story by the use of spandrel girders. These are called "curtain" walls. Tying brick-bearing walls to the floor beams at horizontal intervals of 6 feet at each tier is a modern practice. The walls forming an angle should be carefully bonded. In brick walls, stone quoins or other solid wedgelike supports frequently are set into exterior angles like a voussoir in an arch. Window and door openings may be spanned by stone or brick horizontal lintels; the lintel supports the superstructure. It consists of one or more masonry units keyed to adjust the weight. Building brick is cheaper than stone. Engineering brick, made for heavy duty construction, and other designs meet special requirements in building.

Structural load-bearing clay tile, kiln burned, is designed to resist impact and moisture in building walls; also to support heavy and compressive loads. Non-load-bearing tile, molded and kiln treated, are made in many shapes and sizes for floor construction, fireproof interior partitions, and wall coping. Mixtures of clay and shale are employed in the manufacture of structural tile. Facing tile is made from a mixture of fire clay and water. Hollow interior spaces in the various units are designed to meet building requirements.

Historical.—Masonry's origin and development are traced through ruins of Babylonian temples, the Egyptian pyramids and tombs, and down through centuries of the Mycenaean, Greek, and Roman civilizations. Contrasted with massive masonry structures erected in Egypt, the Assyrians built temples and palaces from platforms reached by steps. Assyrian walls were of sun-dried brick, faced with kiln burned brick. "Cyclopean" and, later, Greek rectangular masonry necessitated the laying up of huge stone blocks in regular courses. The Greeks developed the Doric, Ionic, and Corinthian columns for use in monumental structures. The walls were chiefly of marble and stone blocks. The Romans adopted the columnar style of the Greeks; they also invented concrete and developed arch, vault, and concrete construction. Roman walls of rectangular stone blocks were laid up; concrete, faced and unfaced, was employed — the unfaced for foundations. Concrete vaults and cross-vaults, cast in solid mass, were extensively used. Marble and brick were employed for wall surfaces. The Romans frequently employed the circular and polygonal forms in the construction of temples and public buildings of enormous size. The key to such operations was in the arch, vault, and dome system. The arch made it possible to span wide openings. In modern times, reinforced concrete and steel-frame construction have put industrial pressure on masonry, making it imperative to use machinery in competitive operations. See also ARCHITECTURE.

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MASOOLA, mä-sōō'lä, a boat common on the coast of Madras, India, adapted to be beached on the surf-beaten shore. The planks are sewed together with coir, over wads of the same material, which press upon the seams. The boats are 30 to 35 feet long, 10 to 11 feet in beam, 7 to 8 feet deep, and are rowed by 12 men, oars double banked, and a steersman with an oar at the stern.

MASORA or **MASORAH**, mä-sō'rä (from *Masoreth*, a Hebrew word signifying "tradition"), the name of a collection of notes referring to the Hebrew text of the Old Testament, and written in Chaldee chiefly on the margin of Hebrew manuscript. This collection of notes

are various in their character, critical, grammatical and explanatory. Since in early Hebrew writing no vowel signs appeared, great confusion arose in time from the many modes of reading and supplying vowels to the consonants. The Masora set a fixed reading to each word and thus put an end to the multiplicity of readings. At what time the accumulation of these notes was commenced cannot be ascertained. According to some Jewish writers the notes are in some cases as old as the time of Moses; according to others they were begun in the time of Ezra. It is more likely that they are the result not of one period but of many centuries of compilation and emendation. A useful edition of the Masora is the translation of Dr. Ginsburg (3 vols., London 1880–87). See JUDAISM — *The Massorah.* Consult Cornely, 'Introductio in V. T. Libros Sacros' (Vol. I, Paris 1894); Ginsburg, C. T., 'Introduction to the Hebrew Bible' (London 1899); Driver, S. R., 'Notes on Hebrew Text of the Books of Samuel, with Introduction to Hebrew Palæography' (2d ed., Oxford 1913); Harris, 'Rise and Development of the Massorah' (in *Jewish Quarterly Review,* Vol. I, London 1889).

MASPERO, SIR Gaston Camille Charles, gäs-tôn kä-mēl shärl mäs-pĕ-rō, French Egyptologist: b. Paris, 23 June 1846; d. 30 June 1916. He studied in the Lycée Louis-le-Grand, 1853–65, and before entering the École Normale in 1865 had already made considerable progress in the study of Egyptology. He remained in the latter college two years and attracted the attention of Mariette, the distinguished Egyptologist. In 1867 he published in the *Revue Archéologique* an Egyptian text and translation under the title 'Stèle du Songe,' and in the same year appeared separately his 'Mémoire sur la grande Inscription d'Abydos et la Jeunesse de Sésostris.' On leaving the École Normale he went to South America to carry out researches in the Quichua language. Further memoirs on ancient Egypt extended his reputation and secured his appointment in 1869 as professor of the Egyptian language and archæology at the École des Hautes Etudes. In 1871 he issued an important essay, 'Des Formes de la conjugaison en Egyptien ancien, en démotique et en copte'; and in 1873 'De Carchemis Oppidi Situ et Historia antiquissima' and 'Du genre epistolaire chez les anciens Egyptiens.' In 1874 he succeeded Rougé as professor of Egyptian philology and archæology at the Collège de France. Sent to Egypt in 1880 as head of a government archæological mission, he succeeded Mariette in the following year in the directorship of excavations and antiquities. He founded and directed an archæological institute at Cairo, had charge of the museum at Bulak, now in Gizeh, carried out many excavations, with important results, and in 1886 returned to France to resume his duties at the college. In 1899 he again went to Egypt as director of excavations and antiquities. In 1914 he left Egypt and became permanent secretary of the Academy of Inscriptions and Belles-Lettres. Maspero's great work is his 'Histoire ancienne des Peuples de l'Orient' (1875), which has been republished in an enlarged and revised form (1894–99). The three volumes of the later edition have been translated into English under the titles 'The Dawn of Civilization' (1894), 'The Struggle of the Nations' (1896) and 'The Passing of the Empires' (1900). His other works comprise the following: 'Contes populaires de l'Egypte ancienne' (1883), translated by him; 'Etudes Egyptiennes' (1886-91); 'Archéologie Egyptienne' (1887; Eng. trans. 'Egyptian Archæology,' 1888); 'Lectures historiques' (1890; Eng. trans., 'Life in Ancient Egypt and Assyria,' 1892); 'Etudes de Mythologie et d'Archéologie Egyptiennes' (1893), invaluable to the student of the religion of ancient Egypt; besides contributions to the 'Mémoires' of the French Archæological Mission at Cairo; 'Les momies royales de Dëir-el-Bahari' (1889); 'Causeries d'Egypte' (1907; Eng. trans., as 'New Light on Ancient Egypt,' 1909); 'Egypt, Ancient Sites and Modern Scenes' (1911); 'Art in Egypt' (1912), and text and translations of the inscriptions upon the pyramids of the fifth and sixth dynasties in *Recueil de travaux relatifs à la philologie et à l'archéologie égyptiennes et assyriennes* (Vols. I–XIV), etc. In 1879 Maspero was made a knight of the Legion of Honor, and in 1895 commander. In 1883 he became a member of the Académie des Inscriptions, and in 1887 an honorary Fellow of Queen's College, Oxford, and an honorary D.C.L. of that university. In 1909 he was made knight commander of Saints Michael and George. See EGYPTOLOGY.

MASQUERADE, măs-kĕ-rād', a popular amusement, in which persons of both sexes mask or disguise themselves and engage in dancing or festivities. Masquerades date from a very early period in which they were connected with religious ceremonials and observances. We find traces of the masque in the Bacchanalia of Greece, the Saturnalia of Rome and in the Purim of the Hebrews. In the Middle Ages they were at times held in the churches, for instance the ceremony of the boy bishop, the feast of fools, etc. The clergy succeeded in putting a stop to these relics of paganism in connection with Christian worship in the 16th century. Masquerades of the modern purely secular type are said to have been the invention of Granacci, an Italian, who lived in the beginning of the 16th century. See CARNIVAL; FESTIVAL.

MASQUERAY, Emmanuel Louis, American architect: b. Dieppe, France, 10 Sept. 1861; d. Saint Paul, Minn., 26 May 1917. He was educated at Rouen and Paris. Having decided to become an architect he studied in the École des Beaux Arts, Paris, and in 1887 was awarded the Deschaumes prize by the Institute of France. He also received the Chaudesaigues prize in 1883. While in Paris he was also an attaché of the Commission des Monuments Historiques. Mr. Masqueray came to New York in 1887, and was at first connected with the office of Carrere and Hastings and later in the office of William M. Hunt. He opened an office here in 1893 and founded the Atelier Masqueray for the study of architecture according to French methods. This was the first wholly independent atelier opened in the country. His reputation became international in 1901 when the commissioner of architecture of the Saint Louis Exposition selected him to be chief of design or consulting architect. The monumental undertaking included the Tran-

portation Palace, the Agricultural, Horticultural, Fisheries and Forestry buildings, the Cascades, the Colonnade of States, pavilions, the Louisiana Purchase monument, 12 bridges, music stands and all the decorative architecture in the grounds. Mr. Masqueray was the architect of the famous cathedral of Saint Paul in Saint Paul, Minn., and the pro-cathedral of the Immaculate Conception in Minneapolis, Minn. He was a charter member of the Society of Beaux Arts Architects and the Architectural League of New York, the New York Chapter of the American Institute of Architects, as well as the national organization.

MASQUES. The old masques, fashionable in England in the 17th century, were in reality the kind of private theatricals that then generally prevailed at the courts of Europe. Their name is understood to have originated from the use of the head masque, representing either romantic, historical or allegorical types on occasions of festivity or solemnity. The first of these masques (or ballets, as they were called in Italy and France) that we find recorded was that given by Bergonzio di Botta, at Tortona, to celebrate the marriage of the Duke of Milan in 1489. It was the talk of all the élite of the Western World. Originally a parade or festival, a form of dramatic masque quickly developed in England under the wits of men as deft as Ben Jonson and Fletcher, aided and abetted by the master-designer, Inigo Jones (q.v.), reaching a height of tawdry theatrical beauty that died out almost as quickly as it had flamed. At Versailles and other courts the masque or ballet survived for over a century longer. The masque of to-day is philosophical in character. It is the drama of personified ideas. It is akin to allegory. Its dramatic purpose is the presentation of universal truths; and in this indirect way to bring their lessons home to the mind and heart alike. The pageant and masque are distinctly antithetical in character. The one is essentially concrete, the other is essentially abstract. The one depends on realism to tell its story, the other depends on symbolism, though either may make use of the elements of the other in subordination. Mr. Percy Mackaye's 'Masque of St. Louis,' performed in that city in 1914, was perhaps the soundest achievement of the American poet in this new form which has yet to find its authentic masters. During the Shakespearean tercentenary celebrations of 1916 many commemorative masques were written and performed. For these and sundry lists of "Masques and Festivals" lately held in the United States consult the bulletins of the American Pageant Association. See FESTIVAL; PAGEANT. The standard authorities on the English masques are Evans, H. A., 'English Masques' (London 1898); Reyher, Paul, 'Les Masques Anglais: étude sur les ballets et, la vie de cour en Angleterre, 1512–1640' (Paris 1909); Brotenak, Rudolf, 'Die Englischen Maskenspiele' (Vienna 1902).

MASS, *in physics,* the quantity of matter in a body. The mass of a body is the same wherever the body may be in the universe. Two bodies have equal masses if the gravitating forces with which another body acts upon them are exactly equal at equal distances. (See GRAVITATION). Hence two bodies have equal masses if their weights are the same at the same place on the earth; so that if the metallic "weight" used by a grocer is carried from place to place, the quantities of sugar and tea balanced by it in a good pair of scales will always be the same, for the mass of tea or sugar is in every case equal to the mass of the metalic "weight." It is to be clearly understood that as the force of gravity is different at different places on the earth, the weight of any body is different at different places. To distinguish between the mass (or quantity of matter) and the weight (or force which tends to move it downward) of a body is very important in beginning the study of physics.

MASS, The. According to the teaching of the Catholic Church, the Eucharist is the Sacrament which contains the body and blood, soul and divinity, of Jesus Christ under the appearances of bread and wine. At the Last Supper (see LORD'S SUPPER), the night before He died, Christ, in the presence of the 12 apostles, instituted the Eucharist (q.v.) by taking bread, giving thanks, blessing the bread, breaking it, and giving it to the apostles, saying, "Take ye and eat. This is my body," and then by taking the cup of wine, giving thanks, blessing the wine, and giving it to them, saying, "Drink ye all of this. This is my blood which shall be shed for the remission of sins. Do this for a commemoration of me." The Church teaches that, when Christ said "This is my body," the substance of the bread was, by His almighty power, changed into the substance of His body, and that, when He said "This is my blood," the substance of the wine was similarly changed into the substance of His blood, while the appearances of bread and wine remained. The Church further teaches that the change of bread and wine into the body and blood of Christ, called Transubstantiation (q.v.), continues to be made by Jesus through the ministry of His priests, to whom through the apostles and their successors, He gave this miraculous power when He said, "Do this for a commemoration of me." The priests exercise this power of Transubstantiation through the words of consecration in the Mass. What, then, is the Mass? The Mass is the solemn memory, with a narrative, of Christ's passion and death. It is the perpetual sacrifice of the New Covenant. In the catechism it is described as the unbloody sacrifice of the body and blood of Christ. It is, specifically, a sacrifice of adoration, thanksgiving, propitiation, and impetration. As, in the offering of this sacrifice, certain words and actions in fixed form are used, the Mass may be defined as the aggregate of prayers and ceremonies which constitute the service of the Eucharist in the Latin, that is, the Roman and Gallican, rites.

This service was known at first by many names: *Εὐχαριστία,* gratiarum actio, thanksgiving; *Λειτουργία,* liturgy, rite; *προσφορά,* oblatio, offering; *κλάσις ἄρτου,* fractio panis, breaking of bread; *κυριακὸν δεῖπνον,* cœna Domini, the Lord's supper; *κοινωνία,* communio, communion; *σύναξις, συνέλευσις,* meeting; solemnia; dominica solemnia; dominica passio; spirituale ac cœleste sacramentum; Dominicum; passio; sacrificium. *Λειτουργία* still survives in the Eastern Church, and "holy liturgy" corresponds exactly to the word Mass. This latter

term has become the recognized and almost exclusive technical name for the liturgy of the West. Its derivation is even yet not quite certain; but it is generally said to be a late Latin verbal noun for *missio* (=*dimissio*), from the verb *mittere,* to send, send away. Primarily, *missa* was used in the sense of «dismissal» with reference to the concluding part of the service, and then, by a gradual process well known to linguists as well as to students of liturgy, it was extended to the whole rite. The first time we know for certain that it was employed in its present sense was in the 4th century, about 385 or 386, in a letter of Saint Ambrose to his sister, in which occurs the statement, *missam facere cœpi* (=I begin to say Mass). A 2d century instance of the use of the word *missa* in this sense is of doubtful authenticity. From the 4th century onward it becomes more and more frequent, until in the 'Sacramentarium Leonianum' (Leonine Sacramentary), of the 5th or 6th century, it is understood throughout (*Item alia=Item alia missa*), and in the 'Liber Sacramentorum Romanæ Ecclesiæ,' usually known as «The Gelasian Sacramentary,» of the 6th or 7th century, it is constantly expressed. Thereafter, while Eucharist remains the normal name for the sacrament, *Missa,* or one of its derivatives in other languages like Mass in English or Messe in French, has been the regular title given to the Eucharistic sacrifice in the Roman and Gallican rites.

So much for the word, which is clearly much later than what it denotes. The history of the Mass itself has its origin in the New Testament in the four accounts of the Last Supper found in Matthew xxvi, 26–28; Mark xiv, 22–24; Luke xxii, 19–20; and Paul, 1 Cor. xi, 23–26. What Christ then did is the foundation of the Mass. It is because He told the apostles to do, in memory of Him, what He himself on that occasion had done, that the liturgy of the Mass came into being and has continued through the ages. That liturgy, fluid and variable in detail, but uniform in outline and in many formulas, always the same in essentials, and from constant repetition tending ever to become fixed, is traceable with more or less certainty through the 1st century in different parts of the New Testament, in the 'Didache' or «Teaching of the Twelve Apostles» (c. 80–100), in the 'First Epistle of Saint Clement of Rome to the Corinthians' (c. 90–100), in the 'Epistle of Barnabas' (c. 96–98), and in the letters of Saint Ignatius, bishop of Antioch (d. 107). In the 2d century there is very probably an interesting allusion to the Mass from the outside, in a letter written by the pagan, Pliny the Younger (C. Plinius Cæcilius), governor of Bithynia, to the Emperor Trajan about 111–113. The eucharistic service, mentioned by Saint Polycarp, bishop of Smyrna (martyred c. 155), by Athenagoras of Athens (c. 177), and by Theophilus, bishop of Antioch (c. 180), is set out in considerable descriptive detail by Saint Justin Martyr (put to death, c. 165) in his 'First Apology' addressed to Antoninus Pius (138–161), and is also treated of by Saint Irenæus, bishop of Lyons (d. c. 202). In the 3d century we already see traces of those different practices in different countries which led to the different liturgies. For the rite followed in Alexandria and Egypt, we have as spokesmen Clement of Alexandria (d. c. 215), Origen (d. 251), and Dionysius of Alexandria (d. 264); for that of Antioch and Syria we have the fragmentary outline given in the second book of the 'Apostolic Constitutions' (which, however, was not written down until the 5th century as the *Διαταγαὶ τῶν ἁγίων ἀποστόλων*), as well as the complete text of a liturgy in the eighth book of the same work; for Rome and the West we have vague allusions in the writings of Hippolytus (d. 235) and Novatian (c. 250); and for the African Church or Church of Carthage we have Tertullian (d. c. 220) and Saint Cyprian, bishop of Carthage (d. 258). The liturgy given in the eighth book of the 'Apostolic Constitutions,' as well as being an early form of the rite of Antioch, is also possibly an example of an early type of the rite of the whole Church. When we reach the 4th century we have much fuller liturgical information, at least for the East, not only in the writings of Saint Athanasius (d. 373), Saint Basil (d. 379), Saint Cyril of Jerusalem (d. 386), and Saint John Chrysostom (d. 407), but also in the *εὐχολόγια,* or service books, which from about the end of this period began to be compiled for Church use. From this time too, we have the specifically different rites which were already foreshadowed in the 3d century. It is generally accepted that the fairly uniform type of liturgy previously used everywhere developed into four great parent-rites, from which all others now in use in Christendom are derived. These four are the liturgies of Antioch, Alexandria, Gaul, and Rome.

I. The rite of Antioch, found pure in the Greek 'Apostolic Constitutions,' was modified at Jerusalem into the Liturgy of Saint James, which itself took the place of the older liturgy at Antioch, and was used throughout the whole patriarchate, embracing all western Syria. This modified liturgy is found in (1) the Greek Saint James, now used only once a year at Zacynthus on 23 October, the feast of that saint, and at Jerusalem on 31 December; (2) the Saint James in Syriac, used by the Syrian Jacobites and Uniates; and (3) the Maronite rite, used in Syriac and also in Karshuni, that is, Arabic written in Syrian characters. The second rite derived from the primitive one of Antioch is the East-Syrian or Chaldean, which is found in two forms, (1) that used, in Syriac, by Nestorians and Chaldean Uniates, and (2) the Malabar rite, which is used, also in Syriac, by Malabar Uniates. The third derivative of Antioch is the Byzantine rite, used in Greek, Arabic, Old Slavonic, Rumanian, and many other languages, by all the Orthodox and by Melchites and other Byzantine Uniates. Next to the Roman Mass, this is the most widespread Christian liturgy. The fourth and last rite derived from Antioch is the Armenian, which is used, in classical Armenian, by Armenians, whether Gregorian (i.e., schismatical) or Uniate. II. The second eastern rite, the Alexandrian, gives us (1) the Greek Liturgy of Saint Mark, which is now no longer used; (2) the Saint Mark in Coptic, used by the Copts, both Monophysite and Uniate; and (3) the Ethiopic liturgy, used by the Monophysite Church of Abyssinia. The two great western parent liturgies are the Gallican and the Roman. III. The Gallican rite, in Latin, was used in

North Italy, Gaul, Germany, Spain, Britain, and Ireland. It was imported about the 4th century from the East, probably from Antioch. From about the 8th century it began to be gradually supplanted by the Roman rite, which became itself considerably Gallicanized in the process. By the 10th or 11th century the Gallican had entirely given way to the Roman rite, except in one or two places. It still survives under the title Ambrosian at Milan, in Italy, and under the title Mozarabic at Toledo, in Spain. In each case it is greatly Romanized, particularly so at Milan. IV. Finally, we have the liturgy of Rome. The original pure Roman rite is now no longer used, nor is the African rite, which belonged to the same family and had many features in common with the present Roman Mass, not the least being that its language was Latin even at a time when Greek was still employed at Rome and elsewhere. The present Roman rite, by far the most widespread of all, is used, in Latin, by nearly the whole Roman patriarchate. It occurs, however, in a Slav dialect in parts of Dalmatia and occasionally in Greek at Rome. In parts of southern Italy, Sicily, and Corsica, although they belong to the Roman patriarchate, the Byzantine rite is used. There are various mediæval modifications of the Roman rite peculiar to the religious orders of the Dominicans, Carthusians, and Carmelites. There were also modifications adopted in certain dioceses, and a few of them, Lyons for example, still keep these local forms; but in most cases the local usage has been abolished.

In the early period the liturgical language used at Rome was Greek, for Greek was spoken by the Roman Christians as well as by those of other centres of Christianity, such as Alexandria, Antioch, and Jerusalem. For example, Pope Clement I (c. 91–104) uses Greek in that famous 'First Epistle to the Corinthians,' to which reference has been already made, and the earliest inscriptions in the Roman catacombs are certainly in Greek. As far as is known, the first Christians to use Latin were those of Africa (Carthage). Pope Victor I (190–202), who was born in Africa, is often said to have been the first Roman pontiff to use it; but this has been disputed. The question turns on whether Victor or Saint Cyprian was the author of the treatise 'De Aleatoribus.' The 3d century popes, Cornelius (251–53) and Stephen (254–57), write in Latin. It may perhaps be fairly said that from about the 3d century Latin became the customary language spoken by Christians at Rome, and gradually from that time onward the only one. It is difficult to say when Latin replaced Greek for Church use. Some authorities place the change at as early a date as the second half of the 3d century; others are of opinion that Greek retained the liturgical language until the end of the 4th century. At all events, in Pseudo-Ambrose 'De Sacramentis' (c. 400) and in a letter of Pope Innocent I (401–17) to Decentius of Eugubium (c. 416) we find that the Mass was then said in Latin. It is probable that there was a transition period, during which the two languages were employed side by side. We know from the first Roman Ordo (c. 770) that as late as the 8th century lessons were read and psalms were sung in Greek. As a matter of fact, Greek has not, even now, entirely disappeared. We still have the Kyrie Eleison in every Mass and the Trisagion, Agios O Theos (O Holy God), Agios ischyros (O Holy Strong One), Agios athanatos, eleison imas (O Holy Immortal One, have mercy on us), in the Mass of the Presanctified on Good Friday.

The development of the Roman Mass into its present form is also difficult to trace, at least in some of its earlier stages. Clement I of Rome, Justin Martyr, Hippolytus, and Novatian are in substantial agreement as to the liturgies which they describe or mention; but our information as to the developments of the Roman rite during the latter half of the 3d and nearly the whole of the 4th century is extremely scanty. What we find is that between the 2d and the 5th century certain important changes were made. When we reach the 5th century we are on surer ground, for the 'De Sacramentis' and Innocent the First's letter to Decentius prove not only that the Mass was then said in Latin but also that it is in essence the rite still in use. In the 'Gelasian Sacramentary,' of the 6th or 7th century, showing the service considerably shortened, we have what is practically the present Roman Mass. Pope Saint Gregory I (590–604) made certain modifications, and left the Roman liturgy largely in the state in which it exists to-day. He it was, in particular, who gave the final touches to the Canon. "No pope," says Benedict XIV (1740–58), "has added to or changed the Canon since Saint Gregory." The Council of Trent (1545–63), wishing uniformity everywhere in the celebration of the Roman Mass, appointed a commission to examine and revise the Missal and restore it to its earlier form, "according to the custom and rite of the holy Fathers." This commission, named on 16 Feb. 1562, had not finished its labors at the close of the Council, 4 Dec. 1563, and its authority was continued and action on its report left to the Pope, Pius IV (1559–65). It was not, however, until the reign of his successor, Pius V (1566–72), that the revision was completed. On 14 July 1570 the reformed Missal — 'Missale Romanum ex decreto ss. Concilii Tridentini restitutum' — was published by the Bull, *Quo Primum,* commanding that that Missal alone should be used wherever the Roman rite is followed. That command put an end to most of the mediæval derived rites. There was, however, an exception. Any liturgy that could prove a prescriptive right by an existence of not less than two centuries was allowed. It is by virtue of this exception that the independent Gallican liturgies at Milan and Toledo, as well as the modified rites of certain religious orders and the local usages of some dioceses, were preserved. This Missal of Pius V is the one still in use. It has, however, since undergone various corrections in non-essentials. A second revised Missal was published by Clement VIII (1592–1605) by the Bull, *Cum Sanctissimum,* of 7 July 1604. Again on 2 Sept. 1634 Urban VIII (1623–44) by the Bull, *Si quid est,* published yet another revision. The last revision of the text, with a correction of the rubrics, was made by Leo XIII (1878–1903). His missal — 'Missale Romanum ex decreto ss. Concilii Tridentini restitutum, S. Pii V Pont. Max. iussu editum, Clementis VIII, Urbani VIII et Leonis XIII auctoritate recognitum' — was published in 1884. The

changes effected by Pius X (1903–14) have reference to the music.

Of the Mass, so instituted, developed, reformed, authorized, and promulgated, it remains to say a few words. It is, indeed, not within the scope of the present article to give in detail the many complicated rules and the minute rubrics that are to be observed in the celebration of Mass. These things, which must be mastered before ordination by every aspirant to the priesthood, are to be found fully set forth in books on ceremonial. All that can be given here is a general outline of the prayers and of some of the ceremonies used. The norm is Missa Solemnis, or High Mass, sung by celebrant, deacon, subdeacon, and choir. The following sketch therefore refers to High Mass and, further, to High Mass as celebrated on an ordinary Sunday. The procession, consisting of thurifer, acolytes, master of ceremonies, subdeacon, deacon, and celebrant, all appropriately vested in accordance with the rubrics, having reached the foot of the altar, the celebrant makes the sign of the cross, and he and his assistants say certain preparatory prayers, including the 42d [43d in Rev. vers.] Psalm and the Confiteor or General Confession. Going up to the altar, the celebrant says silently two short prayers asking forgiveness of his sins. Then, having blessed the incense and incensed the altar, he reads the Introit, consisting of an antiphon, a verse of a psalm, and the little doxology, Gloria Patri, etc. The Introit has previously been sung by the choir. The Kyrie Eleison follows, said by the celebrant and the assistant ministers, and sung by the choir. The celebrant then intones the first words of the great doxology, Gloria in Excelsis Deo, and he and the ministers say the remainder of it together, while the choir sings it. Turning to the congregation, the celebrant greets them, in his singing voice, with the salutation, Dominus vobiscum (The Lord be with you), to which the choir answers, Et cum spiritu tuo (And with thy spirit). He then sings the word, Oremus (Let us pray), and, turning his face to the altar, he sings the prayers known as the Collects, which are different every day. These are followed by the Epistle, which the celebrant reads while the subdeacon chants it. After the Epistle comes the Gradual, consisting of two separate chants, of which the first is the Gradual proper and the second is the Alleluia or, in Lent and on certain fast days, the Tract. Five times in the year, as well as in all Requiem Masses, the Gradual chants are followed by a canticle known as the Sequence. The celebrant then says silently the prayers, Munda cor meum, etc. (Cleanse my heart, etc.), and Dominus sit, etc. (May the Lord be in my heart and on my lips, etc.), reads a selection from one of the four Gospels, and blesses the incense. The subdeacon then holds the Gospel-book and the deacon incenses it, and then sings the Gospel as previously read by the celebrant. At the end the response, Laus tibi, Christe (Praise to thee, Christ), is said. At this point, a sermon, if there is one, is preached, in the vernacular of course. After the sermon, the celebrant intones the first words of the Nicene Creed, Credo in unum Deum (I believe in one God), and says the remainder, which is sung by the choir. When the singing of the Creed is finished, the celebrant sings Dominus vobiscum and, after the response as before, he sings the word Oremus (Let us pray). Then follow in order the three principal parts of the Mass, namely, the Offertory, the Consecration, and the Communion. The Offertory is the beginning of the action of sacrifice. While the choir sings the Offertory antiphon, the celebrant offers the bread, wheaten and unleavened, with the prayer, Suscipe, sancte pater, etc. (Accept, holy father, etc.). Then, blessing the water and mixing a little of the water with the wine in the chalice, he says the prayer, Deus qui humanæ, etc. (God, who didst wonderfully create, and still more wonderfully renew, the dignity of man's nature, etc.). Next, offering the chalice, he and the deacon say, Offerimus tibi, Domine, calicem salutaris, etc. (We offer unto thee, Lord, the chalice of salvation, etc.). Bowing before the altar, the celebrant says the prayer, In spiritu humilitatis, etc. (In the spirit of humility, etc.), and then blesses the bread and wine with the prayer, Veni sanctificator, etc. (Come, Sanctifier, etc.). He then blesses the incense and incenses first the bread and wine with the prayer, Incensum istud, etc. (May this incense, etc.), and then the altar with the prayer, Dirigatur, Domine, oratio mea, etc. (Let my prayer, Lord, be directed, etc.). Handing back the censer to the deacon, he says, Accendat in nobis Dominus, etc. (May the Lord enkindle in us, etc.). Here the celebrant, the ministers, the clergy present, and the congregation are all incensed. Washing his fingers at the side of the altar, the celebrant recites the Lavabo, that is, the last seven verses of Psalm 25 [26], concluding with the little doxology. Then, bowing before the middle of the altar, he says the prayer, Suscipe Sancta Trinitas, hanc oblationem, etc. (Receive, holy Trinity, this oblation, etc.). He then turns to the congregation and gives the exhortation, Orate, fratres, etc. (Pray, brethren, etc.), to which the ministers make answer Suscipiat Dominus sacrificium, etc. (May the Lord receive the sacrifice, etc.). Next follow the Secreta, or secret prayers, which, like the Collects, vary every day, but are said, not sung, by the celebrant. The last Secret, which ends the Offertory act, he brings to a close with the Ecphonesis, Per omnia sæcula sæculorum, sung aloud, to which the choir responds, Amen. There follow three short chants sung dialogue-wise by the celebrant and the choir. The celebrant then sings the Preface, which ends with the Sanctus, etc., said by him and sung by the choir. At the Sanctus a bell is rung thrice. The Canon, which is the fundamental part of the Mass, follows. Its form never varies except for slight changes (1) when the Roman See is vacant, (2) when the Episcopal See is vacant, (3) when the Mass is celebrated (a) in Rome and (b) in some French churches, (4) when it is celebrated by (a) a Pope or (b) a bishop, (5) when a bishop is being consecrated, (6) on Maundy Thursday, and (7) at the time of the five chief feasts of the year, namely, Christmas, Epiphany, Easter, Ascension, and Pentecost. The Canon is said in a low tone (secreto) by the celebrant. He beseeches God to accept and bless the sacrifice, and to guard and protect the Church, the Pope, and the bishop; he prays for the living, present and absent; he commemorates the saints; he again

begs the acceptance of the sacrifice; he asks for peace and for deliverance from eternal damnation; he once more implores God to bless, approve, and ratify the oblation, so that it may become the body and blood of Jesus Christ. Then, reciting what Christ did with the bread the day before He suffered, he consecrates the Host by saying, secretly, plainly, and attentively, the words, Hoc est enim corpus meum (For this is my body). Immediately he genuflects on one knee and adores and elevates the Host, to show it to the people. Next, reciting what Christ did with the cup of wine, he consecrates the wine by saying the words, Hic est enim calix sanguinis mei, novi et æterni testamenti: mysterium fidei: qui pro vobis et pro multis effundetur in remissionem peccatorum (For this is the chalice of my Blood, of the new and eternal testament: the mystery of faith: which shall be shed for you and for many, for the remission of sins). Adding the words, Hæc quotiescumque feceritis, in mei memoriam facietis (As often as ye do these things, ye shall do them in remembrance of me), he again genuflects on one knee and adores the precious Blood and elevates the chalice containing it. During each elevation, a bell is rung thrice, additional lighted candles are borne by the acolytes, and the thurifer incenses thrice the consecrated bread and thrice the consecrated wine. Proceeding with the Canon, the celebrant says the Anamnesis prayer, in which a solemn commemoration is made of Christ's passion, resurrection, and ascension, and offers to the Lord the victim now on the altar, asking the Almighty Father to accept the offerings, and to command them to be carried by the hands of the holy angel to the altar on high, so that those who receive the most sacred Body and Blood of His Son may be filled with all heavenly blessing and grace. He next prays for the dead, prays again for the living, and makes a further commemoration of the saints, closing with the second Ecphonesis, Per omnia sæcula sæculorum. The answer, Amen, sung by the choir, brings the Canon to an end. Here follows that part of the Mass known as the Communion. The celebrant sings a short exhortation and clause, and then sings the Pater Noster as far as the word, tentationem. The choir sings the last petition, Sed libera nos a malo (But deliver us from evil). After this comes an Embolism, containing a further prayer for deliverance from evil and for peace, said by the celebrant, and ended by the third Ecphonesis, the words of which are the same as those of the two former ones. During the first part of the Embolism, he breaks the Host in the middle, over the chalice. Following the Ecphonesis and its response, he sings the greeting, Pax Domini sit semper vobiscum (May the peace of the Lord be always with you), to which the choir replies, Et cum spiritu tuo. Putting a particle of the Host into the chalice, with the prayer, Hæc commixtio et consecratio, etc. (May this mingling and consecration, etc.), he genuflects, bows down, strikes his breast thrice, and says the Agnus Dei, etc. (Lamb of God, etc.), which contains two petitions for mercy and one for peace. The choir sings the Agnus Dei. The celebrant, having made a further prayer for the peace and unity of the Church, gives the kiss of peace to the deacon, who in turn gives it to the subdeacon, and he in turn to the clergy present. The celebrant then prays for deliverance from his iniquities and from all evils, and asks that the participation of Christ's body may not turn to his judgment and condemnation, but may profit him to the safety and health of soul and body. Having said the words, Panem cœlestem accipiam, et nomen Domini invocabo (I will take the Bread of heaven, and will call upon the name of the Lord), he recites three times the Domine, non sum dignus, etc. (Lord, I am not worthy, etc.), a bell being rung each time, and, with specified and appropriate short prayers, he eats the consecrated bread and drinks the consecrated wine. During the two ablutions, that is, of the chalice and of his fingers, which follow, he says two other short prayers. While the choir sings the antiphon known as the Communion, the celebrant reads it, and this ends the Communion act. The last division of the Mass now begins. The celebrant, having sung the Post-Communion prayers, sings also the Dominus vobiscum, to which the choir gives the customary response. Then the deacon sings, Ite, missa est (Go, the Mass is ended), or, in penitential seasons, Benedicamus Domino (Let us bless the Lord), and the choir answers, Deo gratias (Thanks be to God). The celebrant says a final prayer, Placeat tibi, Sancta Trinitas, obsequium servitutis meæ, etc. (Holy Trinity, may the performance of my homage be pleasing to thee, etc.), and blesses the congregation. He then reads the last Gospel, which is normally the beginning of the first chapter of the Gospel of Saint John (vv. 1–14), and, when he finishes, the ministers respond, Deo gratias. So ends the Mass.

Low Mass (Missa privata), in which the celebrant supplies the part of the absent ministers and uses the speaking instead of the singing voice, is a late abridgment. It became a necessity when, in the early Middle Ages, the pious custom grew up for practically every priest to say Mass once a day. By the 9th century we find that many priests were in the habit of saying Mass several times the same day. By the 13th century this multiplication of Masses began to be forbidden. By special indult (1746) of Pope Benedict XIV, priests in Spain and Portugal were permitted to celebrate three Masses on All Souls' Day (2 November), a privilege extended quite recently to all other countries. The rule now is that, except on that day and on the feast of Christmas (25 December), when three Masses are also allowed, and on Sundays and certain holy days when, in case of necessity, authorization for two Masses is given, a priest may say only one Mass a day. Pius the Fifth's Missal (1570) recognized Low Mass and specifically arranged its order. By direction of Pope Leo XIII certain prayers in the vernacular, in which the congregation participates with the celebrant, are recited after every Low Mass. In some countries (e.g., Ireland) the 129th [130th] Psalm (De Profundis) is said after the Low Mass and before the vernacular prayers. There are special rites for a Pontifical Mass, high or low, and additional special rites for a Papal Mass. A Missa Cantata, without deacon and subdeacon, but with celebrant, choir, and singing as at High Mass, is a compromise. The Mass of the

Presanctified (Missa præsanctificatorum, λειτουργία τῶν προηγιασμένων), which is really not a Mass at all but a service of Communion from an oblation consecrated and reserved at a previous celebration, was once common in both the Eastern and the Western Church. In the Byzantine rite such a service still occurs several times in the year, but in the Roman rite it is now used only on Good Friday. Conventual or Chapter Mass (Missa conventualis or capitularis) is an official Mass celebrated in such churches as are bound to have the whole office every day. A Missa solitaria is a Mass said without an assistant. Such Masses, forbidden by many synods, may nevertheless be celebrated by dispensation given under special circumstances. Missa sicca, or dry Mass, was used on occasions when a real Mass could not be said, as, for example, at a wedding or a funeral in the afternoon. It consisted of the prayers of the Mass with the essential parts — offertory, consecration, communion — omitted. Varieties of the dry Mass were Missa nautica, said at sea when the rolling of the ship rendered a real Mass dangerous or impossible, and Missa venatoria, said for hunters. The dry Mass was in vogue from at least the 14th century, but by the end of the 17th century it was nearly entirely abolished. Requiem Mass is said for the dead, and Nuptial Mass (pro sponso et sponsa) for a marriage.

In the early ages the Mass was divided into two distinct parts, the Mass of the Catechumens (Missa catechumenorum) and the Mass of the Faithful (Missa fidelium). This distinction, at one time fundamental, gradually disappeared as the discipline of the catechumenate fell into disuse. It has now long been lost, and the division is so hidden in the present rite that but few people advert to it. The *Dominus vobiscum* and the *Oremus,* following the Gospel (or the Creed, when it is said) and preceding the Offertory Act, show the line of demarcation.

The celebrant of Mass must be in priest's orders and free of irregularity and censure. He must also be in the state of grace, and be fasting from at least the previous midnight. He is bound to observe the rubrics and the laws concerning the matter (azyme bread and pure wine), the vestments, the vessels, and the ceremonies. Mass should be celebrated in a consecrated or blessed church and on a consecrated altar or altar-stone. In special cases, however, it may be said in a private oratory or even in an ordinary room. It is offered in the morning, though, for good and sufficient cause, the time may be extended to a limited period after mid-day.

The two great distinguishing marks of the Roman Mass are (1) that it is a sacrifice and (2) that it supposes Transubstantiation. These were the two features to which the Reformers particularly objected. They took the position that "the Eucharist and Holy Supper of the Lord" was a remembrance of Christ and a solemn setting forth of his death, and not a sacrifice, and that Transubstantiation did not take place. They were anxious, indeed, to retain a Eucharistic service, but one stripped of what to them appeared to be its objectionable parts. They were also insistent that the service should be in the vernacular, and that communion, when administered to the faithful, should be administered under both kinds, that is, in the form of bread and wine, and not of bread alone as was the practice of the Catholic Church. At first they repelled the charge that they were opposed to the Mass, and the Augsburg Confession "protests against any notion that it abolishes Mass"; but the logic of events was too strong for this contention, and ultimately the Reformation, as far as it could, did away with the Mass. In his Latin Mass (1523) and his German Mass (1526) Luther put forth the basis of the numerous liturgies promulgated by his followers in the 16th century. In the former he laid down the principle that "we cannot deny that Mass and the communion of bread and wine is a rite divinely instituted by Christ." He therefore allows the Mass, as it stood in the ancient missals, to be consonant with primitive purity, except the Offertory and the Canon, that is, everything that savored of oblation. He did not recognize Transubstantiation. He developed instead the theory of Consubstantiation, according to which Christ's body and blood are really and corporeally present, during the celebration of the Lord's Supper, in, with, and under the substance of bread and wine, in a union not hypostatic, not of mixture, not of local inclusion, but wholly transcendent and mysterious, so that the elements may with propriety be termed either bread and wine or the body and blood of Christ. Zwinglius and Oecolampadius, and with them the main body of Helvetian Protestantism, went farther. They rejected all notion of a real presence, and recognized only figurative symbols in the elements which Christ had appointed as a commemoration of his death. Bullinger modified Zwinglius's doctrine without changing its essentials, and, by divesting it of its merely commemorative character and admitting the presence in the communion, gave it the form in which it was adopted by the Helvetic churches. Bucer did not acknowledge the local or real presence of Christ's body and blood in the bread and wine after consecration, but contended that the body and blood were really, and without figure, received by the worthy communicant, through faith. Calvin taught that the body of Christ is present in the Eucharist, but "dynamically," not objectively; that the believer partakes of it, but spiritually and by faith; that the elements are unchanged; and that therefore the Catholic Mass is idolatry. In England the Reformers maintained that in the Lord's Supper there is no Transubstantiation and no other oblation than a giving of thanks and a commemoration of the death of the Lord: in other words, that, as Cranmer phrased it, the Roman Mass is "heinous and abominable idolatry." These views found practical expression in the Book of Common Prayer, the first vernacular liturgy of the Church of England, published in the reign of Edward VI, and effective on Whitsunday, 9 June 1549. The Eucharistic part of the service was indeed named "The Supper of the Lorde and holy Communion, commonly called the Masse," but the whole of the oblation and offertory prayers were swept away and the former Canon changed in many of its most material parts. In the second Book of Edward VI, which went into force on 1 Nov. 1552, the word Mass was omitted, and any language in the Canon that might imply either the doctrine

of Transubstantiation or of sacrifice also disappeared. The attitude of the Anglican Church on this subject is crystallized in the 31st of the Articles of Religion: "Wherefore the sacrifices of the Masses, in which it was commonly said, that the Priest did offer Christ for the quick and the dead, to have remission of pain or guilt, were blasphemous fables, and dangerous deceits." Laws were enacted containing severe penalties for saying or hearing Mass. So important did it seem to condemn the Roman sacrifice that, for centuries, the occupant of the English throne was bound by the oath taken at coronation to repudiate the doctrine of Transubstantiation and of the Mass. It was not until 1910 that, by the Accession Declaration Act, the oath was purged of its objectionable clauses.

Modern unbelief, which denies the divinity of Christ and rejects every supernatural institution, does not of course recognize the sacred character of the Mass. Using the so-called historico-religious method, it accounts for the Eucharist and the Eucharistic sacrifice as a result of a spontaneous development in the religion founded by Christ; but this line of argumentation neither explains nor explains away the Mass, and succeeds only in raising still more difficult problems for solution.

Despite all the attacks to which it has been subjected, the Mass remains the great central act of sacrifice in the Catholic Church, the distinctive feature of the Catholic religion, the everlasting witness and guarantee of the bond which unites all Catholics with the Roman See. Catholics are required, under pain of grievous sin, to attend Mass on Sundays and holy days of obligation, unless prevented from doing so on reasonable grounds, such as sickness or too great distance from a church. Some lax Catholics, it is true, shirk their duty in this respect; but the crowded condition of the churches both in town and country in every and during the hours of celebration shows how generally and how generously the law is observed. In practice, multitudes of Catholics hear Mass and receive holy Communion every day.

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MASS PRODUCTION. The term *mass production* may be fairly defined as the American contribution to methods of supplying the world's needs. Created by the engineer-owner type of management which is prevalent in the United States, as distinct from the financier type of management, its major developments are more clearly traceable in the industrial history of the United States than elsewhere. The great size to which this facility has grown, the manifold nature of its operations and its prodigious volume and variety of output, foster the impression that mass production is a thing of great complexity, when in reality it represents the principle of extreme simplification as applied to manufacturing processes. Commodities themselves grow more complex—as the electric refrigerator compared with the icebox, or the motorcar compared with the wagon—but to prevent similar complexity reaching unmanageable proportions in the processes by which commodities are manufactured, the simplifying principles of mass production are adopted. Essentially, these consist in dividing a commodity into its constituent parts, defining the operations required to make each part, allocating each operation to its appropriate craft or machine, subassembly of lesser into major parts, and final assembly of the major parts to complete the commodity. This method in its origin and growth is not to be accounted for on any economic theory; it is purely the result of practical men's response to the requirements of the job; and, being yet in process of development, no economic theory thus far formed embraces all its relations and significance.

The principal effect of mass production on business procedure has been to convert industry from the old and relatively safe principle of restricted production for a known market and a calculable profit, to the new and riskier principle of producing for a market not yet in being, which the enterpriser hopes to develop by rendering goods more easily available through the lower prices made possible by the manufacturing economies that are attainable under volume production. The older method was a safer one for investments and permitted adjustment to shrinking markets without great loss, whereas the newer method is so dependent on uninterrupted volume production to at least 75 per cent of capacity, that almost invariably it incurs loss when required to adjust its vast facilities to less

than that volume. In this respect, mass production in the present stage of economic development is more profitable to society at large than to corporations practicing it. It represents a salient thrusting beyond the main line of general economic progress, an exposed position endangered by the failure of other economic factors to make a commensurate advance.

Mass production eliminates none of the older developmental stages of manufacture. The handicraft stage is present in it, the craftsman still reigns supreme in the creation and design of the commodity; but at the point where formerly he was responsible for commodity reproduction also, he is now superseded. Reproduction of the commodity created by the master craftsman is now the function of the machine. Most of the commodities of the handicraft era were simple in form and purpose, employing at most one or two arts. They were later committed to the machine for the sole purpose of accelerating the repetitive process of reproduction. The machine produced more in less time at lower labor cost. During this transition period in American industry the machine became known as a "laborsaving" device or, less euphoniously, a destroyer of employment. But machine production of itself does not constitute mass production.

The earlier years of the machine age were marked by the invention of newer and better methods of rendering old and basic services. In transportation for example, the locomotive and its train were substituted for the horse-drawn stagecoach. But, as in the case of the locomotive, the new service-delivering commodity was invariably more complex than the old, its structure contained more parts, its production involved more arts, and where the most elaborate stagecoach could have been produced by one or two skilled artisans, under no circumstances could a locomotive be commercially produced by merely manual workers however skilled. Like the major proportion of capital goods today, it could not have been produced at all. Consequently, in its later development the machine came to be recognized as "laborserving" rather than "laborsaving," because without it much of the present work of the world could not have been conceived, let alone performed. A million men massed together could build a pyramid but not a 125,000-horsepower steam turbine.

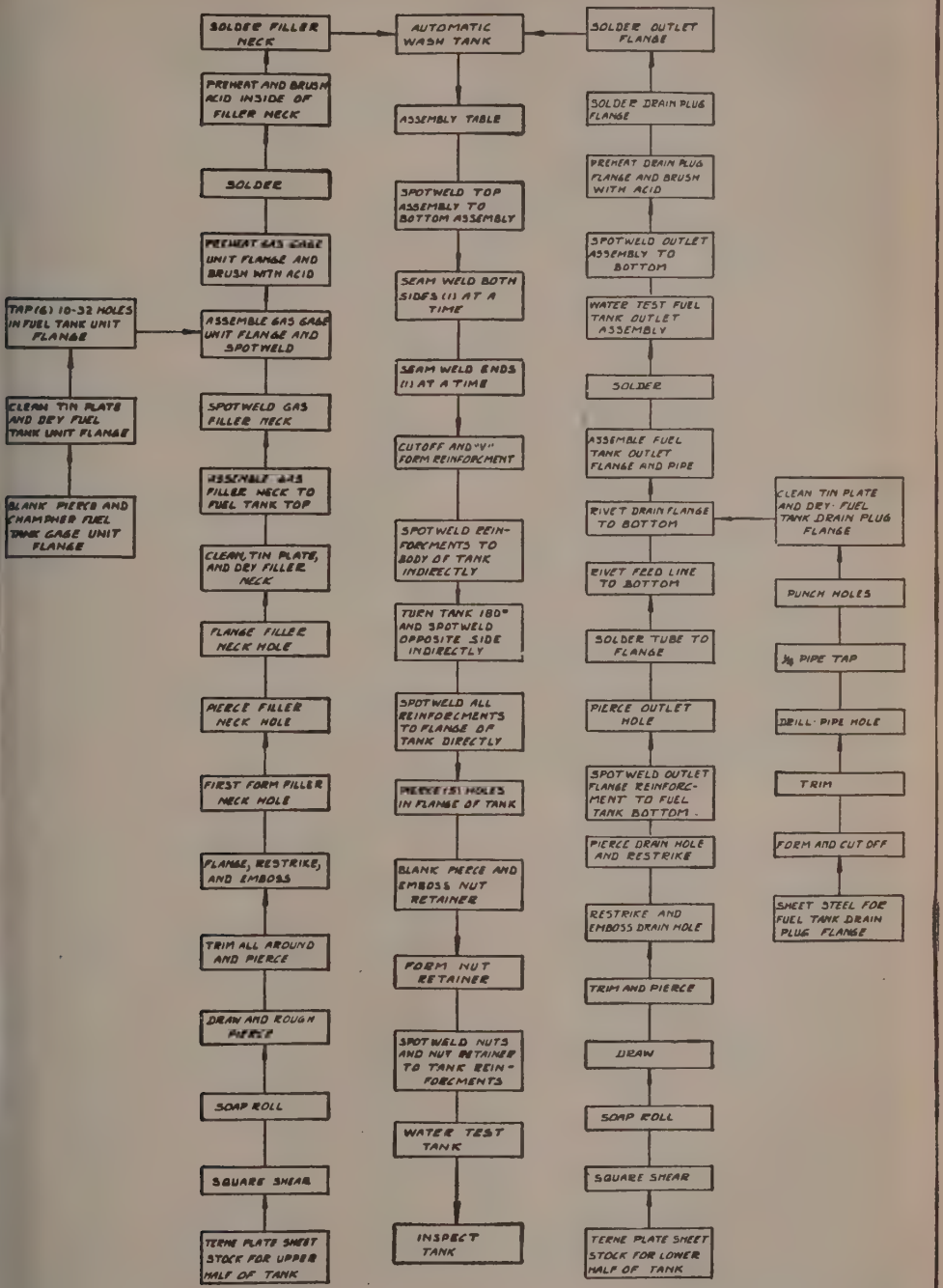
To the stage of creation, design and handicraft, and to the stage of machine reproduction of goods, was added the stage in which industry concentrated on the production of the *parts* of a commodity, constituting each part an industry in itself under one general management for the purpose of producing a particular result. This is mass production. And since it has come to its fullest development and use in the automotive industry and is now applied to the production of airplanes and other military weapons and vehicles, the method may be broadly described as follows: The commodity, say an automobile, is reduced to its major parts—frame, engine, axles, transmission, body, fueling, oiling, cooling, electrical systems, etc.—and each major part reduced to its constituent parts, as say, the engine to its 1,250 parts, or the gearshift to its 40 parts. Each part is separately studied with a view to its most efficient production in quantity and its perfect interchangeability with similar parts, the latter quality being achieved through the control of production processes by precision measurements which in certain instances approximate a ten-thousandth of an inch. This involves planning the layout of the shop so that the minor parts to be assembled into a major part may be conveniently located for easy handling, and so that major parts, when completed, may flow in sufficient quantity and orderly succession and converge at the exact place on the final assembly line where they are needed to give their degree of completion to the total process of assembling a car.

In recent years the number of parts thus involved has greatly increased. In the Model "T" period a car contained about 5,000 parts; the medium price car of today contains between 15,000 and 16,000 parts, depending on the model. Two opposing forces constantly operate within mass production practice: (1) the designer's and engineer's drive toward improvement and refinement which often increases the number of parts in the object improved; and (2) the manufacturer's drive toward fewer and simpler production operations, reducing the number of separate parts by simpler design or by integrating them into the unity of a larger design. To illustrate the first: Until recently the motorist shifted gears by using a lever that protruded from the transmission through the floor board of the car to within reach of the motorist's hand; it was a simple assembly of two parts. Engineers subsequently devised a remote control gearshift operated from the steering wheel and containing 40 parts. By such improvements the number of parts and operations involved in the manufacture of the car often are increased. Illustrating the opposite tendency—the effort to reduce the number of parts and operations—production of a Ford steel crankshaft is a case in point. Formerly the forging of a crankshaft involved 62 fabricating operations. After five years of laboratory incubation and shop experiment with prolonged testing in actual use on 2,000 company service cars and trucks, a cast steel crankshaft was developed which reduced the number of fabricating operations to 54, at the same time reducing the weight, increasing the strength, and diminishing the waste attendant on its manufacture.

The layout of the mass production shop is a series of assembly and subassembly lines resembling the midrib and lateral veins of a leaf or the trunk and limbs of a tree. Each line begins at the edge of a stock pile, whence it takes the material to be shaped or assembled into the part which that particular line fabricates, and moves it along through a series of operations until it is complete. Thus the engine assembly begins with the cylinder block, which moves along the engine assembly line into which lateral or subassembly lines feed camshaft, crankshaft, pistons and rods, valves, flywheel, oil pump, etc., many of which are the product of more remote subassembly lines. For example, the oil pump is the product of a subassembly involving 13 distinct operations by as many men.

To illustrate the number of operations and the successive steps taken to perform them, the process of producing what most laymen would regard as a simple part—a fuel or gasoline tank—is now described.

(1) A steel sheet previously cut to size is taken from stock pile and run through soap roller to oil it for drawing. (2) It is inserted


SOLDER FILLER NECK
PREHEAT AND BRUSH ACID INSIDE OF FILLER NECK
SOLDER
PREHEAT GAS GAGE UNIT FLANGE AND BRUSH WITH ACID
ASSEMBLE GAS GAGE UNIT FLANGE AND SPOTWELD
SPOTWELD GAS FILLER NECK
ASSEMBLE GAS FILLER NECK TO FUEL TANK TOP
CLEAN, TIN PLATE, AND DRY FILLER NECK
FLANGE FILLER NECK HOLE
PIERCE FILLER NECK HOLE
FIRST FORM FILLER NECK HOLE
FLANGE, RESTRIKE, AND EMBOSS
TRIM ALL AROUND AND PIERCE
DRAW AND ROUGH PIERCE
SOAP ROLL
SQUARE SHEAR
TERNE PLATE SHEET STOCK FOR UPPER HALF OF TANK
TAP (6) 10-32 HOLES IN FUEL TANK UNIT FLANGE
CLEAN TIN PLATE AND DRY FUEL TANK UNIT FLANGE
BLANK PIERCE AND CHAMFER FUEL TANK GAGE UNIT FLANGE
AUTOMATIC WASH TANK
ASSEMBLY TABLE
SPOTWELD TOP ASSEMBLY TO BOTTOM ASSEMBLY
SEAM WELD BOTH SIDES (1) AT A TIME
SEAM WELD ENDS (1) AT A TIME
CUTOFF AND "V" FORM REINFORCMENT
SPOTWELD REINFORCMENTS TO BODY OF TANK INDIRECTLY
TURN TANK 180° AND SPOTWELD OPPOSITE SIDE INDIRECTLY
SPOTWELD ALL REINFORCMENTS TO FLANGE OF TANK DIRECTLY
PIERCE (5) HOLES IN FLANGE OF TANK
BLANK PIERCE AND EMBOSS NUT RETAINER
FORM NUT RETAINER
SPOTWELD NUTS AND NUT RETAINER TO TANK REINFORCEMENTS
WATER TEST TANK
INSPECT TANK
SOLDER OUTLET FLANGE
SOLDER DRAIN PLUG FLANGE
PREHEAT DRAIN PLUG FLANGE AND BRUSH WITH ACID
SPOTWELD OUTLET ASSEMBLY TO BOTTOM
WATER TEST FUEL TANK OUTLET ASSEMBLY
SOLDER
ASSEMBLE FUEL TANK OUTLET FLANGE AND PIPE
RIVET DRAIN FLANGE TO BOTTOM
RIVET FEED LINE TO BOTTOM
SOLDER TUBE TO FLANGE
PIERCE OUTLET HOLE
SPOTWELD OUTLET FLANGE REINFORCMENT TO FUEL TANK BOTTOM
PIERCE DRAIN HOLE AND RESTRIKE
RESTRIKE AND EMBOSS DRAIN HOLE
TRIM AND PIERCE
DRAW
SOAP ROLL
SQUARE SHEAR
TERNE PLATE SHEET STOCK FOR LOWER HALF OF TANK
CLEAN TIN PLATE AND DRY FUEL TANK DRAIN PLUG FLANGE
PUNCH HOLES
⅛ PIPE TAP
DRILL PIPE HOLE
TRIM
FORM AND CUT OFF
SHEET STEEL FOR FUEL TANK DRAIN PLUG FLANGE

Courtesy, Ford Motor Company

Flowsheet showing successive basic operations (follow arrows) in mass production of a fuel or gasoline tank. (Complete key of operations is outlined in *text*.)

into draw die to form lower half of fuel tank. (3) Placed in a trim and pierce die that trims it all round and pierces four holes. (4) Placed in a restrike press that reshapes it and pierces drain plug flange hole. (5) Placed on spot welder that welds a reinforcement on end of piece. (6) Inserted in die that pierces four holes in piece. (At this point a feedline tube assembly arrives from an auxiliary line which represents six operations.) (7) Gas feedline outlet is riveted onto the piece. (8) Drain outlet flange is riveted on. (9) Tube of feedline is securely spot-welded to tank bottom. (10) Piece is placed on table. (11) Is hung on overhead conveyor which carries it to solder line. (12) Twelve men solder hardware on the piece. (13) It is then placed on overhead conveyor, carried through automatic wash of soda ash solution, to oxidize the acid, thence through a fresh water wash, lastly through a drying oven. (14) Piece removed from conveyor, placed on assembly table. The process thus far has engaged 28 men.

In the meantime the sheet forming the upper half of the fuel tank has been proceeding along a parallel line through similar operations, requiring 30 men, meeting lower half at the assembly table. At this point (15), upper and lower half of tank are assembled, spot-welded and seam-welded at ends. (16) Seam-welded on sides. (17) External reinforcements are spot-welded to one side of tank. (18) Reinforcements spot-welded to opposite side. (19) Same reinforcements spot-welded to flange of tank. (20) Five holes pierced to attach tank to car frame. (21) Double spot-welding of nuts and nut retainers that attach tank to frame. (22) Tank moves by conveyor to water test where six men give it a five-minute test for leaks under 20-pound air pressure. (23) Belt conveyor passes tank before line of four inspectors. (24) Four men apply antirust oil to threads of nuts. (25) Two men hang tank on conveyor which delivers it to final assembly line where it takes its place in the car. This second series of operations engages 35 men.

The making of a fuel tank requires 27 parts, 55 operations (10 minor motions in additions to those just described), and 93 men. From this it may be seen how many more operations and men are involved in the making and assembly of a complicated part such as a motor or a rear axle. The effect of the process is to make every part not only instantly interchangeable but also of uniform quality, neither of which is possible by any other process.

As to the effect of mass production on employment, the number of jobs normally established and the number of persons normally employed in proportion to the population has steadily increased from the time machines first came into industrial use. In 1870 the work of 324 persons per 1,000 population was required to supply goods and services; in 1930, with the machine predominant, 400 persons out of every 1,000 were similarly employed. In the meantime, 20 great new industries, entirely impossible without machinery, had sprung into existence. The experience of the Ford Motor Company, with all its expert efficiency in decreasing the number of men required on specific jobs, is that the number of man-hours of labor per car produced has steadily increased.

American business management always has been the focus of two seemingly irreconcilable demands, that of the consumer for higher quality at lower prices, and that of the employee for a higher wage and a shorter workday. Previous to about 1900, managerial ability was measured by the dexterity with which these two demands could be balanced one against the other. Wages would be reduced or the workday lengthened and the difference used to improve the quality or reduce the selling price of goods, until employee protest made a change of policy advisable; or, on the opposite course, the quality of goods was lowered or the price increased and the difference applied to wages, until consumer protest and loss of trade compelled abandonment of that makeshift. About 1900 there appeared on the American scene a more modern and competent type of business management that studied these apparently antagonistic demands and, recognizing both to be just, concluded they were therefore practicable. Thereupon, management developed methods—the beginnings of mass production—that eliminated waste of time and materials and increased the output, enabling employees to *earn* a higher wage by more efficient work in fewer hours, and consumers to buy better goods at lower prices. With that reform a new era began in American business and it is now nowhere questioned that in the United States the consumer may purchase more value at lower cost and the employee earn a higher wage for less hard labor than anywhere in the world.

On a superficial view it sometimes seems that mass production methods reduce employment. That may be the result in a given job, but the reverse is true of the total volume of industrial employment. How it works out in practice may be seen by a study of an insignificant item, the inner shell of the hubcap of a motorcar. Made by machinery this article costs 12-and-a-fraction cents. Made by hand at 1929–1938 wage rates, it would cost $2.50. A machine will produce 2,610 hubcap shells while the handworker is hammering out one. To produce by hand the number required for one day's normal output of motorcars would require the employment of about 5,000 men. The uninformed conclusion is that this machine throws 5,000 men out of work. The fact is that had the hubcap shell been made by hand, it would indicate a stage of progress in which everything else pertaining to a motorcar would also be made by hand, and therefore a stage of progress in which neither these 5,000 men nor the other 350,000 men engaged in fabricating automobiles could have been employed in any mass production industry. And the 24 years of employment at $7 a day that went into the construction of that hubcap-making machine would not have been possible. A handmade Ford car would cost at least $17,850, and at that price there would be no automotive industry. It was by economies, such as making this hubcap shell by machinery, that a motorcar at a payable price was made available to the general public and an industry established that gave vast direct and indirect employment. Labor economies do not mean unemployment. The typewriting machine invaded a business world that wrote its correspondence and kept its accounts with a pen; instead of reducing office employment, the typewriting machine opened a new profession for tens of thousands who otherwise could not have worked in offices, and in addition employed tens of thousands of mechanics in making typewriters, cash registers, and comptometers. Nor did it in-

jure the pen and pencil busines—witness the growing manufacture of fountain pens and patent pencils.

The stimulating effect of the typewriting machine on what would seem to be its rivals, the pen and pencil, indicates a law of business that even mass production has not altered, namely, that nothing useful is ever superseded. When oil came in as an illuminant, some prophesied the disappearance of candles; probably more candles are manufactured today than when they were the main source of artificial lighting. When gas came, it seemed to be the end of oil; more oil is produced for more uses today than ever before. Then electricity arrived and gas seemed to be doomed; today more gas is manufactured and used for more purposes than in the heyday of the gaslight. By all logic, the stove should have abolished the fireplace, but the fireplace is commoner today in domestic architecture than at any time in half a century. House furnaces should have superseded the stove, but now besides the furnace business and the continued manufacture of coal and wood stoves, there is a flourishing business in oil, gas, and electric stoves. The automobile did not abolish the bicycle; in a recent year more bicycles were made than in any other year of bicycle history, and the industry experienced in 1942 another boom due to wartime conditions. The motorcar outmoded the horse as a means of motive power, which should have spelled the end of the blacksmith shop; but towns that had one or two blacksmith shops now have from four to ten garages. New business does not extinguish useful old business, and mass production, instead of destroying old business, has presented it with the means to insure its survival. The great mass production industries, with their reliance on tens of thousands of smaller industries as suppliers, have had the effect of increasing rather than diminishing the amount of individual business enterprise in the country.

The effect of mass production on the employee may be stated as follows: it enabled him for the first time to become a consumer of the goods he makes; it prolongs his effective working life by practically eliminating the strain of hard physical labor; it increases his technical skill by its higher requirements of workmanship and by the variety of his experience with technical processes. Contrary to a view assiduously and academically disseminated, mass production requires a high degree of mass skill. In a total of 74,282 employees in one Ford factory, 12,258, or 16.5 per cent, are highly skilled men. This percentage of skilled men is much higher than could have been found among the people of the handicraft period. The percentage of semiskilled men also runs higher under mass production than under the previous system. And unskilled labor is enabled to *earn* a higher wage than it ever was paid before. The presence of modern machines imparts to the men who manage them some of the skill that went to their making. Every tool enshrines the craft and experience of the men who developed it, and transmits something of these values to those who work with it. It is not accidental, therefore, that in the United States where mass production has reached its widest use, technical skill among the people is more prevalent than in any other country.

The extent to which the mass production technique could be used to arm a nation quickly and effectively was widely recognized at the advent of World War II, and in the United States the automotive industry was called upon to play a very important part in the war effort. A good example of the application of mass production technique to production of war material was the Willow Run bomber plant, 35 miles west of Detroit, where 8,685 four-engine bombers of the B-24 Liberator type were manufactured and assembled. Willow Run's greatest contribution to the war effort was the demonstration that automobile-type mass production of airplanes is actually the method best suited for incorporating constant modifications.

There had never been any doubt that mass production of airplanes would be less costly in time and manpower, if engineering changes could be frozen. Willow Run, however, proved that engineering changes could be incorporated into new planes faster in a mass-production setup than in the more conventional airplane manufacture. It was also demonstrated that the mass production technique is in fact a very flexible system; this was shown by the elimination of the greater part of modification center work, by incorporating into original production the diverse parts required. Again, this plant demonstrated the close control on quality that the mass production technique permits.

The future of mass production is definitely determined. Automatic machinery will greatly increase in variety and use. This, not with the impossible purpose of making human beings obsolete in industry, but as the result of an inescapable evolution which will enhance economic supply and liberate human brain and brawn to the long overdue cultivation of new and waiting fields. See also INDUSTRIAL DESIGN.

EDSEL FORD,
Revised by Henry Ford II, President, Ford Motor Company.

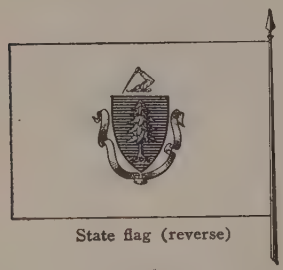
MASSA, mäs'sä, or **MASSA DI CARRARA,** town in Tuscany, Italy; capital of the province of Massa e Carrara; on a hill three miles from the Gulf of Genoa, 25 miles north of Pisa and 20 miles southeast of Spezia. It is an episcopal see, has a cathedral, public library, and academy of arts and sciences, and an ancient ducal palace now used as the prefectual building. The chief industry is the quarrying of the superior white marble in the vicinity; tobacco, silk, cotton, paper, and oil are manufactured. Massa was once the capital of the principality of Massa and later capital of the duchy of the same name, but since 1870 it has been in the state of Tuscany. Pop. 41,800.

MASSACHUSET, mäs-a-choo'set, a tribe of North American Indians of the Algonquian stock, formerly living in the neighborhood of Massachusetts Bay, between Salem and Plymouth. Their capital, Massachuset, was where Quincy now stands. A pestilence in 1617 greatly reduced their number and on the arrival of the white settlers the tribe numbered but a fraction of its former hosts, about 500. In 1633 this number was further depleted by the ravages of smallpox. They were placed by the whites in the missions of Natick, Nonantum, and Ponkapog in 1646 and gradually disappeared. See ALGONQUIN; INDIANS.

MASSACHUSETTS, one of the original thirteen states of the United States. The name is derived from that of an Algonquian confederacy which inhabited the region of Massachusetts Bay. It appears to be compounded from the Algonquian words, *massa* (great), *wadchu* (hill), and *set* (near), meaning "near the great hill," which probably refers to the Blue Hills near Quincy, which was the site of the confederacy's capital. It is bounded on the north by New Hampshire and Vermont, on the west by New York, on the south by Connecticut, Rhode Island, and the Atlantic Ocean, and the east by the Atlantic Ocean. The main portion of the state is

approximately 130 miles from east to west; the width from north to south is 110 miles at the widest parts and in the west is 48 miles.

State flag (obverse)



State flag (reverse)

Land area	7,867 square miles
Water area	390 square miles
Total area	8,257 square miles
Latitude	41° 10′-42° 53′ N.
Longitude	69° 57′-73° 30′ W.
Altitude	Sea level to 3,491 feet
Population (1940)	4,316,721
Population (1950)	4,690,514
Capital city—Boston; Pop. (1950)	801,444
Ratified the Constitution	Feb. 6, 1788
Bird	Chickadee
Flower	Mayflower
Motto	*Ense Petit Placidam Sub Libertate Quietem* (By the Sword She Seeks Peace Under Liberty)
Nicknames	Old Bay State, Baked Bean State, Old Colony State, Puritan State
Song (unofficial)	*Massachusetts*
Tree	Elm

State seal

Physical Characteristics.—*Topography.*—The topography of Massachusetts may be described in four regions: western mountains, the Connecticut Valley, central plateau, and eastern lowlands. The mountains in the west, known as the Berkshire Hills, run north and south across the state and are a southern extension of the Green Mountains of Vermont, themselves a part of the Appalachian system. In the extreme west, along the border of New York State, lies the Taconic Range, which reaches an elevation of 3,491 feet in the northwest at Mount Greylock, highest point in the state, and 2,603 feet at Mount Everett in the southwest. East of the Taconic Range lies the picturesque Berkshire Valley, in which are located a number of manufacturing centers, chief of which is Pittsfield, and also residential towns which are noted as summer resorts. The Berkshire Hills to the east comprise a succession of ridges, the highest being the Hoosac Range, which reaches 2,588 feet at Spruce Hill. There is some farming, chiefly on the plateaus, but this region is noted chiefly for its scenic beauty and as a summer resort. The mountain barrier has tended to isolate Massachusetts from the region to the west, with the result that the state faces to the east and south and tends to remain, along with the rest of New England, a distinctive region. East of the Berkshire Hills the broad Connecticut Valley extends across the state from north to south. Here the deep, alluvial soil and the high summer humidity provide rich crops of tobacco, onions, and potatoes. Several manufacturing centers, such as Springfield, Holyoke, and Chicopee, are located in the valley. Dominant features of the landscape here are the traprock ridges which have resisted erosion and which rise sharply from the valley to peaks such as Mount Tom (1,202 feet), Mount Holyoke (878 feet), and Mount Toby (1,269 feet). The central plateau east of the Connecticut is a southern extension of the White Mountains of New Hampshire. It is a hilly and largely wooded region with an elevation of about 1,100 feet in the central portion, but with some higher peaks such as Mount Wachusett (2,006 feet). East of this plateau the hills slope away to a coastal lowland which was once submerged beneath the sea. The highest point along the coast is the Great Blue Hill of Milton (635 feet). In the eastern region are located most of the population centers, constituting roughly three fourths of the state's population. The shoreline is rocky and picturesque in the north and sandy to the south, and is deeply indented by bays such as Massachusetts Bay, Cape Cod Bay, and Buzzards Bay, and by many inlets. The hook-shaped Cape Cod Peninsula in the southeast, about 65 miles in length, was formed by glacial moraine, as also were the islands of Martha's Vineyard, Nantucket, and the sixteen Elizabeth Islands, which are part of the state. The region with its mild climate, beautiful beaches, and fine harbors for sailing is one of the principal summer resort areas of New England.

Climate.—Lying in the middle of the temperate zone, Massachusetts is in the area of recurrent conflicts between cold, dry air masses flowing from the northwest and the warmer, moisture-laden air from the south. The resultant disturbances bring storms and weather changes at fairly frequent intervals. The prevailing winds are from the northwest in winter and south to southwest in summer. Heavy snowstorms in winter often occur with northeasters. Winters are long, leading to short spring seasons, with fairly warm summers, and cool, bracing fall weather. Along the eastern and southern shores the climate is tempered by the ocean, being milder in winter and less oppressive in summer than in the interior. The average January temperature at Williamstown in the northwest is nearly 23°F., while at Boston it is about 30°F., and on Nantucket 32.6°F. The average July temperature is near 70°F. throughout most of the state. The highest tem-

perature recorded is 106°F. and the lowest —28°F. Average dates for the last killing frost in spring are two to three weeks earlier in coastal areas than in the interior and correspondingly later in the fall, so that there is considerable variation in the growing season. Precipitation in most areas exceeds 40 inches annually, with 48 inches as the highest average at any station, and it is rather evenly distributed throughout the 12 months. There is little permanent snow cover along the coast, but in mountain areas snow lies deep all winter.

Rivers and Harbors.—Rivers have played an important part in the history of the state, but primarily as sources of waterpower for manufacturing and the production of electricity, rather than for navigation. The fact that no important river flowed eastward from the center of the state retarded settlement in that region, and early settlers in the Connecticut Valley ascended that river from Long Island Sound. The Connecticut River is navigable in the state only by small boats, but is a valuable source of power. Tributaries from the west are the Deerfield and Westfield rivers, and from the east the Millers and Chicopee rivers. The Berkshire Valley is drained to the south by the Housatonic River, which empties into Long Island Sound, and to the north by the Hoosic River, which flows into the Hudson. The Swift River valley in the central plateau has been dammed to form the large Quabbin Reservoir. Farther east, the Merrimack River rises in New Hampshire and flows for 35 miles through the northeastern corner of Massachusetts; it is navigable by small boats for about 17 miles from Newburyport to Haverhill, but is valuable chiefly as a source of power for the industrial cities of Lowell, Lawrence, and Haverhill. The Concord River empties into the Merrimack, and the Charles River flows into Massachusetts Bay at Boston. In the southeastern part of the state the Blackstone River, valuable for waterpower, and the Taunton River drain into Narragansett Bay. Scattered throughout the state are many small lakes and ponds, mostly of glacial origin. In the Cape Cod region many glacial depressions with rich, peaty soil serve as cranberry bogs.

Massachusetts is fortunate in having many excellent harbors, which help to account for its early eminence in shipping. Along the eastern shore are the harbors of Boston, Lynn, Marblehead, Salem, Gloucester, Newburyport, Plymouth, and Provincetown. Boston and Provincetown accommodate the largest ocean-going vessels. On the south shore are the important harbors of New Bedford on Buzzards Bay, and Fall River on Narragansett Bay.

Political Divisions.—*Counties.*—The state is divided into fourteen counties. Nantucket with an area of 46 square miles and (1950) 3,484 persons is the smallest. Worcester County has the largest area (1,532 square miles) and Middlesex the greatest population (1,064,569). The counties and their county seats are as follows:

County	County Seat
Barnstable	Barnstable
Berkshire	Pittsfield
Bristol	Taunton, Fall River, and New Bedford
Dukes	Edgartown
Essex	Salem, Lawrence, and Newburyport
Franklin	Greenfield
Hampden	Springfield
Hampshire	Northampton
Middlesex	Cambridge and Lowell
Nantucket	Nantucket
Norfolk	Dedham
Plymouth	Plymouth
Suffolk	Boston
Worcester	Worcester and Fitchburg

Cities and Metropolitan Areas.—Massachusetts in 1950 had 39 places incorporated as cities, with 2,500 inhabitants or more, and 114 unincorporated places of 1,000 population or more. The cities ranged in size from Newburyport, with a population of 14,111, to Boston, with 801,444 residents. According to the 1950 census, Massachusetts had more cities with populations of over 50,000, 17 in all, than any other state except California, which had 19. Besides Boston, cities of more than 100,000 are: Cambridge, Fall River, New Bedford, Somerville, Springfield, and Worcester. In addition to those mentioned above, cities of more than 50,000 residents are: Brockton, Holyoke, Lawrence, Lowell, Lynn, Malden, Medford, Newton, Pittsfield, and Quincy. (For populations of these and other cities, see individual articles and the back of the state map.)

The Bureau of the Census in 1950 designated nine metropolitan areas within Massachusetts. These were Boston, Brockton, Fall River, Lawrence, Lowell, New Bedford, Pittsfield, Springfield-Holyoke, and Worcester. The Boston area comprised the entire Suffolk County, 9 cities and 19 towns in Middlesex County, 4 cities and 10 towns in Essex County, 1 city and 16 towns in Norfolk County, and 2 towns in Plymouth County.

The Boston metropolitan area, with a population of 2,369,986 in 1950, compared with 2,177,621 in 1940, ranks as the sixth most populous in the United States. The area is also one of the nation's largest wholesale centers, a leader in per capita retail sales, one of the outstanding industrial centers, and a leading educational center. Its activities include the usual industries associated with a large population center, with more than ordinary emphasis on confectionery, drugs, chemicals, sugar refining, soap, plastics, printing and publishing, electrical machinery, and other fine metal products.

The Lowell and Lawrence metropolitan areas, located in the Merrimack River valley, have long been centers for extensive textile manufacturing, including cottons, woolens, and worsteds. Other manufactures include such diversified products as boots and shoes, hard rubber products, soap, and plastics, as well as dyeing and finishing processing.

The Fall River and New Bedford metropolitan areas, located on the southern shore of the state, have climatic conditions which gave the area an early lead in the manufacture of fine cotton goods, in addition to marine equipment. In recent years, however, there has been a tendency towards diversification into other fields, such as dyeing and finishing, leather goods, rubber goods, and fine metal products, including copper, brass, and silverware.

Located in the Connecticut River valley, the Springfield-Holyoke metropolitan area ranks high in the manufacture of paper and textiles of all kinds, rubber goods, games and toys, fine metal products, and light machinery, including firearms and electrical equipment.

The Worcester area of central Massachusetts, located along the Blackstone River, is also noted for its diversity of industries, including machine tools, steel and wire products, tex-

tile machinery, grinding machines, firearms, woolens and worsteds, carpeting, and clothing.

The People.—The population is approximately three fifths native, one quarter foreign-born or of mixed foreign-born and native parentage, and one eighth from other states. More than 98 per cent is of the white race (98.6 per cent white; 1.3 Negro; and 0.1 other). Almost one fourth of the foreign-born persons of the state reside in Suffolk County and more than one fifth in Middlesex County. The Irish Free State (Ireland) has contributed more than one hundred thousand (103,388) of the foreign-born population and a large percentage of this group live in the metropolitan areas.

The population of Massachusetts increased from 378,787 in 1790 to 4,690,514 in 1950. During the earlier years of this period the percentage rate of growth was slightly over 10 per cent each decade. The rate of growth reached its peak during the decade 1850–1860 with an increase of 34.8 per cent. From 1880 to 1910 the growth rate was approximately 25 per cent for each decade. After that it tapered off rapidly and for the decade 1930–1940 was only 1.6 per cent. Official United States census figures indicate a resumption of the upward trend in population growth at the rate of approximately 8.7 per cent for the decade 1940–1950.

During colonial days Massachusetts was typical in that its population was predominantly rural. The percentage of rural population decreased steadily from 86.5 per cent of the total in 1790 to 9.8 per cent in 1930. Thus Massachusetts has become a predominantly urban state with about 90 per cent of its population living in urban areas. The United States census of population for 1950 indicated a reversal in this trend, with people moving into rural areas and commuting to their urban places of employment. In 1950 the rural population was 15.6 of the total.

Famous Men and Women.—Massachusetts, as one of our original colonies, has produced many statesmen and patriots. Among them are Benjamin Franklin (Boston, 1706–1790), statesman, printer, author, and scientist; Israel Putnam (Salem Village, now Danvers, 1718–1790), American Revolutionary soldier; Samuel Adams (Boston, 1722–1803), American Revolutionary patriot and statesman, delegate to 1st and 2d Continental Congresses, signed Declaration of Independence, and became governor of Massachusetts; James Otis (West Barnstable, 1725–1783), American Revolutionary statesman, a leader in upholding the colonial cause; Artemas Ward (Shrewsbury, 1727–1800), American Revolutionary general; John Adams (Braintree, now Quincy, 1735–1826), 2d president of the United States and signer of the Declaration of Independence; Paul Revere (Boston, 1735–1818), silversmith and patriot; John Hancock (Braintree, now Quincy, 1736/7–1793), merchant, statesman, first signer of the Declaration of Independence, and first governor of the State of Massachusetts; Elbridge Gerry (Marblehead, 1744–1814), statesman, member of Massachusetts Provincial Congress and Continental Congress, a signer of the Declaration of Independence and also of the Articles of Confederation, was governor of Massachusetts and vice president of the United States under James Madison; and John Quincy Adams (Braintree, now Quincy, 1767–1848), 6th president of the United States, and representative in Congress for many years thereafter.

Among the many men and women notable in the world of literature who were born in the state are: William Cullen Bryant (near Cummington, 1794–1878), poet, editor and co-owner of the New York *Evening Post* for almost 50 years; William Hickling Prescott (Salem, 1796–1859), historian, essayist, author of the *History of the Conquest of Mexico;* George Bancroft (Worcester, 1800–1891), historian and statesman; Ralph Waldo Emerson (Boston, 1803–1882), essayist and poet; Nathaniel Hawthorne (Salem, 1804–1864), novelist; John Greenleaf Whittier (Haverhill, 1807–1892), poet, editor, and ardent abolitionist; Oliver Wendell Holmes (Cambridge, 1809–1894), teacher of anatomy, poet, and essayist; Edgar Allen Poe (Boston, 1809–1849), poet and writer of short stories; Sarah Margaret Fuller (Cambridgeport, 1810–1850), journalist and critic; John Lothrop Motley (Dorchester, 1814–1877), historian and diplomat; Richard Henry Dana (Cambridge, 1815–1882), lawyer, specializing in admiralty cases, and author of *Two Years Before the Mast;* Henry David Thoreau (Concord, 1817–1862), essayist, naturalist, and philosopher; James Russell Lowell (Cambridge, 1819–1891), poet, essayist, editor, and diplomat; Edward Everett Hale (Boston, 1822–1909), Unitarian minister and author of the well-known short story *The Man Without a Country;* Francis Parkman (Boston, 1823–1893), historian and author of *The California and Oregon Trail,* as well as other histories of early America; Emily Elizabeth Dickinson (Amherst, 1830–1886), poet, none of whose poems (except two) were published during her lifetime; Horatio Alger (Revere, 1834–1899), author of more than 100 popular books for boys; and Henry Brooks Adams (Boston, 1838–1918), assistant professor of history at Harvard, editor of the *North American Review,* and author of many books of biography and history.

A few of those who became famous in the field of art are: John Singleton Copley (Boston, 1738–1815), portrait painter; Samuel McIntire (Salem, 1757–1811), architect and wood carver, designed many of the houses and public buildings in old Salem; Charles Bulfinch (Boston, 1763–1844), architect of Massachusetts State House on Beacon Hill and designed many public buildings in Boston, also completed the Capitol in Washington, D.C.; John Rogers (Salem, 1829–1904), sculptor well known for his Civil War groups; James Abbott McNeill Whistler (Lowell, 1834–1903), painter and etcher; and Winslow Homer (Boston, 1836–1910), painter, known especially for his paintings of the sea.

Among Massachusetts-born inventors are Eli Whitney (Westboro, 1765–1825), inventor of the cotton gin and firearms parts; Samuel Finley Breese Morse (Charlestown, 1791–1872), artist and inventor of the telegraph; Elias Howe (Spencer, 1819–1867), inventor of the sewing machine; and Francis Blake (Needham, 1850–1913), inventor and physicist, whose telephone transmitter was purchased by the Bell Telephone Company.

Others who have become famous for various reasons are: Cotton Mather (Boston, 1662/63–1727/28), Puritan clergyman, scholar, and author; Horace Mann (Franklin, 1796–1859), educator, who revolutionized public school organization and teaching; Lucy Stone (West Brookfield, 1818–1893), reformer and pioneer in woman's rights; Clara Barton (Oxford, 1821–1912), philanthropist and Civil War worker, through whose efforts the American Red Cross was established; Charles William Eliot (Boston, 1834–1926), president of Harvard (1869–1909), and one of the most influential leaders in educational activities in this country; Samuel Pierpont Langley (Roxbury, 1834–1906), airplane pioneer and astronomer; Lyman Abbott (Roxbury, 1835–1922), clergyman, editor, and author, who became associated with Henry Ward Beecher and succeeded him as pastor of the Plymouth Congregational Church in Brooklyn; Phillips Brooks (Boston, 1835–1893), Episcopal bishop and a great preacher, rector of Trinity Church of Boston; Dwight Lyman Moody (Northfield, 1837–1899), a layman who became one of the world's great evangelists; Oliver Wendell Holmes (Boston, 1841–1935), son of the essayist, associate justice of the United States Supreme Court for 30 years; Luther Burbank (Lancaster, 1849–1926), plant breeder and originator of many new varieties of fruit, flowers, and vegetables; Nathaniel Carl Goodwin (Boston, 1857–1919), favorite comedian of the 1880's and 1890's; and Otis Skinner (Cambridge, 1858–1942), actor.

Others of national fame who, by residence or work in Massachusetts, have brought distinction to the state are: John Eliot (1604–1690), missionary to the American Indians and founder of the Praying Towns in Massachusetts; Mary Morse Baker Eddy (1821–1910), founder of the Christian Science Church and author of *Science and Health;* Louisa May Alcott (1832–1888), author of *Little Women* and other novels; Henry James (1843–1916), novelist, who claimed Cambridge as his American home; Edwin Austin Abbey (1852–1911), mural painter, who did the *Quest of the Holy Grail* series for the Boston Public Library; and John Singer Sargent (1856–1925), portrait painter and mural artist who also did a series of murals for the Boston Public Library.

Natural Resources.—*Fauna.*—Cape Cod deflects the Gulf Stream in such a way that the water to the south is much warmer than that to the north, and thus the state is a meeting place for many southern and northern species of fauna and flora. For example, southern fishes and other marine life are found in the water south of the Cape, including the Portuguese man-of-war, whil

MASSACHUSETTS — 1950 Total Population 4,690,514

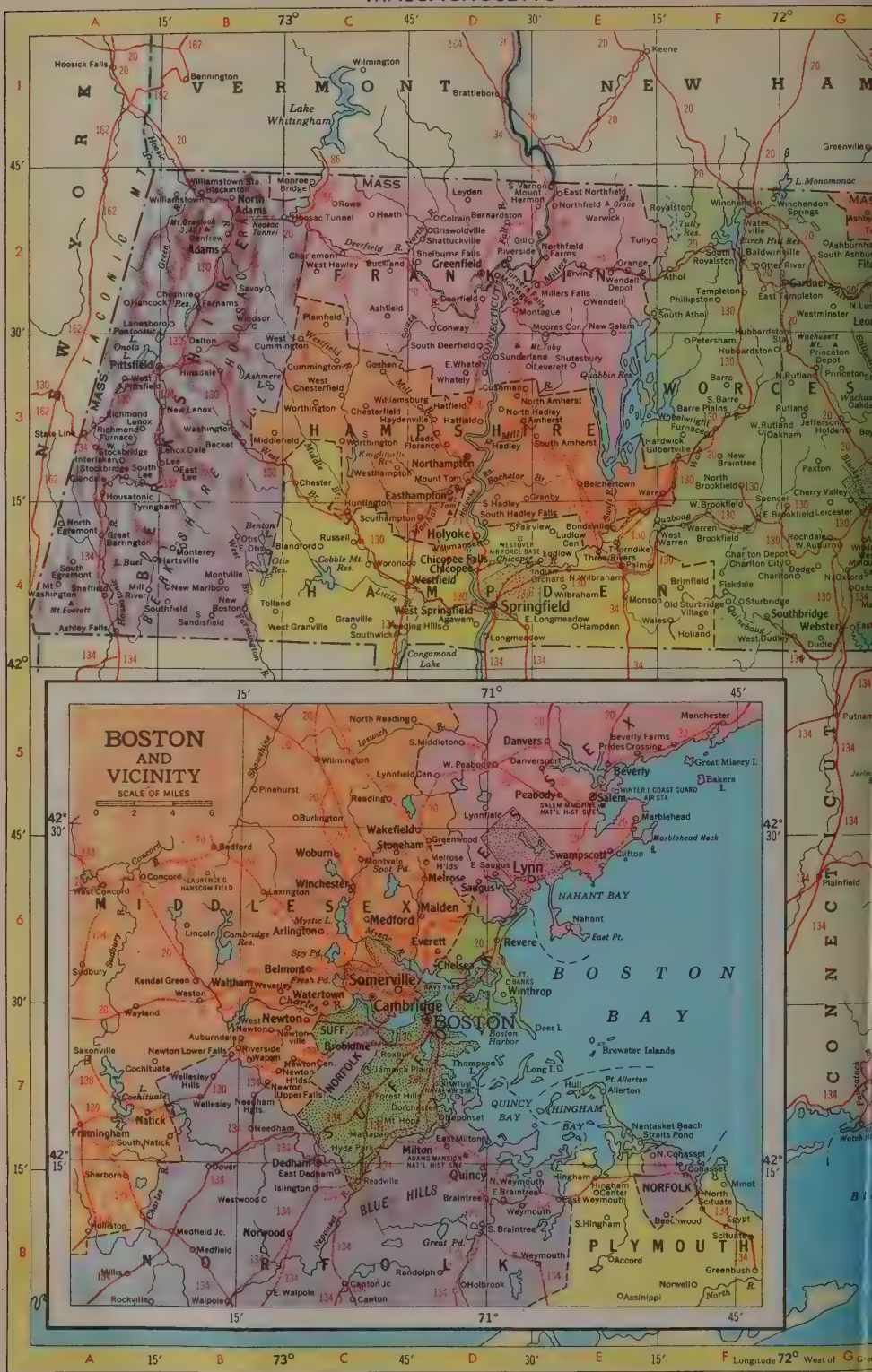
.bington □(L4).....7,152
.ccord (E8)..... 150
.coaxet (K7)..... 130
.cton □(J3).....3,510
.cushnet □(L6).....4,401
.dams □(B2).....12,034
.gawam □(D4).....10,166
.llerton (E7)..... 500
.mesbury □(L1).....10,851
.mherst □(E3).....10,856
.ndover □(K2).....12,437
.nnisquam (M2)..... 500
.rlington □(C6).....44,353
.shburnham □(G2)2,603
.shby □(G2).....1,464
.shfield □(C2)..... 977
.shland □(J3).....3,500
.shley Falls (A4).... 500
.ssinippi (E8)..... 500
.ssonet (K5).....1,002
.thol □(F2).....11,554
.ttleboro (J5).....23,809
.ttleboro Falls (J5)2,500
.uburn □(G4).....8,840
.uburndale (B7).....6,218
.von □(K4).....2,666
.yer □(H2).....5,740
aldwinville (F2).....1,407
allard Vale (K2).....1,200
arnstable ◉□(N6)10,480
arre □(F3).....3,406
arre Plains (F3).... 144
arrowsville (K5).... 700
ecket □(B3)..... 755
edford □(B6).....5,234
eechwood (F8)..... 200
elchertown □(E3)..4,487
ellingham □(J4)....4,100
elmont □(C6).....27,381
erkley □(K5).....1,284
erlin □(H3).....1,349
ernardston □(D2)..1,117
everly (E5).....28,884
everly Farms (E5).2,500
illerica □(J2).....11,101
lackinton (B2)..... 440
lackstone □(H4)...4,968
landford □(C4)..... 597
olton □(H3)..... 956
ondsville (E4).....1,200
OSTON (D7)....801,444
ourne □(M6).....4,720
ournedale (M5).....
oxford □(K2)..... 926
oylston Center(H3)
raintree □(D8)....23,161
rant Rock (M4)..... 350
rewster □(O5)..... 987
ridgewater □(K5).9,512
rimfield □(F4).....1,182
rockton (K4).....62,860
rookfield □(F4)....1,567
rookline □(C7)....57,589
rookville (K4).....
ryantville (L4).....
uckland □(C2).....1,605
urlington □(C5)....3,250
uzzards Bay (M5)..1,459
yfield (L1)..... 950
ambridge◉(C6)..120,740
anton □(C8).....7,465
anton Jct. (C8).....
◉ County Seat

Carlisle □(J2)..... 846
Carver □(M5).....1,530
Caryville (J4)..... 300
Cataumet (M6)..... 100
Centerville (N6).....1,100
Central Village(K6). 350
Charlemont □(C2)... 855
Charlton □(F4).....3,136
Charlton City (F4)...1,200
Charlton Depot(F4) 150
Chartley (K5)..... 600
Chatham □(P6).....2,457
Chathamport (P6)... 150
Chelmsford □(J2)....9,407
Chelsea (D6).....38,912
Cherry Valley (G3).....
Cheshire □(B2).....2,022
Chester □(C3).....1,292
Chesterfield □(C3).. 496
Chicopee (D4).....49,211
Chicopee Falls
(D4) 12,915
Chilmark □(M7)..... 183
Chiltonville (M5).....
City Mills (J4)..... 500
Clifton (E6).....
Clinton □(H3).....12,287
Cochituate (A7).....2,500
Cohasset □(F7).....3,731
Collinsville (J2).....1,500
Colrain □(D2).....1,546
Concord □(A6).....8,623
Conway □(D2)..... 873
Cordaville (H3)..... 250
Cotuit (N6).. 700
Crescent Beach(M6)
Cummaquid (N6).... 200
Cummington □C3).. 620
Cushing (L1)..... 398
Cushman (D3)..... 250
Cuttyhunk (L7)..... 40
Dalton □(B3).....4,772
Danvers □(D5).....15,720
Danversport (E5).....2,500
Dartmouth □(K6).11,115
Dedham ◉□(C7)...18,487
Deerfield □(D2).....3,086
Dennis □(O5).....2,499
Dennis Port (O6).....1,200
Dighton □(K5).....2,950
Dodge (G4)..... 835
Dodgeville (K5).....1,500
Dorchester (D7).....
Douglas □(H4).....2,624
Dover □(B7).....1,722
Dracut □(J2).....8,666
Dudley □(G4).....5,261
Dunstable □(J2)..... 522
Duxbury □(M4).....3,167
E. Blackstone (H4).
E. Braintree (D8).....
E. Brewster (O5)..... 500
E. Bridgewater □
(L4) 4,412
E. Brookfield □(G4)1,243
E. Dedham (C8).....5,000
E. Dennis (O5)..... 275
E. Douglas (G4).....1,846
E. Falmouth (M6)...1,405
E. Foxboro (K4)..... 500
E. Freetown (L5).....1,200
E. Harwich (O6)..... 500
□Population of Township

E. Lee (B3)..... 350
E. Longmeadow □
(E4) 4,881
E. Milton (D7).....
E. Northfield (E2)... 950
E. Norton (K5)..... 800
E. Orleans (P5)..... 383
E. Otis (B4)..... 95
E. Pembroke (M4)... 200
E. Pepperell (H2)....2,500
E. Sandwich (N6).... 325
E. Saugus (D6).....
E. Taunton (K5).....5000
E. Templeton (G2)..1,200
E. Village (G4)..
E. Walpole (C8).....2,000
E. Wareham (M5).... 500
E. Weymouth (E8).10,000
E. Whately (D3).....
Eastham □(O5)..... 860
Easthampton □
(D3) 10,694
Easton □(K4).....6,244
Eastondale (K4)..... 600
Edgartown ◉□(M7)1,508
Egypt (F8)..... 600
Elmwood (L4)..... 350
Erving □(E2).....1,322
Essex □(L2).....1,794
Everett (D6).....45,982
Fairhaven □(L6)....12,764
Fairview (D4).....2,108
Fall River ◉(K6).111,963
Falmouth □(M6).....8,662
Farnams (B2)..... 200
Farnumsville (H4)...1,427
Fayville (H3).....1,000
Feeding Hills (D4)..3,500
Fisherville (H4).....1,167
Fiskdale (F4).....
Fitchburg ◉(G2)...42,691
Florence (D3).....4,500
Forest Hills (C7)....10,000
Forge Village (H2)..1,115
Foxboro □(J4).....7,030
Framingham □
(A7) 28,086
Framingham Center
(J3) 4,500
Franklin □(J4).....8,037
Furnace (F3)..... 150
Gardner (G2).....19,581
Gay Head □((L7).... 88
Georgetown □(L2)..2,411
Gilbertville (F3).....1,039
Gill □(D2).....1,070
Gleasondale (J3).....
Glendale (A3)..... 350
Gloucester (M2)....25,167
Goshen □(C3)..... 321
Grafton □(H4).....8,281
Granby □(E3).....1,861
Graniteville (J2).....1,000
Granville □(C4)..... 740
Great Barrington □
(A4) 6,712
Green Harbor (M4).. 300
Greenbush (F8)..... 650
Greenfield ◉□
(D2) 17,349
Greenwood (D6).....5,500
Griswoldville (D2)... 590

Groton □(H2).....2,889
Groveland □(L1)....2,340
Hadley □(D3).....2,639
Halifax □(L5)..... 944
Hamilton □(L2).....2,764
Hampden □(E4).....1,322
Hancock □(A2)..... 445
Hanover □(L4).....3,389
Hanson □(L4).....3,264
Hardwick □(F3).....2,348
Hartsville (B4).....
Harvard □(H2).....3,983
Harwich □(O6).....2,649
Harwich Port (O6)...1,350
Hatfield □(D3).....2,179
Haverhill (K1).....47,280
Haydenville (C3).....1,009
Heath □(C2)..... 305
Hebronville (J5)..... 754
Hingham □(E8).....10,665
Hingham Center
(E8) .....
Hinsdale □(B3).....1,560
Holbrook □(D8).....4,004
Holden □(G3).....5,975
Holland □(F4)..... 377
Holliston □(A8).....3,753
Holyoke (D4).....54,661
Hoosac Tunnel (C2) 150
Hopedale □(H4).....3,479
Hopkinton □(J4)....3,486
Hortonville (K5).....
Housatonic (A3).....1,601
Hubbardston □(F3)..1,134
Hubbardston
Hubbardston Station
(F3) 120
Hudson □(H3).....8,211
Hull □(E7).....3,379
Humarock (M4)..... 50
Huntington □(C4)...1,257
Hyannis (N6).....4,235
Hyannis Port (N6).. 300
Hyde Park (C7).....
Indian Orchard
(E4) 10,000
Interlaken (A3)..... 60
Ipswich □(L2).....6,985
Islington (C8).....2,300
Jamaica Plain (C7)..
Jefferson (G3).....
Kendal Green (B6)..
Kingston □(M5).....3,461
Lakeville □(L5).....2,066
Lancaster □(H3).....3,601
Lanesboro □(A2)....2,069
Lanesville (M2).....1,046
Lawrence ◉(K2)...80,536
Lee □(B3).....4,820
Leeds (D3).....1,700
Leicester □(G4).....6,029
Lenox □(A3).....3,627
Lenox Dale (B3)..... 500
Leominster (G2)...24,075
Leverett □(E3)..... 791
Lexington □(B6)....17,335
Leyden □(D2)..... 306
Lincoln □(B6).....2,427
Linwood (H4)..... 981
Littleton □(H2).....2,349
Littleton Common
(J2) 1,017
Longmeadow □(D4)6,508

Lowell ◉(J2).....97,249
Ludlow □(E4).....8,660
Ludlow Center (E4) 500
Lunenburg □(H2)...3,906
Lynn (D6).....99,738
Lynnfield □(D5).....3,927
Lynnfield Center
(C5) 2,600
Magnolia (M2).....
Malden (D6).....59,804
Manchaug (G4)..... 790
Manchester □(F5)...2,868
Manomet (M5)..... 350
Mansfield □(J4).....7,184
Marblehead □(E5)13,765
Marion □(L6).....2,250
Marlboro (H3).....15,756
Marshfield □(M4)...3,267
Marshfield Hills
(M4) 500
Marstons Mills(N6) 600
Mashpee □(M6)..... 438
Mattapan (C7).....
Mattapoisett □(L6).2,265
Maynard □(J3).....6,978
Medfield □(B8).....4,549
Medfield Jct. (B8)... 500
Medford (C6).....66,113
Medway □(J4).....3,744
Melrose (D6).....26,988
Melrose Highlands
(D6) 7,713
Mendon □(H4).....1,619
Merrimac □(L1).....2,804
Merrimacport (L1).. 210
Methuen □(K2).....24,477
Middleboro □(L5).10,164
Middlefield □(B3)... 295
Middleton □(K2)....2,916
Milford □(H4).....15,442
Mill River (A4)..... 300
Millbrook (M4)..... 200
Millbury □(H4).....8,347
Millers Falls (E2)....1,134
Millis □(A8).....2,551
Millville □(H4).....1,692
Milton □(D7).....22,395
Minot (F8)..... 150
Monroe Bridge (C2) 150
Monson □(E4)... 6,125
Montague □(E2).....7,812
Montague City (D2) 668
Monterey □(B4)..... 367
Montvale (C6).....
Montville (B4).....
Monument Beach
(M6) 650
Moores Corner (E2)
Mt. Hermon (D2).... 750
Mt. Hope (C7).....5,000
Mt. Tom (D3)..... 230
Mt. Washington □
(A4) 34
Myricks (K5)..... 210
Nabnassett (J2)..... 500
Nahant □(E6).....2,679
Nantasket Beach
(E7) 1,900
Nantucket ◉□(O7).3,484
Natick □(A7).....19,838
Needham □(B7).....16,313
Needham Hts. (B7).5,500


MASSACHUSETTS
BOSTON AND VICINITY
SCALE OF MILES
0 2 4 6
VERMONT
NEW HAMPSHIRE
MASS
MIDDLESEX
ESSEX
WORCESTER
HAMPSHIRE
HAMPDEN
FRANKLIN
BERKSHIRE
NORFOLK
PLYMOUTH
BOSTON BAY
NAHANT BAY
QUINCY BAY
HINGHAM BAY
BLUE HILLS
Lake Whitingham
Connecticut R.
Deerfield R.
Westfield R.
Mill R.
Housatonic R.
Hoosic R.
Taconic Mts.
Greylock 3,491
Mt. Everett
Mt. Toby
Mt. Holyoke
Mt. Tom
Mt. Wachusett
Mt. Grace
Mt. Hermon
Mt. Monadnock
Mt. Watatic
Mt. Hope
Wilmington
Bennington
Brattleboro
Keene
Greenville
L. Monomonac
Hoosick Falls
Williamstown
North Adams
Adams
Pittsfield
Lenox
Stockbridge
Great Barrington
Lee
Housatonic
Tyringham
Monterey
Otis
Becket
Dalton
Onota L.
Richmond
Lenox
Washington
Interlaken
Stockbridge South
Glendale
East Lee
Lee
Lenoxboro
Pontoosuc
Cummington
Hinsdale
West Cummington
Ashmere L.
Windsor
Savoy
Hancock
Cheshire Res.
Farnams
Plainfield
Ashfield
Conway
Deerfield
Greenfield
Shelburne Falls
Buckland
West Hawley
Charlemont
Monroe Bridge
Rowe
Heath
Hoosac Tunnel
Williamstown Sta.
Blackinton
Greenfield
Montague
Millers Falls
Wendell
Wendell Depot
Orange
Athol
Templeton
Phillipston
South Athol
East Templeton
Gardner
Westminster
Leominster
Fitchburg
Ashburnham
South Ashburnham
Baldwinville
Otter River
Birch Hill Res.
Winchendon
Winchendon Springs
Royalston
Tully
Tully Res.
Warwick
Northfield
Northfield Farms
Riverside
Gill
Erving
Erving Paper Mill
Leyden
Colrain
Bernardston
Griswoldville
Shattuckville
Hermon
Mount Hermon
East Northfield
Greenfield Community College
Greenfield Tap & Die Corp.
Turners Falls
Montague City
Sunderland
Shutesbury
Everett
Quabbin Res.
Petersham
Hubbardston
Barre
Barre Plains
Rutland
Oakham
New Braintree
Hardwick
Gilbertville
Wheelwright
Furnace
North Brookfield
West Brookfield
Warren
Brookfield
East Brookfield
Spencer
Leicester
Cherry Valley
Rochdale
West Auburn
Auburn
Charlton Depot
Charlton City
Dodge
Charlton
Oxford
North Oxford
Sturbridge
Old Sturbridge Village
Southbridge
Webster
Dudley
West Dudley
Wales
Holland
Brimfield
Flakdale
Monson
Three Rivers
Palmer
Thorndike
Indian Orchard
Wilbraham
Ludlow
Ludlow Center
Bondsville
Quaboag
Granby
South Hadley
South Hadley Falls
Fairview
Belchertown
New Salem
Orange
Athol
Royalston
Winchendon
Winchendon Springs
Ashburnham
Fitchburg
Leominster
Greenville
Plainfield
Putnam
Jerico
Watch Hill
Northampton
Easthampton
Mount Tom
Bachelor Br.
Holyoke
Chicopee Falls
Chicopee
Westfield
West Springfield
Springfield
Agawam
Longmeadow
E. Longmeadow
Hampden
Wilbraham
Monson
Granville
Southwick
Tolland
West Granville
Feeding Hills
Congamond Lake
Ashley Falls
Sandisfield
New Boston
Southfield
Mill River
New Marlboro
Sheffield
Mt. Washington
Mt. Everett
Montville
Otis Res.
Cobble Mt. Res.
Woronoco
Russell
Blandford
Huntington
Southampton
Williamsburg
Haydenville
Leeds
Florence
Hatfield
Whately
Cushman
Amherst
North Amherst
South Amherst
Hadley
North Hadley
Sunderland
Leverett
Shutesbury
Quabbin Res.
Barre
Petersham
Hubbardston
Princeton
Paxton
New Braintree
North Brookfield
Spencer
Leicester
Cherry Valley
Rochdale
Auburn
Charlton Depot
Charlton City
Dodge
Charlton
Oxford
North Oxford
Sturbridge
Old Sturbridge Village
Southbridge
Webster
Dudley
West Dudley
Wales
Holland
Brimfield
Flakdale
Monson
Three Rivers
Palmer
Thorndike
Indian Orchard
Wilbraham
Ludlow
Ludlow Center
Bondsville
Quaboag
Granby
South Hadley
South Hadley Falls
Fairview
Belchertown
New Salem
Orange
Athol
Royalston
Winchendon
Winchendon Springs
Ashburnham
Fitchburg
Leominster
Greenville
Plainfield
Putnam
Jerico
Watch Hill
Boston
Cambridge
Somerville
Everett
Malden
Medford
Melrose
Wakefield
Stoneham
Woburn
Lynnfield
Reading
Burlington
Winchester
Lexington
Arlington
Belmont
Watertown
Waltham
Newton
Brookline
Chelsea
Revere
Winthrop
Lynn
Saugus
Swampscott
Marblehead
Salem
Peabody
Beverly
Danvers
Peabody
Lynnfield
Wakefield
Stoneham
Woburn
Melrose
Saugus
Lynn
Swampscott
Clifton
Marblehead
Salem

MASSACHUSETTS

Neponset (D7).....
New Bedford ◉ (K6) 109,189
New Boston (B4).....
New Braintree □(F3) 478
New Lenox (B3).....
New Marlboro □ (B4) 989
New Salem □(E2).... 392
Newbury □(L1).....1,994
Newburyport ◉ (L1) 14,111
Newton (C7).....81,994
Newton Center (C7) 15,214
Newton Highlands (C7) 11,480
Newton Lower Falls (B7) 1,215
Newton Upper Falls (C7) 3,451
Newtonville (C7)...13,689
Nonquitt (L6)..... 18
Norfolk □(J4).....2,704
N. Abington (L4)....3,906
N. Acton (J2)..... 300
N. Adams (B2).....21,567
N. Amherst (E3)..... 750
N. Andover □(K2)..8,485
N. Attleboro □(J5)12,146
N. Bellingham (J4).. 300
N. Billerica (J2).....3,300
N. Brewster (O5).....
N. Brookfield □(F3)3,444
N. Carver (L5).....
N. Chatham (O6).... 200
N. Chelmsford (J2).
N. Cohasset (F7).....
N. Dartmouth (K6).
N. Dighton (K5).....1,000
N. Eastham (O5)..... 270
N. Easton (K4).....4,000
N. Egremont (A4)... 215
N. Falmouth (M6)... 800
N. Grafton (H4).....2,000
N. Hadley (D3).....1,000
N. Hanover (L4)..... 800
N. Harwich (O6)..... 210
N. Hatfield (D3)..... 300
N. Leominster (G2).
N. Marshfield (M4). 450
N. Middleboro (L5) 500
N. Oxford (G4).....1,250
N. Pembroke (M4).. 400
N. Plymouth (L5)....4,000
N. Reading □(C5)...4,402
N. Rutland (G3)..... 125
N. Scituate (F8).....1,100
N. Swansea (K5).....
N. Truro (O4)..... 250
N. Uxbridge (H4)....2,100
N. Westport (K6)...3,000
N. Weymouth (D8). 700
N. Wilbraham (E4).
Northampton ◉ (D3) 29,063
Northboro □(H3)...3,122
Northbridge □(H4)10,476
Northfield □(E2).....2,246
Northfield Farms (E2) 500
Norton □(K5).....4,401

◉ County Seat

Norwell □(F8).....2,515
Norwood □(B8)....16,636
Oak Bluffs □(M7)...1,521
Oakdale (G3).....
Oakham □(F3)..... 455
Ocean Bluff (M4).... 300
Ocean Grove (K6)...1,000
Old Sturbridge Village (F4).....
Onset (M6).....1,674
Onset Station (M5).
Orange □(E2).....5,894
Orleans □(O5).....1,759
Osterville (N6)..... 1,003
Otis □(B4)..... 359
Otter River (F2).....
Oxford □(G4).....5,841
Palmer □(E4).....9,533
Paxton □(G3).....1,066
Peabody (E5).....22,645
Pembroke □(L4).....2,579
Pepperell □(H2).....3,460
Petersham □(F3)..... 814
Phillipston □(F2).... 638
Pigeon Cove (M2)...1,011
Pinehurst (B5).....2,905
Pittsfield ◉(A3).....55,348
Plainfield □(C2)..... 228
Plainville □(J4).....2,088
Pleasant Lake (O6). 125
Plymouth ◉□(M5)13,608
Plympton □(L5)..... 697
Pocasset (M6)..... 500
Pottersville (K6).....
Prides Crossing(E5) 450
Princeton □(G3).....1,032
Princeton Depot (G3) .....
Provincetown □ (O4) 3,795
Quincy (D7).....83,835
Quissett (M6)..... 300
Randolph □(D8).....9,982
Raynham □(K5).....2,426
Raynham Center (K5) 1,800
Reading □(C5).....14,006
Readville (C8).....6,000
Rehoboth □(K5).....3,700
Renfrew (B2).....
Revere (D6).....36,763
Richmond □(A3)..... 737
Richmond Furnace (A3) 250
Riverside (D2).....
Riverside (B7)..... 400
Rochdale (G4).....1,800
Rochester □(L6).....1,328
Rock (L5)..... 600
Rockland □(L4).....8,960
Rockport □(M2).....4,231
Rockville (A8)..... 500
Rowe □(C2)..... 199
Rowley □(L2).....1,768
Roxbury (C7).....
Royalston □(F2)..... 838
Russell □(C4).....1,298
Rutland □(G3).....3,056
Sagamore (M5).....1,500
Salem ◉(E5).....41,880
Salisbury □(L1).....2,695
Sandwich □(N5).....2,418

□Population of Township

Santuit (N6)..... 400
Saugus □(D6).....17,162
Saundersville (G4)... 380
Savoy □(B2)..... 291
Saxonville (A7).....3,200
Scituate □(F8).....5,993
Scotland (L5).....
Seekonk □(J5).....6,104
Segreganset (K5)..... 300
Sharon □(K4).....4,847
Shattuckville (D2)... 225
Shawsheen Village (K2) 2,100
Sheffield □(A4).....2,150
Shelburne Falls (D2) 2,364
Sheldonville (J4)..... 300
Sherborn □(A8).....1,245
Shirley □(H2).....4,271
Shirley Center (H2).1,082
Shrewsbury □(H3)10,594
Shutesbury □(E3).... 213
Siasconset (P7)..... 225
Silver Lake (L5).....2,024
Somerset □(K5).....8,566
Somerville (C6)....102,351
S. Acton (J3).....1,200
S. Amherst (E3)..... 750
S. Ashburnham (G2)1,000
S. Athol (F2)..... 100
S. Attleboro (J5).....
S. Barre (F3).....1,800
S. Berlin (H3)..... 200
S. Braintree (D8).....5,600
S. Bridgewater (L5).
S. Carver (M5)..... 300
S. Chatham (O6)..... 450
S. Dartmouth (L6)...
S. Deerfield (D3).....1,418
S. Dennis (O6)..... 300
S. Duxbury (M4)..... 800
S. Easton (K4).....1,500
S. Egremont (A4).... 415
S. Essex (L2).....
S. Groveland (L2).... 900
S. Hadley □(D4)....10,145
S. Hadley Falls(D4)
S. Hanover (L4)..... 600
S. Harwich (O6)..... 400
S. Hingham (E8).....
S. Lancaster (H3).....1,462
S. Lawrence (K2)...25,000
S. Lee (A3)..... 325
S. Lincoln (J3).....
S. Middleboro (L5). 600
S. Middleton (D5)...
S. Natick (A7).....
S. Orleans (O5)..... 89
S. Royalston (F2).... 415
S. Sandisfield (B4)...
S. Sudbury (J3)..... 900
S. Vernon (D2)..... 225
S. Walpole (K4)..... 750
S. Wareham (L5).....
S. Wellfleet (P5)..... 450
S. Westport (K6)..... 200
S. Weymouth (E8)...
S. Worthington (C3) 50
S. Yarmouth (O6)....1,185
Southampton □(C4)1,387
Southboro □(H3)....2,760
Southbridge □(G4)17,519
Southfield (B4)..... 100
Southville (H3)..... 300
Southwick □(C4).....2,855
Spencer □(F3).....7,027
Springfield ◉ (D4) 162,399
State Line (A3)..... 200
Sterling □(G3).....2,166
Still River (H3)..... 150
Stockbridge □(A3)..2,311
Stoneham □(C6)....13,229
Stoughton □(K4)....11,146
Stow □(H3).....1,700
Straits Pond (F7).... 250
Sturbridge □(F4).....2,805
Sudbury □(A6).....2,596
Sunderland □(D3)... 905
Sutton □(G4).....3,102
Swampscott □(E6).11,580
Swansea □(K5)..... 6121
Swansea Center(K5)
Taunton ◉(K5).....40,109
Teaticket (M6)..... 800
Templeton □(F2).....4,757
Tewksbury □(K2)...7,505
Thorndike (E4).....1,650
Three Rivers (E4)...2,359
Tolland □(B4)..... 107
Topsfield □(L2).....1,412
Townsend □(H2).....2,817
Townsend Harbor (G2) 197
Truro □(O5)..... 661
Tully (E2).....
Turners Falls (D2)...5,179
Tyngsboro □(J2).....2,059
Tyringham □(A4).... 235
Unionville (J4)..... 150
Upton □(H4).....2,656
Uxbridge □(H4).....7,007
Vineyard Haven (M7) 1,864
Waban (B7).....6,000
Wakefield □(C5)...19,633
Wales □(F4)..... 497
Walpole □(B8).....9,109
Waltham (B6).....47,187
Waquoit (M6)..... 400
Ward Hill (K2)..... 580
Ware □(E3).....7,517
Wareham □(L5).....7,569
Warren □(F4).....3,406
Warwick (E2)..... 429
Washington □(B3)... 281
Watertown □(C6).37,329
Waterville (F2)..... 450
Waverley (B6).....10,000
Wayland □(A7).....4,407
Webster □(G4).....13,194
Wellesley □(B7).....20,549
Wellesley Hills (B7).
Wellfleet □(O5).....1,123
Wendell □(E2)..... 342
Wendell Depot(E2).
Wenham □(L2).....1,644
W. Acton (H3).....1,300
W. Auburn (G4).....
W. Barnstable (N6). 750
W. Berlin (H3)..... 325
W. Boxford (K2)..... 400
W. Boylston □(G3)..2,570
W. Brewster (O5).....
W. Bridgewater □ (K4) 4,059
W. Brookfield □(F4)1,674
W. Chatham (O6).... 300
W. Chelmsford (J2). 300
W. Chesterfield (C3) 200
W. Concord (A6)....1,285
W. Cummington(B3) 180
W. Dennis (O6)..... 600
W. Dudley (F4)..... 200
W. Falmouth (M6).. 700
W. Granville (C4).... 200
W. Groton (H2).....
W. Hanover (L4).....1,200
W. Harwich (O6)..... 400
W. Hawley (C2)..... 56
W. Mansfield (K5)... 900
W. Medway (J4).....1,625
W. Millbury (G4)..... 300
W. Newbury □(L1).1,598
W. Newton (B7).....15,000
W. Peabody (D5).....1,100
W. Pittsfield (A3)....2,000
W. Rutland (F3).....
W. Springfield □ (D4) 20,438
W. Stockbridge □ (A3) 1,165
W. Tisbury □(M7)... 347
W. Townsend (H2).. 900
W. Upton (H4).....1,400
W. Wareham (L5)... 800
W. Warren (F4).....1,244
W. Yarmouth (N6)..1,355
Westboro □(H3).....7,378
Westfield (D4).....20,962
Westford □(J2).....4,262
Westford Station(J2) 300
Westhampton □(C3) 452
Westminster □(G2).2,768
Weston □(B6).....5,026
Westport □(K6).....4,989
Westport Point(K6) 500
Westwood □(B8).....5,837
Weymouth □(D8)..32,690
Whately □(D3)..... 939
Wheelwright (F3).... 270
Whitinsville (H4).....5,662
Whitman □(L4).....8,413
Wilbraham □(E4)....4,003
Wilkinsonville (G4).
Williamsburg □(C3)2,056
Williamstown □(B2)6,194
Williamstown Station (B2) 5,000
Willimansett (D4)....9,474
Wilmington □(C5)...7,039
Winchendon □(F2).6,585
Winchendon Springs (G2) 500
Winchester □(C6)..15,509
Windsor □(B2)..... 372
Winthrop □(D6)....19,496
Woburn (C8).....20,492
Woods Hole (M6).... 750
Woodville (H4)..... 350
Worcester ◉(H3).203,486
Woronoco (C4)..... 501
Worthington □(C3). 462
Wrentham □(J4).....5,341
Yarmouth □(O6)....3,297
Yarmouth Port(N6) 330

the water to the north is inhabited by entirely different ocean faunas. Whales are occasionally sighted off the coast or washed up on the beach. Fish caught in the lakes and rivers and along the coast include bass, rock bass, bluefish, butterfish, carp, catfish, cod, eel, flounder, haddock, hake, halibut, herring, mackerel, perch, pickerel, salmon, smelt, sturgeon, swordfish, and trout. The shellfish include clams, lobsters, oysters, scallops, and shrimp.

The deer population has increased in recent years and is now quite abundant. Cottontail rabbits and gray squirrels are plentiful. Muskrat, mink, skunk, raccoon, weasel, otter, bobcats, red fox, and gray fox are fur-bearing animals to be hunted.

A large variety of water, marsh, and shore birds find their homes along the seacoast and streams. The best known of the long-winged swimming birds are the gulls and terns. The ring-necked pheasant, ruffed and Whitlow grouse, and the heather hen are among the ground dwelling, scratching game birds to be found. Among the birds of prey are the eagle, turkey buzzard, and many members of the hawk and owl families. The perching birds include the lark, starling, bluejay, bobolink, cowbird, blackbird, meadowlark, oriole, rusty blackbird, grackle, and twenty varieties of sparrows.

Flora.—A wide variety of plants may be found. There are the marsh grasses, sedges, and rushes of the seacoast; the skunk cabbage, white hellebore, marsh marigolds, white and blue violets in the low marshy parts of the uplands; the Solomon's-seal, Canada mayflower, ferns, and trilliums as well as azalea, rhodora, mountain laurel, dogwood, and viburnum on the drier slopes of the uplands. The state is the northern limit for the holly and tupelo.

Minerals.—Although important mineral resources are not associated with Massachusetts and the deposits are predominantly nonmetallic, many of the metals, including gold, silver, copper, manganese, iron, nickle, tin, and leads, have been found. The nonmetallic minerals include alum, asbestos, barite clay, kaolin, fuller's earth, anthracite, lignite, and bituminous coal, corundum, emery, cyanite, feldspar, fluorspar, garnet, graphite, lime, spodumene, mica, ocher, sienna, peat, pyrite, building and paving sand, building gravel, silica, granite, limestone, marble, sandstone, trap-rock, talc, soapstone and several of the less rare gem stones such as the aquamarine cheastolite, jasper, rhodonite, spinel, and tourmaline.

Forests.—Originally almost all the land of the state except Cape Cod was covered with dense forests. The forest area now includes more than three million acres which is over 60 per cent of the total land area of the state. The natural forests can be classified as the pine-oak region on Cape Cop, Nantucket, and Martha's Vineyard, the central hardwood region in the eastern part of the state, the white pine-transitional hardwood region in the central area, the spruce in the northwestern area, and the northern hardwood in the far western part of the state. The largest forested areas are in the western area which has a scattering of pine and hemlock in addition to the deciduous forest of maples, birches, beeches, and oaks.

Soils.—Massachusetts has a large variety of soils among which can be found those suitable for all crops climatically adapted to the area. Of the five million acres of land in the state 210,000, or 4.1 per cent, are suitable for intensive agriculture; 1,580,000 acres, or 31.2 per cent, are suitable for extensive agricultural purposes; while the remaining 64.7 per cent is adaptable for nonagricultural uses and is mainly covered with forest growth.

Siliceous rocks particularly granites, gneisses, schists, and quartzites predominate in the parent rock material of Massachusetts soils, and largely account for their sandy texture. In the Berkshire region which constitutes the western end of the state, limestone formations have improved the quality of the soils.

Continental glaciation thousands of years ago rejuvenated and redistributed the pre-existent soil mantle, added freshly ground rock material, and softened a previously harsh landscape. In the period which has elapsed since the last invasion of an ice sheet, generous precipitation, aided by a cool climate, has caused Massachusetts soils to be leached of the soluble elements thereby producing podsolic soils. Three hundred years of exploitative farming have further depleted the soils in some places of plant nutrients, particularly lime, potash, and nitrogen.

Thus, with the exception of those strongly influenced by limestone and those formed on recent alluvial and lacustrine deposits, Massachusetts soils have only low to moderate native fertility. However, these soils respond quickly and readily to good management. The addition of lime, organic matter, and commercial fertilizer makes it possible to maintain a high level of fertility.

Waterpower.—One of the state's important resources is its natural system of over 4,000 miles of rivers and more than 1,100 lakes. All or parts of 19 river systems, excluding the coastal streams, provide ample water supplies for domestic, recreational, and industrial purposes. The largest of the lakes, Quabbin Reservoir, 24,704 acres, and Wachusett Reservoir, 4,160 acres, are man-made and provide metropolitan Boston with an excellent supply of water.

Plentiful water resources have played an important part in the successful industrial development of the state throughout its entire history. During its earlier years small factories and mills were located along the streams in order to harness the waterpower directly for driving the machines. These streams also provide an abundance of soft water for processing purposes. While much of the state's industry still tends to locate on or near streams especially those requiring water for nonpower purposes, the machines are no longer driven directly by waterpower, but by electricity, much of which is generated in turn by waterpower.

With the coming of the electrical era most of the state's waterpower facilities have been converted to generate hydroelectric power. Most of the hydroelectric plants, representing a capacity of over 400,000 horsepower, are located on the Connecticut River and its tributaries in the western half of the state. It is estimated (1948) that the potential undeveloped waterpower is slightly over 100,000 horsepower.

Parks, Preserves, Reservations, and Other Points of Interest.—The state has acquired through public and semipublic agencies more than 266,000 acres of land which is devoted to outdoor recreation. Of this amount almost 80 per cent is controlled by state agencies while municipal park and forest lands comprise about 19 per cent.

There are 184 recreational areas owned and administered by the state. Divisional administration within departments makes a total of 16 administrative units in control of these recreational areas. The department of conservation, through four of its five divisions, administers 106 of these areas and is therefore obviously the major agency from the standpoint of administration.

The state possesses four state parks: the John C. Robinson, Joseph Skinner, and Lindon-Bates parks in western Massachusetts, and the Roland C. Nickerson State Park on Cape Cod. These comprise approximately 3,388 acres and are maintained by the division of parks and recreation. The division also has authority over Salisbury Beach with four miles of unexcelled beach at the extreme northeasterly end of the state, and Standish Monument in Plymouth which has an observation tower and excellent picnic grove.

Of approximately 172,000 acres of state forests, almost 103,000 acres are included in the 28 forests where provision has been made for outdoor recreation. A majority of this area is in the western part of the state. The division of forestry has charge of 47 state forests which are devoted to scientific forest practice and wildlife management.

The division of wildlife research and management administers 13 wildlife sanctuaries comprising 3,671 acres. In addition 15,577 acres in 18 state forests have been set aside as wildlife refuges.

The division of fisheries and game administers four game farms of 364 acres and six fish hatcheries and two breeding pond systems of 853 acres. These areas are devoted to the scientific propagation of various types of small game and fish for stocking purposes and experimentation. The division also has leased 75 miles of public fishing waters in southern, central, and western Massachusetts. These waters are stocked and offer fine fishing.

There are eight state reservations of 13,546 acres which are developed for recreational purposes. Four of these areas are administered by special unpaid commissioners appointed by the governor while the other four are under the jurisdiction of the commissioners of the county or counties in which they are located.

The state is rich in places of historical interest and merit. The Pilgrim and Puritan settlements of the 17th century, the scenes of memorable occasions of the Revolutionary period, and the literary achievements of such men as Emerson, Thoreau, and Hawthorne during the 19th century are great contributions to the history of our country. Among places of historical interest are the monument at Provincetown which marks the first landing of the Pilgrims; Plymouth Rock at Plymouth; the Myles Standish Monument at South Duxbury; Bunker Hill Monument in Charlestown; the Salem Maritime National Historic Site in Salem; the Old State House, the Old South Meeting House, the Old North Church, and Faneuil Hall in Boston; and the battlegrounds of Lexington and Concord. The historic town of Deerfield and the restored Fort Massachusetts at North Adams have significance in the history of the French and Indian Wars. The homestead of William Cullen Bryant in Cummington is now maintained by the state.

Production and Manufactures.—*Agriculture.*—While Massachusetts is the third most densely populated state in the Union with more than 550 inhabitants per square mile, over 90 per cent of the people are crowded into thickly settled areas which constitute only 5 per cent of the space. Thus, 95 per cent of the state is open rural countryside where the remaining 10 per cent live comfortably at an average of only 50 people per square mile.

Approximately 70 per cent of the 100,000 families living in the rural areas, reside there for residential purposes only. They depend entirely on nonagricultural income, except for small subsistence enterprises such as backyard gardens and flocks. Another 10 per cent, or 10,000 rural families, are part-time farmers who depend partly on farming for their income and partly on nonagricultural employment or income. The remaining 20 per cent of the families (about 20,000) living in the rural areas are commercial farmers who are entirely dependent on farm income.

The latter two groups above make up approximately 30,000 farms which the United States Bureau of the Census has reported since 1920. Although there has been little change in the actual number of people living in the rural areas during the past 150 years, recent developments, including the automobile and improved roads, indicate that there is a trend toward increased numbers living in the rural areas and commuting to their work.

At the same time the number of commercial farms are growing less as the average size of each farm is increasing. This reflects the need for larger units in order to operate efficiently the expensive equipment which is required for mechanized farming.

Approximately 40 per cent of the land is in farms. The state ranks as one of the lowest in farm tenancy with almost 95 per cent of the farms operated by their owners.

The agricultural industry, with an output valued at almost 200 million dollars (192.5 million in 1946), ranks fourth among the industries of the state, being exceeded only by textiles, boots and shoes, and electrical machinery. Agricultural output during and since World War II is at the highest level in the history of the state.

The principal farm products in the order of their importance are poultry and poultry products, dairy products, vegetables, fruits (principally apples and cranberries), potatoes, cigar tobacco, and horticultural specialties such as greenhouse and nursery products.

The major portion of land in farms is used for producing roughages for dairy cattle, such as corn silage, hay, and pasture. The improvement of land, including drainage and stone and brush removal with power machines, and modern practices, including new plant varieties, fertilization, and mechanization, have increased the production of feed nutrients in the form of roughage which in turn replaces part of the grain imports from the Western states. These modern techniques are not only revitalizing the state's livestock industry, but vegetable, fruit, and cash crop production as well.

Fisheries.—Seafood landings for Boston, Gloucester, New Bedford, and Cape Cod during 1947 totaled more than 480 million pounds at a value of $35,715,071. These figures do not include shellfish. Boston is the chief port of entry supplying almost one third of the fresh and frozen fish consumed in the United States.

Forest Products.—Massachusetts forests produce about 135 million board feet per year, or about 10 per cent of the total consumption. Forest trees most used for commercial purposes are the

white pine for builders' finish, boxes, crates, toys, novelties, and patterns; hemlock for dimension stock and planks; red spruce for general lumber uses, such as planks and boards; red oak and white oak for timbers, shipping lumber, shipbuilding, and machine construction; hard maple for the manufacturing of furniture, heels, and turning; white birch for turning stock and furniture; ash for truck bodies, sporting goods, and machine construction; and red maple and other woods for fuel.

Mineral Production.—Practically the entire mineral production of the state is nonmetallic and includes building stones, crushed stone, lime, sand, gravel, and clay. Granite is plentiful and is found in 11 of the 14 counties but the most important quarrying centers are Quincy, Rockport, Westford, and Milford. Some marble is produced in Berkshire County.

Manufactures.—Although commerce, finance, education, recreation, and agriculture occupy important places in the state's economy, the manufacture of industrial products is its basic activity. There was little manufacturing in the state before the American Revolution. Although there was no local advantage due to the possession of raw materials, waterpower did encourage industrial development beginning in the early part of the 19th century. The climate of the southeastern part of the state was favorable to cotton spinning. Massachusetts has always been a leader in the textile industry. The first cotton mill was established at Beverly in 1788 and the first woolen mill at Byfield in 1794. The first power loom was set up in 1814 at Waltham. With the improvement in machinery and the development of waterpower, great centers such as Lowell, Lawrence, and Fall River arose in the 1830's. The development of these cities is in effect the story of the textile factory system. The boot and shoe industry is interwoven with the story of the growth of Lynn, Haverhill, Brockton, and many smaller municipalities. The first printing done in the American colonies was at Cambridge in 1639. From this small beginning the printing and publishing business has become an important industry in the state.

Following World War I much of the cotton textile industry was transferred to the South. For a time business pessimism prevailed. However, this was replaced with a spirit of aggressive management during the latter part of the 1930's and as a result a great diversification of industry has developed.

The two principal groups of industries are still (1949) textiles and shoes. Other important manufactured products are electrical machinery, foundry and machine shop products, machine tools, paper and paper products, rubber goods, textile machinery, furniture, bakery and confectionery products, chemicals, plastics, etc.

Transportation and Communications.—The state, extending midway across southern New England from east to west, occupies a strategic position in the paths of transportation and communications in the northeastern United States. Boston is the nearest large United States metropolitan center to western Europe. It is directly on the line of air traffic between the United States and Europe. Actually it is 1,200 miles nearer the Panama Canal than San Francisco and it is nearer to the ports of Argentina and Brazil than southern United States ports bordering the Gulf of Mexico.

The metropolitan area of Boston is connected with the West by two railway systems which cross the state from east to west. These lead either directly or by branches, by way of the Buffalo gateway, to all of the industrial centers of the North Central states. One system extends from Boston to the north and east, serving all of northern New England. The other general system serving Massachusetts reaches into the South by way of New York. A network of branch lines connects the factory centers of the state with each other, with the seaboard, and with the railway systems leading north, south, and west.

In 1948, the state was served by 1,746 miles of steam railway mileage. Of this 652 miles were main lines. This mileage is only about 400 miles less than the peak which was reached before the development of the state's modern system of roads and highways, which now play the usual important role in fulfilling modern transportation requirements.

With the automobile, truck, and buses the demand for good roads resulted in the construction of a vast network of all-weather, year-round, improved highways. In 1948, all of the state's 23,644 miles of roads and highways were surfaced except 1,285 miles. In 1948 the state was served by 78 airports and 18 seaplane bases. Of these, six were military airports. These serve not only local but international air traffic for both civilian and military needs. Massachusetts is well provided with telephone and telegraph service.

Economic and Financial Factors.—*Banking.*—On Dec. 31, 1948, the 258 state banks in Massachusetts had combined assets of $4,895,594,000 and deposits totaling $4,378,888,000. As of the same date there were 120 national banks with total assets of $3,095,090,000 and total deposits of $2,791,927,000.

The banks under the supervision of the state commissioner of banks include, in addition to the state commercial, mutual savings, and private banks reported on above, trust companies, cooperative savings and loan associations, and credit unions. Massachusetts ranks high in both the amount of savings deposits per capita and the number of depositors. A state law provides for a savings bank life insurance system which operates through the savings banks.

Finances.—Following is a statement of Massachusetts finance for the fiscal year 1947–1948.

Balance in treasury, beginning of fiscal year 1947–48	$ 46,167,900
Gross receipts, all sources, 1947–48	571,015,481
Total	$617,183,381
Gross disbursements, 1947–48	573,646,645
Balance, beginning of fiscal year 1948–49	$ 43,536,736

On July 1, 1948, the net direct debt of the state totaled $116,586,008.

Taxation.—The state has an income tax, and a poll tax amounting to $2 per male person over 20 years of age; there is no sales tax.

Government.—*Executive.*—The Massachusetts constitution adopted in 1780 remains the basis of government and is the oldest among state constitutions still in force. Conventions for revision of the constitution were held in 1820, 1853, and 1917–1919, upwards of 70 articles of amendment having been adopted. The executive branch of the government is headed by a governor, elected annually until 1920, and since then biennially. Other state administrative officials, elected for a

two-year term, include the lieutenant governor, members of the executive council, secretary of the commonwealth, treasurer and receiver general, auditor, and attorney general. The council, consisting of the lieutenant governor and eight councilors elected by districts, advises the governor

GOVERNORS OF MASSACHUSETTS

Governors of Plymouth Colony

Chosen annually by the people

John Carver	1620–1621	William Bradford	1639–164
William Bradford	1621–1633	Edward Winslow	1644–164
Edward Winslow	1633–1634	William Bradford	1645–165
Thomas Prence	1634–1635	Thomas Prence	1657–167
William Bradford	1635–1636	Josiah Winslow	1673–168
Edward Winslow	1636–1637	Thomas Hinckley[1]	1680–168
William Bradford	1637–1638	" "	1689–169
Thomas Prence	1638–1639		

Governors of Massachusetts Bay Colony

Chosen annually under the first charter

Matthew Cradock	1629	Thomas Dudley	1645–164
John Endecott[2]	1629	John Winthrop	1646–164
John Winthrop	1629–1634	John Endecott	1649–165
Thomas Dudley	1634–1635	Thomas Dudley	1650–165
John Haynes	1635–1636	John Endecott	1651–165
Henry Vane	1636–1637	Richard Bellingham	1654–165
John Winthrop	1637–1640	John Endecott	1655–166
Thomas Dudley	1640–1641	Richard Bellingham	1665–167
Richard Bellingham	1641–1642	John Leverett	1672–167
John Winthrop	1642–1644	Simon Bradstreet	1679–168
John Endecott	1644–1645		

The Inter-Charter Period

Joseph Dudley became president of New England under royal commission on May 17, 1686, holding the office until December 19, the same year, when Sir Edmund Andros became governor of New England, appointed by King James II. On April 18, 1689, Governor Andros was deposed by a revolution of the people. After the dissolution of the first charter, Simon Bradstreet was governor from June 7, 1689 to May 16, 1692.

Governors of the Province of Massachusetts Bay

Appointed by the king under the second charter

Sir William Phips	1692–1694	*William Tailer*	173
William Stoughton[3]	1694–1699	Jonathan Belcher	1730–174
Richard Coote	1699–1700	William Shirley	1741–174
William Stoughton	1700–1701	*Spencer Phips*	1749–175
The Council	1701–1702	William Shirley	1753–175
Joseph Dudley	1702–1715	*Spencer Phips*	1756–175
The Council	1715	The Council	175
Joseph Dudley	1715	Thomas Pownall	1757–176
William Tailer	1715–1716	*Thomas Hutchinson*	176
Samuel Shute	1716–1723	Francis Bernard	1760–176
William Dummer	1723–1728	*Thomas Hutchinson*	1769–177
William Burnet	1728–1729	Thomas Hutchinson	1771–177
William Dummer	1729–1730	Thomas Gage	1774–177

Until the Constitution

A provincial congress	1774–1775	The Council	1775–178

Under the Constitution

Governors elected annually until 1920, since then biennially

John Hancock		1780–1785	*Thomas Talbot*	Republican	1874–187
James Bowdoin		1785–1787	William Gaston	Democrat	1875–187
John Hancock		1787–1793	Alex. H. Rice	Republican	1876–187
Samuel Adams		1793–1797	Thomas Talbot	"	1879–188
Increase Sumner	Federalist	1797–1799	John D. Long	"	1880–188
Moses Gill	"	1799–1800	Benjamin F. Butler	Dem., Independent	1883–188
Caleb Strong	"	1800–1807	George D. Robinson	Republican	1884–188
James Sullivan	Democrat-Republican	1807–1808	Oliver Ames	"	1887–189
Levi Lincoln	" "	1808–1809	John Q. A. Brackett	"	1890–189
Christopher Gore	Federalist	1809–1810	William E. Russell	Democrat	1891–189
Elbridge Gerry	Democrat-Republican	1810–1812	Frederic T. Greenhalge	Republican	1894–189
Caleb Strong	Federalist	1812–1816	Roger Wolcott	"	1896–190
John Brooks	"	1816–1823	W. Murray Crane	"	1900–190
William Eustis	Democrat-Republican	1823–1825	John L. Bates	"	1903–190
Marcus Morton	" "	1825	William L. Douglas	Democrat	1905–190
Levi Lincoln, Jr.	Democrat-Federalist	1825–1834	Curtis Guild, Jr.	Republican	1906–190
John Davis	Whig	1834–1835	Eben S. Draper	"	1909–191
Samuel T. Armstrong.	"	1835–1836	Eugene N. Foss	Progressive-Dem.	1911–191
Edward Everett	"	1836–1840	David I. Walsh	Democrat	1914–191
Marcus Morton	Democrat	1840–1841	Samuel W. McCall	Republican	1916–191
John Davis	Whig	1841–1843	Calvin Coolidge	"	1919–192
Marcus Morton	Democrat	1843–1844	Channing H. Cox	"	1920–192
George N. Briggs	Whig	1844–1851	Alvan T. Fuller	"	1925–192
George S. Boutwell	Democrat, Free Soil	1851–1853	Frank G. Allen	"	1929–193
John H. Clifford	Whig	1853–1854	Joseph B. Ely	Democrat	1931–193
Emory Washburn	"	1854–1855	James M. Curley	"	1935–193
Henry J. Gardner	American	1855–1858	Charles F. Hurley	"	1937–193
Nathaniel P. Banks	Republican	1858–1861	Leverett Saltonstall	Republican	1939–194
John A. Andrew	"	1861–1866	Maurice J. Tobin	Democrat	1945–194
Alex. H. Bullock	"	1866–1869	Robert F. Bradford	Republican	1947–194
William Claflin	"	1869–1872	Paul A. Dever	Democrat	1949–195
William B. Washburn	"	1872–1874	Christian A. Herter	Republican	1953–

[1] Mr. Hinckley was governor till the union of the colonies in 1692, except during the administration of Andros.

[2] While Cradock was governor of the Company in England, John Endecott was sent out as governor of the Plantation in Massachusetts Bay, serving under Cradock and under Winthrop until the latter arrived at Salem and assumed control.

[3] Those whose names are printed in italics were acting governors.

MASSACHUSETTS: ... looks seaward while boulder-strewn moorlands make up the background. Rockport still quarries some granite, but lives on its fishing and tourist trades.

Kodachrome by Jack Breed

N.G.S.

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Harvard University, Cambridge, Massachusetts. The Charles River separates Cambridge and Boston.

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Wellesley College, Wellesley, Massachusetts

Courtesy New York Central System

The Massachusetts State House on Boston Common.

Courtesy Massachusetts Development and Industrial Commission

The Christian Science Church (The Mother Church) at Boston.

Rich agricultural land on the Connecticut River near South Deerfield

Courtesy The New York, New Haven and Hartford Railroa

The little fishing village of Menemsha on Martha's Vineyard.

and acts as a check on his control of finance and appointments. The governor makes recommendations to the legislature, and may call special sessions; he may veto acts of the legislature, including the disallowance or reduction of items in appropriation bills, but the legislature may override the veto by a two-thirds vote of both branches. He is commander in chief of the military and naval forces of the state.

By a constitutional amendment of 1918 it was provided that all state administrative agencies, except those serving directly under the governor and council, should be organized into not more than twenty departments. Four of these are headed by elective officers: the auditor, treasurer and receiver general, the attorney general, and the secretary of state. The legislature created sixteen other departments with heads appointed by the governor and council, as follows: agriculture; banking and insurance; civil service and registration; conservation; corporations and taxation; correction; education; industrial accidents; labor and industries; mental diseases; metropolitan district commission; public health; public safety; public utilities; public welfare; and public works. As regards the recruitment of state employees, there is a division of personnel which classifies positions paid from state funds and standardizes salaries, and a civil service department which administers the examining and certifying of qualified persons. Most state employees are under civil service regulations. Administrative efficiency is aided by the commission on administration and finance. This includes a budget bureau which draws up from departmental estimates an executive budget which the governor presents to the legislature.

Legislature.—The legislature—called the General Court—consists of two houses, a Senate of 40 members and a House of Representatives of 240, both elected for a two-year term and representing in each case single member districts apportioned according to legal voters. The powers of the two chambers are similar and each chooses its own officers. The legislature meets in annual sessions, beginning on the first Wednesday in January, and there is no prescribed limit for their duration. Massachusetts was a pioneer among state legislatures in the establishment of joint standing committees, composed of members from both houses, a system adopted to save time and prevent duplication of legislative work. Measures intended to provide for direct democratic action in lawmaking were the popular initiative and the referendum, adopted in 1924. Under the former, a petition for legislation signed by 20,000 qualified voters must be voted on, pro or con, by the legislature before its adjournment, and if not passed as a law may under certain regulations be submitted to the people by ballot at the next election. Likewise the referendum permits a law passed by the legislature to be suspended and submitted to the voters at the next election. The state has been a leader in furthering interstate action among the New England states. In 1937 the General Court established a commission on interstate cooperation, which serves as a regional clearing office for the area in dealing with interstate problems.

Courts.—The Massachusetts court system is highly regarded by students of the American judiciary. At the bottom are 73 district and municipal courts, which have both civil and criminal jurisdiction. In ten cities and towns justices of the peace have jurisdiction over minor offenses. Special tribunals include courts of probate and insolvency in each county, juvenile sessions of the district courts, and a land court. The superior court, comprising a chief justice and 31 associate justices, is a court of original jurisdiction, both civil and criminal, and is the court to which most of the jury cases go. The supreme judicial court, composed of a chief justice and six associates, heads the judicial system and is almost exclusively a court of appeal. Judges throughout the state are appointed by the governor and council, with tenure during good behavior. Massachusetts has adopted various devices to shorten court procedure or prevent litigation. These include: the use in hearings of auditors and masters whose findings are prima facie evidence; arbitrators to whom, by agreement of the parties, controversies are referred; pretrial hearings in the superior court, at which judge and lawyers discuss the cases; and the rendering by the supreme judicial court of advisory opinions to the legislature, and to the governor and council. A significant feature, inaugurated by Massachusetts, is the judicial council, composed of justices and leading attorneys with authority to investigate judicial practices and to suggest reforms.

Public Health and Welfare.—Massachusetts has a vast program of legislation and many state agencies for the promotion of public welfare and social betterment. A department of public health carries on multitudinous activities, which include measures for control of communicable diseases, investigation and advice to communities concerning water supply and sewage, inspection of places which process or distribute food products, laboratories for research, testing, and production of antitoxins and vaccines, a program for cancer control, and an extensive program of child hygiene and health education. State sanatoriums are located at Lakeville, North Reading, Rutland, Westfield, and a state hospital at Pondville for cancer patients.

A department of public welfare has supervision over public relief, old age assistance, dependent and delinquent children, and private charitable corporations. Institutions under the department are the state hospital and infirmary at Tewksbury, the hospital school for crippled children at Canton, the Lyman School for boys under the age of 15 at Westborough, the industrial school for boys over 15 at Shirley, and the industrial school for girls at Lancaster.

A department of mental health has general supervision over all public and private institutions for persons with mental disorders, epileptics, and drug addicts. State hospitals for mental disorders are the Boston Psychopathic Hospital, the Metropolitan State Hospital at Waltham, and state hospitals at Boston, Bridgewater, Danvers, Foxborough, Gardner, Grafton, Medfield, Monson (for epileptics), Norfolk, Northampton, Taunton, Tewksbury, Westborough, Worcester, and the hospital cottages for children at Baldwinsville. State schools for mental defectives are located at Belchertown, Wrentham, and the Walter E. Fernald State School at Waltham.

The department of correction administers the state prison at Charlestown, a prison colony at Norfolk, the Massachusetts Reformatory at Concord, the reformatory for women at Framingham, and the state farm at Bridgewater.

Social Legislation.—Massachusetts was one of the early states to pass laws for the improvement

of industrial working conditions. The department of labor and industries acts to enforce laws and promote improvements having to do with safety and health conditions in places of employment. The department of industrial accidents administers the workmen's compensation law. A minimum wage commission established in 1912 with limited powers, was given authority in 1937 over minimum wages for women and children. In conformity with provisions for federal assistance, an unemployment compensation act was passed in 1937, providing for weekly benefit payments to the unemployed.

Suffrage and Elections.—Until 1691 the right to vote was based on church membership; the constitution of 1780 established a property qualification which was changed to tax payment in 1820, the latter being abolished in 1891. At present all persons may vote who are citizens 21 years of age, literate, have resided for one year in the state and six months in the community, and who are not excluded as persons avoidably on relief, or as being under guardianship. Party candidates for state and federal office are nominated at state primaries held in September of election years. The state was the first to adopt the so-called Massachusetts type of ballot on which the names of candidates are arranged by offices rather than by party columns.

Local Government.—As regards local government, the state allows only limited home rule to local units, and controls them through general and special laws. The county is a relatively unimportant unit of administration, principally for judicial purposes, and has no authority to tax. Much more important is the system of town government which developed in Massachusetts and extends throughout New England. It has made a notable contribution to the history of democratic government. The town is an area which includes one main and often minor centers of population, along with the surrounding countryside. Although unincorporated, the towns exercise wide powers within limits specified by state law. The principal agency of government is the town meeting, held annually or oftener. At the traditional "open" town meeting all citizens are free to take part in the discussion and to vote on town matters. There are many elected officials, chief of which are the selectmen, who act as agents in carrying out the decisions of the town meeting. Since 1916 towns with 6,000 population have been free to apply for the limited type of town meeting, to which representatives are elected; all voters may attend and speak, but only the representatives vote. A few towns operate under the town manager plan.

Until 1915 cities were chartered by special acts of the legislature, Boston being the first city incorporated (1822). In 1915 an optional charter system was introduced under which towns with 12,000 or more population may adopt one of five different plans of city government. Several cities have taken advantage of the optional charter plan, but many populous centers continue as towns. Municipal power to tax and borrow is limited and the legislature may amend charters and annul city ordinances.

In 1919 the state established the metropolitan district commission, which has authority over sewerage, parks, and water supply of many cities and towns under its jurisdiction. It carries out projects authorized by the General Court, notable among them being the Quabbin Reservoir in western Massachusetts, which supplies water t metropolitan communities. A division of metro politan planning functions under the commissio as an advisory authority.

Education.—Massachusetts was a pioneer i the development of public education in America In numerous respects precedents were establishe which were widely followed elsewhere. The prin ciple of tax-supported, state-controlled educatio began with the famous law of 1647 in the Ba Colony. This act stated that it was a principa aim of the "ould deluder, Satan, to keepe me from the knowledge of the Scriptures," and wen on to provide that every town of 50 familie should appoint someone to teach reading and writ ing, and that towns of 100 families should set u grammar schools capable of fitting youth for col lege.

The first public high school in the country which trained youth for business and industria pursuits as distinct from the old Latin gramma schools, was established at Boston in 1821. Fiv years later a high school for girls was starte there. In 1827 the General Court of Massachu setts passed the first American law requiring the establishment of high schools. It applied to towns of 500 families, but was widely evaded. In 185 Massachusetts enacted the first compulsory edu cation law in the United States, requiring the attendance of children 8 to 14 years of age fo 12 weeks a year.

In spite of these pioneering advances, educa tion in the early commonwealth was at a low ebb with widespread public apathy, wretchedly trained teachers, and poor methods. About one third o the children were without any educational oppor tunities whatsoever. Under the leadership o Horace Mann a revival began about 1837 with the establishment of a state board of education. As first secretary of the board, Mann wrote an nual reports which became classics as a discussion of school problems, and they led to improvements throughout the nation. It was due to his efforts that the first normal school in the country for the training of teachers was opened at Lexington in 1839.

The present educational system in the state operates under general laws enacted in 1920, with some later amendments. The state department of education is headed by a commissioner, who is served by an advisory board of education of six members, all appointed by the governor and council. The commissioner and board of education have coordinating and advisory function, and supervise all educational work supported by the state, but they have little direct control over local schools. The principle of local control of the schools has always been the rule, exercised in the towns and cities by elected school committees which have general charge of all public schools. Every town is required by law to maintain a sufficient number of schools for children of school age. Towns of 500 families, unless granted exception, must maintain a high school, kept open 180 days in each year, and lesser towns must pay for tuition of their children in the high school of a neighboring town. State financial aid is granted in certain cases. By law, attendance at a public school, or other school approved by the local school committee, is compulsory for children between the ages of 7 and 14, and for children between 14 and 16 unless they are granted employment certificates by the local school superintendent. under conditions which are carefully re-

stricted. A considerable number of children in the state attend parochial or other private schools.

The state grants extensive aid to vocational education. Under the supervision of the department of education are the three textile schools at Fall River, Lowell, and New Bedford, the agricultural schools of Bristol, Essex, and Norfolk counties, and the Massachusetts Maritime Academy at Hyannis. Financial aid for industrial training is given to cities and towns which maintain industrial schools, departments, and courses. In the department of education there is a division of the blind and a division of immigration and Americanization.

In the field of higher education, the state maintains the University of Massachusetts, located at Amherst. The state agricultural experiment station is located there. Apart from the university are the state teachers colleges, located at Bridgewater, Fitchburg, Framingham, Lowell, North Adams, Salem, Westfield, and Worcester, and the Massachusetts School of Art at Boston.

The state is outstanding for the number of private colleges and universities of high standing located there. Among them are the following: Harvard University (1636) at Cambridge, Williams College (1793) at Williamstown, Amherst College (1821) at Amherst, the College of the Holy Cross (1843) at Worcester, Tufts College (1852) at Medford, Boston College (1863) at Newton, Boston University (1869) at Boston, and Clark University (1887) at Worcester. Among the colleges for women only are Mount Holyoke College (1836) at South Hadley, Wellesley College (1870) at Wellesley, Smith College (1871) at Northampton, Radcliffe College (1879), affiliated with Harvard, Simmons College (1899) at Boston. Among institutions for technical training are the Massachusetts Institute of Technology (1861) at Cambridge, and Worcester Polytechnic Institute (1865).

Libraries.—Considering the number of notable libraries in the state, and the availability of library services to the public, probably no state is better served in this respect than Massachusetts. With the object of assisting library services generally, there is a division of public libraries in the department of education. There is no town in the state without its free public library. The Boston Public Library, housed in a building noteworthy for its architecture, was the first city public library supported wholly by taxation. It is one of the great scholarly libraries in the country and has set an example in making its collections freely available to the public. The libraries at Harvard University constitute one of the principal collections in the country. Other outstanding libraries include: the Boston Athenaeum, containing the books owned by George Washington; the state library, which has a collection of the laws of foreign countries and of legislative records; the Massachusetts Historical Society Library; the New England Historic Genealogical Society Library (family records); the Essex Institute Library at Salem (marine); and the American Antiquarian Society Library at Worcester, notable for its collection of bound newspapers. The Boston Museum of Natural History and the Museum of Fine Arts (specializing in Oriental collections) are outstanding in their respective fields.

History.—It is common knowledge that the first permanent settlement in Massachusetts was made in 1620 by the Pilgrims. But there had been for many years previous an active interest in the region due to its possibilities for fishing, trading with the Indians, and the acquisition of land. In 1602, Bartholomew Gosnold, an English navigator, skirted the coast of Massachusetts, gave Cape Cod its name, and settled briefly on Cuttyhunk Island. Captain John Smith explored the coast in 1614 and soon published his *Description of New England,* a glowing account of the region and its prospects. Active interest continued and, in 1620, the Council for New England was organized, with a royal charter granting title to all land between the 40th and 48th parallels. From this title came, directly or indirectly, the land grants of five colonies. Thus, regardless of the Pilgrims, settlement would have occurred soon.

The origin of the Pilgrim settlement goes back to a small group of folk in England, called Separatists because they worshipped in defiance of the established Anglican Church. They were molested by neighbors, and under their leaders, William Brewster, John Robinson (their pastor), and William Bradford, they left England, 1607–1609, and settled at Leyden in Holland. Here they lived peaceably for some years, working as laborers. But life there was hard, and fearful that their children would be assimilated by the Dutch, a part of the congregation decided to migrate to America. Permission was obtained from the Virginia Company of London (London Company) to settle in their territory, and capital to finance the undertaking was obtained from a group of London promoters. This small band left Holland for England and on Sept. 6/16, 1620, the memorable voyage began from Plymouth on the *Mayflower.* Aside from the crews, there were 102 persons on the vessel, of whom 35 were from Leyden and 67 from England, the latter not being Separatists but persons sent over by the London promoters to work.

The plan had been to settle south of the Hudson River, but, due to stress of weather, anchor was finally dropped in Provincetown Harbor, Nov. 11/21, 1620. Since this was outside the bounds of the Virginia Company, they were without charter of government or title to land. To meet this situation, the male settlers signed the "Mayflower Compact," by which they agreed to be governed by the will of the majority until more permanent provision could be made. This first American example of pure democracy was patterned after the church covenant under which all authority was vested in the assembly of church members. During the terrible first winter about half the population died, but new settlers came, including nearly all of the Leyden congregation. By 1640 there were eight towns with 2,500 population in the Plymouth Colony. The Pilgrims were simple country folk and artisans from the middle and lower classes in England, with little or no education, and without social or political distinction. In this respect they formed a contrast to their more wealthy and aristocratic neighbors of Massachusetts Bay Colony, into which they were absorbed in 1691.

During the decade after 1620 a number of small communities were established around Massachusetts Bay. In 1622 a group of businessmen of Dorchester, England, decided to establish a permanent fishing settlement in New England, to avoid the time wasted by fishermen in annual ocean crossings. In 1623 settlement was made at the present site of Gloucester on Cape Ann. The

attempt failed, but Roger Conant led a group which moved to Salem in 1626 and this became the second permanent settlement in Massachusetts. In 1628 a new company, backed by many influential Puritan gentry and merchants, obtained a grant of land from the Council for New England. Charles I in 1629 granted a royal charter incorporating this group as the Massachusetts Bay Company. From this stemmed the main settlement of Massachusetts.

This was a period of growing discontent in England. The conflict between crown and Parliament, which later led to the civil war, was growing more acute. There was a rapidly increasing number of Puritans, numerous in the towns and among the gentry, who disliked the High Church policies and repression of Archbishop William Laud. In these circumstances a group within the Massachusetts Bay Company, including John Winthrop, Thomas Dudley, and Sir Richard Saltonstall, proposed to leave England and create a Puritan refuge in America. Since the royal charter contained no clause binding the company to maintain headquarters in England —whether such a clause was omitted by accident or design is not known—it was decided to turn the charter and government of the company over to settlers who would move to New England. This move would be a protection against control of the company by groups hostile to the Puritans in England, as well as against interference by the crown. In 1630 a well-equipped fleet of vessels, carrying some 900 passengers, with Winthrop as governor, crossed the ocean and founded Boston and several towns nearby. The decade which followed witnessed a great wave of migration to America, some 15,000 going to Massachusetts and even more to the West Indies. Although the desire for religious freedom was an influential cause, this has been overstressed, and it is probable that desire for economic betterment, including land hunger, was an even more important factor.

The transfer of the company charter to America had an important bearing on the future government of the colony and its relations with England. What had been the charter of a trading corporation became the instrument for governing a colony. It was assumed in the colony that neither king nor Parliament had anything to say about the colony's affairs, and, in fact, for half a century this was almost the case. Within the colony, control was tightly vested in the hands of a narrow theocracy. Winthrop and his associates, intent on building a religious commonwealth, did not believe in democracy and felt that power must be retained in their hands. At first the General Court was composed of shareholders, called freemen, who made up less than one per cent of the inhabitants. In 1631 it was decreed that only members of an approved Puritan church might become freemen. A representative plan was soon adopted under which the freemen of each town chose deputies to the General Court. Eventually the court split into two houses.

The clergy exerted great political influence. In its early years the colony was rent by controversies and by persecution of those who challenged the prevailing orthodoxy, such as Roger Williams and Mrs. Anne Hutchinson. The Reverend Thomas Hooker left in 1636 to found Connecticut. It was not until the 18th century that more liberal views prevailed. In the years after 1688 occurred the famous witchcraft delusion, centering in Salem where 20 persons were put to death.

Constant complaints reached England of the arbitrary rule of Massachusetts authorities, of their assumption of sovereign powers, and of their failure to obey imperial laws. After the Restoration in 1660, Charles II tried to assert a greater degree of royal control. Royal commissioners sent out to investigate, met with the utmost in tactics of delay and obstruction. Finally, in 1684 Charles revoked the Massachusetts charter. This was followed by the brief experiment in colonial absolutism known as the Dominion of New England. Sir Edmund Andros was sent out as governor with autocratic powers over all of New England, as well as New York and New Jersey. This aroused the most intense opposition in Massachusetts. When news reached Boston in 1689 of the "Glorious Revolution" in England, which brought William and Mary to the throne, the Bostonians had their own revolution, clapping Andros and his advisers into jail. In 1691, Massachusetts received a new charter which brought her government more into line with that of other colonies. Henceforth, there was a governor appointed by the king, with power of veto over acts of the legislature; the charter forbade religious tests for voting; and Maine and Plymouth Colony were joined to Massachusetts.

During the 17th and early 18th centuries the settlers of Massachusetts suffered severely from Indian attacks. In 1637 the Pequot War occurred and in the years 1675–1678, the much more severe King Philip's War, in which the forces of that chieftain were crushed. The whites suffered severe losses and frontier settlement was retarded for a generation. In the subsequent wars against the French and Indians many frontier towns were ravaged. Massachusetts played a prominent role in the wars of colonial rivalry with France, 1689–1763. Under Sir William Pepperell, Massachusetts troops took the chief part in the capture of Louisburg in 1745, and they figured in various campaigns during the crucial struggle of the Seven Years' War, 1756–1763.

After the British and colonial victory over France, issues were raised which soon led to revolution in the empire. It was the British view that the colonists should pay a larger share of their cost of administration and defense. Massachusetts enjoyed prosperity from her shipbuilding industry, her trade to the West Indies, and from slave-trading expeditions to Africa. British trade regulations had been laxly enforced, and extensive smuggling had developed. British measures after 1761 to eliminate smuggling and increase colonial revenue met opposition from the mercantile classes of Massachusetts, and from leaders such as James Otis, Samuel Adams, John Adams, and John Hancock. The Massachusetts House in 1765 took the lead in calling an intercolonial Congress to resist the Stamp Act. Samuel Adams, a radical agitator of Boston who led the movement for nonimportation agreements and "committees of correspondence," did much to develop an irreconcilable revolutionary spirit. Royal troops were stationed in Boston and friction with the citizens culminated in the Boston massacre, March 5, 1770, in which soldiers, goaded by a mob, fired, killing five persons. When Parliament persisted with a tax on tea, Samuel Adams took the lead in organizing the "Boston tea party," 1773. Citizens disguised as Indians boarded the vessels in Boston Harbor and dumped the chests of tea into the water. In retaliation Parliament passed the

Boston Port Bill, closing the port to commerce. When Governor Gage dissolved the General Court in 1774, the members resolved themselves into a provincial congress and adopted plans for mustering the militia, including the minutemen. The first blood of the revolution was shed at Lexington on April 19, 1775, when General Gage sent troops to Concord to destroy military stores collected there by the colonists. At the Battle of Bunker Hill, June 17, 1775, the British suffered over 1,000 casualties in taking a hill from militia who were besieging them in Boston. For the remainder of the war, no important engagement was fought in Massachusetts.

In September 1779 a convention, authorized by the people, framed a state constitution which was ratified in June 1780.

A few years later came the episode known as Shays' Rebellion, 1786–1787. Business depression and rigorous foreclosures for debts and taxes caused an uprising of the farmers led by a former army captain, Daniel Shays. Although suppressed by the militia, it alarmed the conservative classes and played its part in the movement for a new federal Constitution. The state ratified the federal Constitution Feb. 6, 1788, after a sharp contest and after the Federalists drafted amendments which met the demand for a bill of rights. Dominated by the commercial classes, who were Federalists, the state became bitterly opposed to the principles of Jeffersonian democracy. There was much opposition to the War of 1812 and the greatest lack of support. Massachusetts took the lead in summoning the abortive Hartford Convention of 1814.

The mid-19th century was the glorious age of Massachusetts, a period in which it had both economic and cultural pre-eminence. A new liberalism had developed, Unitarianism in religion and transcendentalism in literature. The state produced a galaxy of literary figures: Emerson, Hawthorne, Holmes, Longfellow, Lowell, Bryant, Thoreau, Prescott, Parkman, and others. Support for social reforms and experimentation developed. In the slavery issue Massachusetts became a center of the abolitionist movement and later gave unstinted support to the Union cause in the Civil War.

As the factory system developed after 1830, Massachusetts gained a leading position in many fields, particularly in cotton and woolen textiles, and in the boot and shoe industry. After 1850, society was transformed by immigration, first of Irish, later of French Canadians and people of southern and eastern European stock.

Throughout its history under the constitution, the state was dominantly Federalist, Whig, and Republican in politics, but the Democratic party came to control many of the industrial centers.

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MASSACHUSETTS, University of, is located in Amherst, near the geographical center of the state, and overlooking one of the picturesque sections of the Connecticut River valley. The campus consists of 700 acres. In addition, the University owns a forest demonstration area of 750 acres on a mountain ten miles from the campus.

The university is the state institution of the commonwealth and was founded under the provisions of the Morrill Land Grant Act of Congress of 1862. Massachusetts accepted the provisions of the Morrill Act in 1863 by founding the college at Amherst to be known as "Massachusetts Agricultural College." The trustees of the college were incorporated in 1863 and officers were appointed in that year. It was not until Oct. 2, 1867, that the college was formally opened to students. In April 1931, the name of the institution was changed by legislative enactment to Massachusetts State College, and in May 1947 the college became the University of Massachusetts.

The university consists of three main parts: an undergraduate college, a graduate school, and the Stockbridge School of Agriculture. The Stockbridge School provides a two-year vocational course.

The graduate school consists of a college of arts and sciences and schools of business administration, engineering, agriculture, horticulture, and home economics.

Since 1946 the legislature has approved a ten million dollar building program at the university.

In 1946 a branch of the university was established at Fort Devens to provide instruction of collegiate grade to Massachusetts veterans. This branch was discontinued in June 1949.

MASSACHUSETTS BALLOT. See BALLOT.

MASSACHUSETTS BAY, an arm of the Atlantic indenting the eastern shore of Massachusetts and extending from Plymouth Harbor on the south to Cape Ann on the north, a distance of 42 miles. It is triangular in shape, the north and south shores inclining toward each other until at the entrance to Boston Harbor they are about five miles apart. The depth from the base of the triangle to Boston Harbor is about 21 miles. The northern shore is rocky and irregular, the southern low and sandy. The principal inlets are: on the north coast, Gloucester and Nahant bays and Salem, Marblehead and Lynn harbors, and on the west Boston Harbor. Along the shores are a number of capes and headlands, and off the coast a number of small islands. At the entrance to Boston Harbor there are several islands, on some of which are fortifications. Cape Cod Bay on the southeast is sometimes included in Massachusetts Bay.

MASSACHUSETTS BAY COMPANY. A royal charter of 1629 confirmed to a group of merchants and others, calling themselves the Massachusetts Bay Company, a grant made to them the year before by the Council of New England which authorized them to trade and colonize in New England between the Merrimack and Charles rivers. The Council's patent of 1628 had accorded the company powers of local self-government which, however, were to be subject to the general government that the Council itself intended to establish over all New England. This dependence on the Council was nullified by the royal charter which permitted the company to establish for its colony whatever form of government it chose, subject only to the king.

At its organization in England, the company closely resembled other European trading companies with charters from their home government authorizing settlements on the American continent. Thus its royal charter provided for the usual government organs for such settlements: a governor, assistants, and a general court of stockholders. But in this instance, the usual clause requiring the company to hold its business meetings in England was omitted. Consequently when in 1630 the leading stockholders, Puritans to a man, despairing of political and religious reforms in England, migrated to Massachusetts with their families, goods and chattels, they could take their charter with them and use it as their basic constitution for the colony's government. Through the control exercised by the general court on admission of new members to the company they were able to limit the suffrage to members of their own faith. Thus, almost at the outset the colony, chartered as a commercial enterprise, was converted into a Calvinist theocracy, virtually independent of external control. As new towns were founded in Massachusetts representative government developed, and the general court consisted of deputies from these towns.

Although the Massachusetts Bay Company remained neutral during the Puritan Revolution in England, it joined with Plymouth, Connecticut and New Haven in a defensive league in 1643. A commission, sent from England to investigate the company in 1664 at the time of the conquest of New Netherland, reported that Massachusetts had committed grave errors in coining money without authority, denying freedom of worship to dissenters, refusing to obey the Navigation Acts, etc. Edward Randolph's report of 1676 was still more critical. Its charter was withdrawn in 1684, but the government continued to function until establishment of the Dominion of New England in 1686.

MASSACHUSETTS HISTORICAL SOCIETY, the oldest of its kind in the United States, was founded by Jeremy Belknap (1744–1798), and held its first meeting in Boston on Jan. 24, 1791. Resident members must be citizens of Massachusetts and may not exceed a total of 125, but 50 corresponding members are elected from other states of the Union, and 10 honorary members from Europe and South America. The society meets on the second Thursday of every month from October to May inclusive. Its chief publications consist of its *Proceedings, Collections, The Winthrop Papers,* and *The Lives of Harvard Graduates.* No dues are collected from members; the expenses of the society and publications being met by the income of its endowment, amounting to one million dollars.

The society possesses a library of 250,000 books and pamphlets, many of which are extremely rare. The chief glory of its library is its large and in

valuable collection of manuscripts, certainly the greatest in New England and probably one of the finest in the United States. The library of the society is open to accredited scholars five days a week. The museum of the society, containing many remarkable portraits and unique objects connected with American history, is open to the public.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY. As stated in its charter, granted by the commonwealth on April 10, 1861, the Massachusetts Institute of Technology was established "for the purpose of instituting and maintaining a society of arts, a museum of arts, and a school of industrial science and aiding generally by suitable means the advancement, development, and practical applications of science in connection with arts, agriculture, manufactures and commerce."

Motivated by the pioneering spirit of its founder, William Barton Rogers (1804–1882), the institute proceeded rapidly to make many seminal contributions to education and industry. It pioneered in extending the laboratory methods of instruction as an indispensable educational technique. It virtually created the modern profession of chemical engineering; its courses in electrical engineering, in aeronautical engineering, and in applied physics were probably the first in the world. It was the first technological institution to recognize and provide for the important place of economics in the training of the engineer.

In attaining its present position, the institute has constantly kept before it three objectives—the education of men, the advancement of knowledge, and the rendering of service to industry and the nation. It aims to give its students such a combination of humanistic, scientific, and professional training as will fit them to take leading positions in a world in which science, engineering, and architecture are of basic importance. This training is especially planned to prepare students, according to their desires and aptitudes, to become practicing engineers or architects, investigators, business executives, or teachers. The useful knowledge and mental discipline gained in this training are, however, so broad and fundamental as to constitute an excellent general preparation for other careers.

To vitalize its educational procedure and to fulfill its objectives, the institute emphasizes original research in pure and applied science. Experience has demonstrated that teaching of the highest type, especially in science and its applications, thrives best in an atmosphere of steady progress in the understanding of the subject taught.

At the present time (1949), the Massachusetts Institute of Technology carries on its teaching and research on its Cambridge site of 100 acres on which are located a complex of academic, residential, and recreational buildings and facilities. It maintains educational and research activities in 47 different locations, in 11 states and Canada, including the Brookhaven National Laboratories on Long Island and the Atomic Energy Laboratory at Oak Ridge, Tennessee.

The growth of the student body may be gleaned from the abbreviated summary:

Year	Total students	Year	Total students
1865–66	72	1915–16	1,900
1875–76	255	1925–26	2,813
1885–86	609	1935–36	2,540
1895–96	1,187	1945–46	1,538
1905–06	1,466	1948–49	5,433

During World War II, the institute trained many thousands of persons for the armed forces. In the postwar period, its enrollment reached 5,600 in 1947–1948, but it dropped to 5,400 in 1948–1949 and the institute is planning a postwar stabilized enrollment of 4,500.

Graduate work at the institute has always been a significant factor. Provisions for offering graduate courses of instruction date back to 1872. Of a total of 31,412 degrees awarded (1868–1949), 23,264, or 74.1 per cent, were bachelor degrees; 6,819, or 21.7 per cent, were engineering; and 1,291, or 4.1 per cent, were doctor's degrees.

MASSACHUSETTS MEDICAL SOCIETY, an association incorporated at Boston, Mass., Nov. 1, 1781, and holding regular sessions from that date to the present. Its charter was signed by John Hancock, first state governor of Massachusetts. Physicians and surgeons, who have made their medical studies in colleges approved by the society and who have been examined by its censors and are of known probity, are eligible to membership. Women were first admitted in 1884. Since 1790 it has regularly issued its *Medical Communications.* It also issues a *Pharmacopoeia* and *Publications,* various reports and essays, an annual directory, and, since 1789, a triennial catalogue.

MASSACRE (French, *massacre,* slaughter, probably connected with Latin, *macellum,* a meat-market), the indiscriminate and unnecessary slaughter of human beings, and, in a transferred sense, of animals. In the case of human beings it implies the absence of all forms of law or of sufficient grounds.

MASSACRE OF THE INNOCENTS, the slaughter of the children in and about Bethlehem by the soldiers of Herod, whose superstitious fears caused him to see a rival in the babe of whose birth he was apprised by the wise men (Matthew II, 1–16). The story has been for centuries a favorite subject with artists, especially those of the Flemish and Italian schools.

Among the greatest examples are those by Tintoretto, Reni and Rubens.

MASSAGE, a procedure, usually performed by the hands, such as friction, kneading, rolling and percussion of the external tissues of the body, either to relieve pain or to assist a cure, or with some hygienic object in view. A male massagist is known as a masseur, a female as a masseuse. Massage in some crude form has always been used by savages as well as by the civilized. It was mentioned by Homer and Hippocrates, having been one of the luxuries of the ancient Greeks, and, among the Romans, was largely used by gladiators, and to make slaves more comely by filling out their tissues. Sometimes it was done by medical practitioners, often by slaves and priests and those appointed to anoint the wrestlers before and after they exercised.

Often the use of massage is associated with that of certain active and passive movements known as the Swedish movement-cure (q.v.), established by Pehr Henrik Ling. His system of gymnastics became popular in spite of opposition and of the fact that it was largely a revival of old methods of treat-

ment. In 1873 Mezger, of Amsterdam, and in 1877 S. Weir Mitchell of Philadelphia pushed forward the cause of massage. To-day it is considered by physicians as a branch of medical treatment, useful in certain cases if rightly administered, but capable of doing harm when improperly applied. Unfortunately the laity frequently look upon it as a sole means of relief or cure. Much depends upon the judgment and skill of the masseur, as the special reaction of the individual patient has to be considered and, on the other hand, a skilful operator can accomplish more in a quarter of an hour than an ignorant one can in an hour. The procedures in massage may be placed under four heads: stroking (the *effleurage* of the French), kneading (malaxation), friction and percussion. Stroking is performed over surfaces with the palm of the hand or its radial border, or with the pulps of the fingers, or the sides of the knuckles. Kneading is the grasping of muscles, etc., with both hands or between the thumb and fingers of one hand, and rolling and squeezing them. Friction is a peculiar and forcible circular rubbing. Percussion is the striking or beating of a part, either with the hand or an instrument called a percussor or muscle-beater. A special technique of massaging the face, and particularly the ears and eyes, has had surprisingly gratifying results in preventing deafness and curing certain types of blindness, for instance, where an embolism of a central artery of the retina has been removed by massage. It is claimed that the modern system of massage makes the blood circulate more freely, strengthens muscle-fibres, causes effusions and exudations to be absorbed, improves secretory and excretory action, and invigorates the whole system. It is frequently used with good results to stimulate assimilation and invigorate digestion, to soothe nervous irritability, relieve pain and arouse nerve-force, to equalize the circulation, to remove morbid deposits from around joints, to restore mobility, and for the correction of obstinate constipation and other disordered conditions.

From the point of view of the modern study of unconscious mentality it will be seen that those persons who are the greatest advocates of massage will be the ones who are unconsciously satisfying a desire for stroking, kneading, friction and percussion. Such a method of curing their ills will make an immediate and a strong appeal to their instincts. This presupposes a physical and mental make up, predisposed by early development, to seek and get satisfactions from the skin and muscle sensations derived from manipulation at the hands of another. This mental disposition is in modern times well recognized in psychoanalysis (q.v.), which, however, goes at the treatment in another way. For any diseases which may be helped by massage, there is a cause in the way in which the mind unconsciously regards the pleasures derived from the manipulation of the skin and muscles. If, for instance, the individual is of such a mental constitution that, because of early environment, he has been led to derive more than ordinary pleasure from being stroked, kneaded, rubbed or even beaten (and the history of the development of massage shows that such persons are quite numerous); such an individual will be the more likely to contract diseases of the type which are on record as having been remedied or cured by massage. He will develop those diseases instinctively without knowing the connection between them and the unconscious wish which is the cause of the specific incidence of the symptoms. This practically amounts to saying that the diseases which are enumerated as having been cured by massage are diseases which are virtually selected by the unconscious because of the fact that their treatment will involve the gratification of wishes for just such specific stimulation of the muscular, tendonous and cutaneous end organs. The patient will do well under such a treatment, at least, partly because a source of unconscious gratification closed to him possibly since early childhood has been through massage reopened to him.

MASSAGETÆ, mą-săj'ĕ-tē, in ancient history, a name given to nomadic tribes of northern Asia who dwelt to the east and south of the Caspian Sea. Herodotus says they worshiped and offered horses to the sun, had a community of wives, killed and ate their aged people, lived chiefly on the milk and flesh of their herds and on fish, and fought on foot and on horseback with lance, bow and double-edged axe. They are chiefly mentioned in connection with Persian history. Cyrus the Great perished in war with the Massagetæ, 529 B.C. According to some they belonged to the Mongolian stock, according to others to the Aryan.

MASSASOIT, măs'ą-soit, American Indian chief, sachem of the Wampanoags: b. Massachusetts, 1580; d. 1661. His dominion extended over nearly all the southern part of Massachusetts, from Cape Cod to Narragansett Bay; but his tribe, once estimated at 30,000 in number, had shortly before the landing of the Pilgrims at Plymouth been reduced by a disease, supposed to have been yellow fever, to barely 300. On 22 March 1621, a little more than three months after the founding of Plymouth, he appeared before the infant settlement with 60 of his warriors, armed and painted, for the purpose of forming a friendly league with the white men. Although the tribe were reputed to be cruel and treacherous, the open and friendly greeting of Massasoit so favorably impressed Governor Carver, that after the necessary formalities were concluded, he formed in behalf of the colony a treaty of peace and mutual protection with the Wampanoags, which for 50 years was sacredly kept by both parties. The friendly disposition of Massasoit toward the colonists never relaxed. He lived within the limits of what is now the town of Warren, R. I., near an abundant spring which yet bears his name, where he often entertained wandering pilgrims or administered to their necessities. Roger Williams, while on his way to Providence, was for several weeks his guest at this place. Massasoit was just, humane and honest, never violating his word and constantly endeavoring to imbue his people with a love of peace. In person, Morton says, in his 'Memorial,' he was "a portly man in his best years, grave of countenance, spare of speech." His second son, Pometacom, called by the colonists King Philip, who ultimately became sachem of the Wampanoags, was of a less placable disposition, and allowed the encroachments of the colonists to hurry him into the bloody contest known as King Philip's War.

Consult Baker, Virginia, *Massasoits' Town Sowams in Pokanoket* (Warren, R. I., 1904).

MASSASSAUGA, măs-ă-sô'gă, the ground rattlesnake of the central United States. See RATTLESNAKE.

MASSAWA, mă-sä'wă (Italian MASSAUA), seaport, Eritrea; on the Red Sea. It is situated on the Bay of Massawa in the hot, arid coastal plain, and has a fine harbor sheltered by the Dahlak Archipelago. The latter is noted for its pearl and mother-of-pearl fisheries. Massawa is 40 miles northeast of Asmara, with which it is connected by road and narrow-gauge railroad. The port is built on two islands—Massawa, with the old Arab town, and Taulud, more modern—and the adjacent mainland. Railroads and highways built on dikes interconnect these sections. The port was heavily damaged by an earthquake in 1921 and was largely rebuilt of stone from the Dahlak Archipelago. Besides pearls, and mother-of-pearl, Massawa exports salt, hides, coffee, fish, oilseeds, and gum arabic. There are shipyards, extensive harbor installations, and manufactures of iron, cement, brick, and tobacco.

Massawa was taken by the Turks in 1557, but the negus of Ethiopia was also later influential in its affairs. In the 18th and 19th centuries it was held by the sherif of Mecca, by Egypt, again by the Turks, and in 1865 was ceded by the latter to Egypt. The Italians established themselves here, Feb. 6, 1885, and began their expansion inland, which resulted in the Italian colony of Eritrea (1890), of which Massawa was the capital until 1897. During World War II, the port was captured by the British, April 7, 1941. The Italians, however, had destroyed the harbor installations and sunk ships in the harbor, and much clearing was necessary. Massawa nevertheless became an important Allied base. Pop. (1947 est.) 25,000.

MASSENA, mă-sä-nä, **André,** French marshal under Napoleon: b. Leven, near Nice, France, May 6, 1758; d. Paris, April 4, 1817. At the age of 17 he entered the French army and, after serving 14 years, settled in Nice where he married. After the outbreak of the revolution he entered a battalion of volunteers and in 1793 was made a general of brigade. Taking command of the right wing of the French army in Italy in 1794, Masséna distinguished himself highly at Rivoli and elsewhere. In 1799 he defeated the Austrian and Russian forces at Zürich and in 1800 his three-month defense of Genoa gave Napoleon Bonaparte time to strike successfully at Marengo.

Created marshal of the empire in 1804, Masséna received in the following year the chief command in Italy, where, after the peace of Pressburg, he occupied the kingdom of Naples. In 1807 he was given command of the right wing of the French army in Poland and soon after received the title of duc de Rivoli. At Esslingen in 1809 his constancy and firmness saved the French army from total destruction and Napoleon rewarded him with the further dignity of prince d'Essling.

In command of the army in Portugal in 1810, Masséna forced Wellington within the lines of Torres Vedras, till want of provisions compelled him to retire. Louis XVIII made him a peer in 1814 and though on the return of the emperor he acknowledged his authority, he took no active part in the events of the Hundred Days.

MASSENA, mă-sē'nä, village, New York, in St. Lawrence County, 33 miles northeast of Ogdensburg on the Raquette and Grass rivers, state and federal highways, and the New York Central, the Grand Trunk, and the Massena Terminal railroads. Altitude 207 feet. It is situated in a rich farming and dairying region, in which the chief crops are potatoes, hay, and apples. The county ships great quantities of milk and cream to large cities such as New York.

In 1900 a company was organized to construct a canal leading water from the St. Lawrence into the Grass River, to be carried by that stream back to the St. Lawrence. The canal, dropping 45 feet in a distance of 3 miles, produces a cheap source of power which has contributed to the development of the village. Power from this canal is used by the Aluminum Company of America, which manufactures aluminum cable for the transmission of electric current, and aluminum structural shapes. The warehouses, mills, and shops of this plant cover an area of 50 acres. Other manufactures include wood products, silk, and women's foundation wear.

Massena came into being as a log cabin settlement in 1792, when Anable Fancher put up a sawmill beside the Grass River and named the place after Marshal André Masséna. Ten years later a party of settlers moved in from Vermont. Massena was incorporated as a village in 1886. In 1927 part of Massena town was annexed to Massena village. The town as originally constituted included the villages of Massena Center and Massena Springs, the latter having been at one time a popular resort because of its mineral waters. Points of interest near by are some old Indian burial mounds and the Long Sault Rapids of the St. Lawrence River. Massena has a mayor-council form of government. Pop. (1950) 13,137.

MASSENET, mäs-nĕ', **Jules Émile Frédéric,** French composer: b. Montaud, France, May 12, 1842; d. Paris, Aug. 13, 1912. He was the son of a blacksmith who had served in the engineers under Napoleon, and was the youngest of 21 children. After studying at the Paris Conservatoire under Adolphe Laurent, Augustin Savard, Napoléon-Henri Reber, and Ambroise Thomas, he gained the first prize for pianoforte in 1859 and four years later the Prix de Rome for his cantata *David Rizzio.* He travelled in Italy and Germany and upon his return to Paris, he had his first opera, *La Grand-Tante,* performed at the Opéra Comique in 1867. He was appointed professor of composition at the conservatoire in 1878 and in the same year was elected to the Académie des Beaux Arts.

Among his earlier works are the song cycles, *Poème du Souvenir* and *Poème d'Avril* (1860); his first important opera, *Don Cesar de Bazan* (1872); followed in the same year by his incidental music to *Les Érinnyes* (a tragedy by Leconte de Lisle), from which his famous *Élégie* was taken, and the sacred drama *Marie Magdeleine* (produced in 1873). An oratorio, *Ève,* was performed in 1875; the opera *Le Roi de Lahore* in 1877; and a sacred legend *La Vierge* in 1879.

One of his most popular operas was *Herodiade,* which was first performed in Brussels in 1881. The work through which he is probably best

known, however, is his opera *Manon*, in which he replaced the usual *recitativo secco* with dialogue over an orchestral accompaniment and adopted the *leitmotiv* device in the manner of Gounod. Based on a libretto by Henri Meilhac and Philippe Gille, *Manon* was first performed at the Opera Comique in 1884 and since then has maintained a steady position in opera repertory. Other dramatic works include *Le Cid* (1885); *Esclarmonde* (1889); *Le Mage* (1891); *Werther,* based on Goethe's story (1892); *Thais,* adopted from the novel by Anatole France (1894); *Le Portrait de Manon,* a short one-act piece (1895); and *Le Jongleur de Notre Dame* (1902). His last important operas were *Don Quichotte,* produced at Monte Carlo in 1910, the title role created by Feodor Chaliapin, and the comedy *Panurge,* which he completed just before his death. He also wrote a large number of popular melodies, pianoforte pieces, orchestral suites, cantatas, and incidental music.

MASSEY, măs'ĭ, Gerald, English poet: b. Gamble Wharf, near Tring, Hertfordshire, May 29, 1828; d. Redcot, South Norwood, Surrey, Oct. 29, 1907. He received but little education, and at eight was employed in a silk factory. Going to London about 1843, he became an errand boy, and in 1849 editor of *The Spirit of Freedom,* a Radical paper, becoming at the same time associated with Kingsley, Maurice and other Christian Socialists. In 1854 he published *Ballad of Babe Christabel* and other poems. The volume attracted the notice of Landor, and the poems issued in succession to it met with no little popularity.

MASSEY, Hart Almerin, Canadian manufacturer and philanthropist: b. Haldimand, Northumberland County, Ontario, April 29, 1823; d. Toronto, Feb. 20, 1896. Educated at Victoria College, Cobourg, Ontario, he assisted in managing his father's farms and while thus engaged set about improving the agricultural implements then in use. His father established a factory at Newcastle of which Hart became sole owner in 1855. He perfected mowing and reaping machines, first of their kind in Canada, and introduced improvements in other farm implements.

MASSEY, Raymond, Canadian actor and producer: b. Toronto, Ont., Aug. 30, 1896. Educated at the University of Toronto and at Oxford he served in the Canadian Field Artillery during World War I and was an instructor in field artillery at Yale and Princeton universities in 1917 and in Siberia in 1918. He made his stage debut in 1922 at Everyman Theatre and entered in the management of this theater in 1926. Here he produced a number of plays and played a variety of parts. His most conspicuous success was as Abraham Lincoln in *Abe Lincoln in Illinois* at the Plymouth Theatre, New York, in 1938–1939. He served in World War II with the rank of major and became an American citizen in 1944.

MASSEY, Vincent, Canadian government official: b. Toronto, Ont., Feb. 20, 1887. The grandson of Hart Almerin Massey, he graduated from the University of Toronto (1910) and Balliol College, Oxford (1918), subsequently entering upon a public career and the presidency of his grandfather's farm equipment firm, the 5th largest in the world.

Massey resigned his business affiliation in 1925 to become a minister in the Liberal cabinet of Prime Minister Mackenzie King, and in 1926 was appointed first Canadian minister to the United States, where he remained until 1930. From 1935 to 1946 he served as high commissioner for Canada in the United Kingdom; was appointed chancellor of the University of Toronto in 1947; and in 1949 became chairman of the Royal Commission on National Development in the Arts, Letters, and Sciences, in whose report an independent Canadian culture was found seriously hampered by that of the United States. In 1952 he succeeded Field Marshal Viscount Alexander to the post of Canadian governor general.

MASSICOT, măs'ĭ-kŏt, a mineral consisting of monoxide of lead, PbO, containing about 92.8 per cent of that metal, which occurs in many deposits in Colorado, Idaho, Nevada, and Virginia.

MASSILLON, mà-sē-yôN', **Jean Baptiste,** French ecclesiastic: b. Hyères, Provence, June 24, 1663; d. Clermont, Sept. 18, 1742. In 1681 he entered the Congregation of the Oratory, then taught at Montbrison, and in 1692 was ordained priest at Vienne. He went to Paris 4 years later as director of the Seminary of Saint Magliore, and won great favor, even at court, by his eloquent sermons. His funeral orations are particularly famous. He was made bishop of Clermont in 1717 and in the following year delivered 10 sermons before the 9-year-old Louis XV, which were later published as *Petite Carême.*

Massillon was elected to the French Academy in 1719 and in the same year he retired from Paris to Clermont, where he died of apoplexy. His works were edited in 1828 by Marie Nicolas Guillon and in 1886 by the Abbé Blampiguan, whose biographical sketch, *Massillon d'après des Documents inédits* (Paris 1879) should be consulted.

MASSILLON, city, Ohio, in Stark County, 8 miles northwest of Canton on the Tuscarawas River, state and federal highways, and the Pennsylvania, the Baltimore and Ohio, and the Wheeling and Lake Erie railroads. Altitude 1,030 feet. Situated in a region of farm lands and coal deposits, it manufactures special steels, automobile accessories, equipment for the conveyance of heat, furnaces, refractories, and fabricated metal products. The city has a public library, a modern general hospital, and a state hospital for the insane. The Baldwin Museum, housed in an old town home, has exhibits in science, history, and art. One of the landmarks in the city is the Jacob S. Coxey house, home of the leader of "Coxey's army."

Settled in 1812, Massillon was first chartered in 1826 when the Ohio and Erie Canal was projected. With opening of the canal between Cleveland and Massillon, the city took its place as a leading grain market, and when canals began to give way to the railroads in the 1850's, it was firmly established as a trading center.

Massillon was named for Father Jean Baptiste Massillon by Mrs. James Duncan, the wife of the founder. It has a mayor-council form of government. Pop. (1950) 29,594.

MASSINGER, măs'-ĭn-jĕr, **Philip,** English dramatist: b. Salisbury, November 1583; d. Southwark, London, March 1640. He studied at

Saint Alban Hall, Oxford, from 1602 to 1606, after which time he left without taking a degree and moved to London where he soon became a well-known playwright. He collaborated with Nathaniel Field, Thomas Dekker, Cyril Tourneur, and Robert Daborne, and regularly with John Fletcher from 1613 until the latter's death in 1625.

Independently, Massinger wrote 15 plays. They are frequently based closely on Italian and Spanish originals, but show much skilfulness in the development of plot, and a knowledge of the requirements imposed by stage presentation. *Henry VIII* in its present form was probably written by him and Fletcher. That he became a Roman Catholic has been suggested, but not proved, on the evidence of certain plays written in collaboration with Dekker. Among the plays wholly by him are *The Bondman* (1624); *The Roman Actor* (1629); *A New Way to Pay Old Debts* (1632); and *The Guardian* (1655). By far the most popular of his works was *A New Way to Pay Old Debts* (q.v.) which kept the stage in England to the end of the 19th century.

Bibliography.—The standard edition of Massinger's plays is by William Gifford, *The Plays of Philip Massinger* (London 1805). Other collections are Hartley Coleridge, *Dramatic Works of Massinger and Ford*, rev. ed. (London 1883) and Arthur Symons, *Selected Plays of Philip Massinger* (London 1887–89). Biographical and critical material will be found in the following works: Koeppel, Emil, *Quellen Studien zu den Dramen Chapmans, Massingers und Fords* (Strassburg 1897); Cruickshank, Alfred Hamilton, *Philip Massinger* (Oxford 1920); Maxwell, Baldwin, *Studies in Beaumont and Fletcher and Massinger* (Chapel Hill, N. C. 1939).

MASSON, măs″n, **David,** Scottish critic: b. Aberdeen, Dec. 2, 1822; d. Edinburgh, Oct. 7, 1907. He was educated at Marischal College and Edinburgh University, and in 1847 moved to London, where he contributed to many magazines and became acquainted with the literary figures of the time. In 1853 he succeeded Arthur Clough in the chair of English literature at University College, London. He was the first editor (1859–1868) of *Macmillan's Magazine,* and was professor of rhetoric and English literature at the University of Edinburgh, 1865–1895. In 1892 he was appointed historiographer royal for Scotland.

Masson's great work is his elaborate and comprehensive *Life of Milton, Narrated in Connection with the Political, Ecclesiastical, and Literary History of His Time* (6 vols., 1859–1880). Other works include *British Novelists and Their Styles* (1859); *Recent British Philosophies* (1865); *Drummond of Hawthornden* (1873); *Three Devils: Luther's, Milton's, and Goethe's* (1874); *De Quincey,* in the English Men of Letters series (1878); *Carlyle Personally and in His Writings* (1885); and *Edinburgh Sketches and Memories* (1892). He also edited *The Poetical Works of John Milton* (1874; reissued many times) and *The Collected Writings of Thomas De Quincey* (14 vols., 1889–1900).

MASSON, mă-sôN, **Frédéric,** French historian: b. Paris, March 8, 1847; d. there, Feb. 9, 1923. He was librarian in the archives of the Foreign Office, 1868–1880, and after the overthrow of the Second Empire became secretary to Prince Napoleon, and was entrusted with the arrangement of the prince's papers and collections. Masson is noted for his works on Napoleonic history. His method was anecdotal, and he based his works on original documents, many of which were in his private collection, which he bequeathed to the Institute of France. In 1903 he was elected to the Académie Française and in 1919 became its perpetual secretary.

His chief work was *Napoléon et sa famille* (13 vols., 1897–1919). Other studies include *La révolte de Toulon en prairial* (1875); *Le Marquis de Grignan* (1881); *Les diplomates de la Révolution* (1883); *Napoléon et les femmes* (1893); *Napoléon chez lui* (1894); *Les cavaliers de Napoléon* (1895); *Napoléon inconnu* (1895); *Marie Valewska* (1898); *Joséphine impératrice et reine* (1898); *Joséphine de Beauharnais* (1899); *Joséphine repudiée* (1901); *L'Impératrice Marie-Louise* (1901); *Napoléon et son fils* (1904); *Napoléon à Sainte-Hélène* (1912); *Pour l'Empereur* (1913–1917); and *Madame Bonaparte* (1920).

MASSON, Louis François Rodrigue, Canadian statesman: b. Terrebonne, Lower Canada (now in Quebec), Nov. 7, 1833; d. Montreal, Nov. 8, 1903. He was educated at Georgetown College in the United States and at the College of St. Hyacinthe in Canada, and in 1859 was called to the bar of Lower Canada. Masson was elected to the Canadian House of Commons as a Conservative member from Terrebonne in 1867 and held his seat until 1882. He served as minister of militia in 1878–1880; became president of the council in the latter year; and in 1884–1887 served as lieutenant governor of Quebec. He was called to the Senate of Canada in 1882 and a second time in 1892.

MASSON, măs″n, **Tom** (in full Thomas Lansing Masson), American humorist and editor: b. Essex, Conn., July 21, 1866; d. Glen Ridge, N. J., June 18, 1934. He was educated in the public schools of New Haven, Conn., and from 1893 to 1922 was literary and managing editor of *Life* magazine; associate editor of *The Saturday Evening Post* 1922–1930. Besides several anthologies of humor, his published works include *The Yankee Navy* (1899), *A Corner in Women* (1905), *The Von Blumers* (1906), *Well, Why Not?* (1921), *Listen to These* (1922), *That Silver Lining* (1923); and in a more serious vein, *The New Plato* (1905), *Why I am a Spiritual Vagabond* (1925), and *In Tune with the Finite* (1928).

MASSYS. See Matsys, Quentin.

MASTER BUILDER, The. The tendency toward symbolism to be observed in the early romantic works of Henrik Ibsen, and occasionally in his dramas of social awakening, becomes dominant in *The Master Builder* (*Bygmester Solness*), published in 1892 and played the next season. In *The Wild Duck* and *The Lady from the Sea,* Ibsen had already mingled symbolism with naturalism; but only in *The Master Builder* does the hidden allegory threaten to warp his surface story out of consistency. The piece, which begins with matter-of-fact scenes and situations from middle-class life, ere long develops into a tenuous fable that suggests much more than it presents.

As a drama of ideas *The Master Builder* emphasizes two notions: the peril of selfish individualism, already shown in *Rosmersholm* and *Hedda Gabler;* and the struggle of age against youth. Ibsen, conscious of his advancing years, felt the inevitable passing of power from the

older to the younger generation. He felt, also, not only the fear of youth, but its fascination, especially in his innocent affair with Emilie Bardach, a girl of 18 whom he, at the age of 61, had met in the Tirol during the summer of 1889, and with whom he later corresponded. He has universalized these merely personal sentiments, setting forth the problem of every man who lives long enough to regret what is gone and to strive desperately to hold what is slipping from him. This particular conflict Ibsen associates with the still larger conflict between individualism and altruism.

Solness, the master builder, has achieved success at the expense of his wife and his business associates. He has checked the rise of old Knut Brovik, and refused to young Ragnar Brovik permission to build independently. He has employed the latter's sweetheart and captured her affections only as a ruse by which to retain Ragnar's services. Obsessed, as he admits, with dread of the younger generation, yet thinking himself at last secure from it, he succumbs when the younger generation knocks at his door in the person of Hilda Wangel. Hilda, who had already appeared in a minor role in *The Lady from the Sea,* is a strange and willful girl who induces Solness to relax his selfish schemes, and, at the same time, to attempt to mount, as he used to do, to the top of a lofty tower. He can no longer safely climb to such heights, and yet, inspired by Hilda's faith, he makes the attempt, only to fall. Though he forfeits life, Hilda exclaims that she heard "harps in the air" when he stood on the dizzy summit. Hilda is the puzzle of the play, an influence for both good and evil, a symbol of youthful aspiration, or perhaps of youth as the enemy of age and of woman as the enemy of man. The charm of the drama lies in its tantalizing hints of concealed significances; its defect lies in its lack of proper correspondence between the human action and the allegory.

FRANK W. CHANDLER.

MASTER OF ARTS (M.A. or A.M., *artium magister*), an academic honor conferred by universities of the United States, Great Britain and other countries, upon students after a course of study and a previous examination in the chief branches of a liberal education, particularly philosophy, philology, mathematics, physics, and history. The word *magister,* connected with a qualifying phrase, was used among the Romans as a title of honor; but its present meaning must be traced to the time of the establishment of the oldest universities. Regularly organized faculties were not then known as they now exist in the universities. The whole circle of academic activity was limited to the seven liberal arts, and those who received public honors on the completion of their course of studies, for their diligence and knowledge, and had already received the degree of *baccalaureus* (bachelor), were called *magistri artium* (masters of the liberal arts). In American and English universities this degree follows that of bachelor. The degree of master of arts is inferior to that of doctor of letters (D.Litt.). In the German universities the title was formerly conferred, but has been superseded by that of doctor of philosophy (Ph.D.), which practically corresponds to the degree of M.A. in other universities. This title is an indispensable preliminary to the attainment of the position of *docent* in the German universities, that is, one who has obtained the right to deliver academic lectures. See also article on DEGREE; COSTUME, ACADEMIC.

MASTER OF BALLANTRAE, bål-ăn-trā', **The,** a novel by Robert Louis Stevenson, published in 1889. It is a Scottish romance of the 18th century, beginning with the Stuart uprising of 1745. It is a somber tragedy of the enmity of two brothers, of whom the elder, James Durrie the Master, takes the side of the Stuarts; the younger, Henry, that of the Hanoverian house.

MASTER OF THE HORSE, an official having charge of the horses, hounds, etc., of a sovereign, as of England. He is there a member of the royal household and the third dignitary of the court. The office is appointive, and he has the use of the royal horses and servants. The office formerly existed in Germany and France.

MASTER OF THE ROLLS, a member of the Supreme Court of Judicature in England, who presides with the lords justices in the Court of Appeal, and ranks next to the lord chief justice. He is the keeper of all records of the Court of Chancery and of the rolls of all grants and patents that pass under the great Seal. By the Supreme Court of Judicature Act of 1873, he was denied the privilege he formerly had of a seat in the House of Commons.

MASTERS, màs'tẽrz, **Edgar Lee,** American poet and author: b. Garnett, Kans., Aug. 23, 1869; d. Melrose Park, Pa., March 5, 1950. In 1880 his family settled at Lewistown, Ill., near the Spoon River. Masters attended school here, and studied (1889) at Knox College, but was mainly self-educated through wide reading, acquiring a lifelong love of poetry. He was admitted to the bar in 1891, and the next year moved to Chicago, where he soon had a flourishing practice. Meanwhile, an unnoticed part of the literary ferment of the period in Chicago, he had published poems and stories, chiefly in various newspapers.

In 1913 William Marion Reedy, editor of *Reedy's Mirror* of St. Louis, Mo., gave him a copy of *Epigrams from the Greek Anthology.* This inspired Masters' most famous work, *The Spoon River Anthology,* epitaphs spoken by about 250 persons buried in the graveyard of a village in the Middle West, revealing their inner lives in terms which are imaginative but essentially pessimistic. The first installment of *Spoon River* appeared anonymously in *Reedy's Mirror,* May 29, 1914, and was published in book form, also anonymously, in 1915. A sequel, *The New Spoon River,* appeared in 1924.

Other poetical works—none comparable to the first *Spoon River*—include *A Book of Verses* (1898); *Songs and Sonnets* (1910); *Songs and Satires* (1916); *Starved Rock* (1919); *Domesday Book* (1920) and its epilogue *The Fate of the Jury* (1929); *The New World,* a history of America in verse (1937); *Illinois Poems* (1941); and *The Sangamon* (1942). His novels include *Mitch Miller* (1920), *Skeeters Kirby* (1923), and *Mirage* (1924), a trilogy based on his youth. Masters also wrote biographies—limited by his lack of scholarship—of *Lincoln, the Man,* a bitter "debunking" of the so-called Lincoln myth

(1931); *Vachel Lindsay*, valuable for personal knowledge (1935); *Whitman* (1937); and *Mark Twain*, viewed as a frustrated genius (1938).

Consult Masters' autobiography, *Across Spoon River* (New York 1936).

MASTERWORT, mȧs'tẽr-wûrt', the rustic name of several umbelliferous plants, as those of the genus *Anethum* (see DILL), formerly much cultivated as pot-herbs, and held in great repute as a stomachic, sudorific, and diuretic.

MASTICATION, CHEWING, mȧs-tĭ-kā'shŭn, or the thorough subdivision of food in the mouth so that it can be readily acted upon by the gastric juice and other digestive secretions. The tongue, cheeks, and lips push the food material between the teeth, and by the lateral and up-and-down motions of the lower jaw it is cut and torn by the incisor, canine, and bicuspid teeth and bruised by the molar or grinding teeth. During these actions the food is softened by the saliva (insalivation), which exudes abundantly from the salivary glands by the act of mastication. Typical mastication is seen only in the higher vertebrata. "The amphibian bolts its fly, the bird its grain, and the fish its brother without the ceremony of chewing," but in man and the higher animals mastication is necessary for complete and comfortable digestion. Thorough comminution of food by mastication is analogous to the pulverizing process employed by the chemist, but associated with mastication is insalivation, as it is almost impossible to swallow substances which are very dry. Imperfect mastication of food, either by reason of rapid swallowing (bolting), or because of the absence of sound and serviceable teeth, is very frequently the cause of the numerous ailments classified under the term indigestion. Exaggerated mastication, which has been so highly recommended by certain persons as almost to constitute a panacea or complete prophylaxis, is known to lessen the secretion of gastric juices which is started by sensations of taste, to protract beyond desirable limits the time required for proper gastric digestion, and to develop the salivary deposit in a proportion relatively too great when compared with the secretion of the pancreas. It is moreover known that the teeth are likely to wear out too soon, if mastication is carried beyond a reasonable time

Exaggerated mastication and the fancied advantages accruing from it are an illustration of an indulgence in a form of securing the gratification of an unconscious desire. In infancy a great pleasure is derived merely from mouthing different objects, a pleasure originating in the mode of absorbing the early meals at the mother's breast. It has been discovered by studying the unconscious wishes of mankind that the sexual desire in the adult is a synthesis of different partial desires which in the infant are satisfied in different parts of the body, now here, now there, but which in the adult are assembled in the genital organs or are at least unified under the supremacy of the genitals. But it has been definitely proven that in some individuals this synthesis has never been successfully accomplished. Either the mouth pleasure zones or the anal or the skin or some other zone, which gave in infancy a quite absorbing sense of gratification, has failed of appropriate subordination, and has persisted into adult life, with some individuals, a source of extraordinary pleasure.

MASTIFF, mȧs'tĭf, a breed of dogs of great size, recognized by the large head, short muzzle, the dependent lips, the broad, hanging ears, and by the general muscularity of the form. The mastiff in general disposition is affectionate and gentle, extremely faithful and vigilant. In Rome and in classical ages these dogs were held in high estimation for their strength and courage. The most valued breeds were obtained from Great Britain, where these dogs originated, and were used to guard flocks and herds; and watching has become instinctive with them. Roman officers were appointed to breed them and to transmit them periodically to Rome, where they fought lions and bears in the arenas of the Roman amphitheaters and were otherwise favorites. The dog now is highly valued, both as a watch-dog, and as a domestic companion. Fawn is the prevalent color, and the weight should be about 165 pounds.

MASTIGOPHORA, mȧs-tĭ-gŏf'ŏ-rȧ, a class of Protozoa "in which the flagellate form is prominent although the amoeboid and encysted conditions frequently occur." The class is synonymous with that of Flagellata (q.v.).

MASTODON, mȧs'tô-dŏn, a genus of fossil proboscideans that lived during the Pleistocene period of earth history. By extension the word *mastodon* is very generally used as a common noun and applied to many proboscideans of middle and late Cenozoic age. For such usage the word *mastodont* is also frequently employed.

The mastodonts first appeared in the Miocene period and continued from then through the Pliocene and most of the Pleistocene period. The early mastodonts were of fair size, some of them being about as large as modern oxen, and from such a beginning they evolved into giants, comparable to modern elephants, during the latter phases of the Cenozoic era.

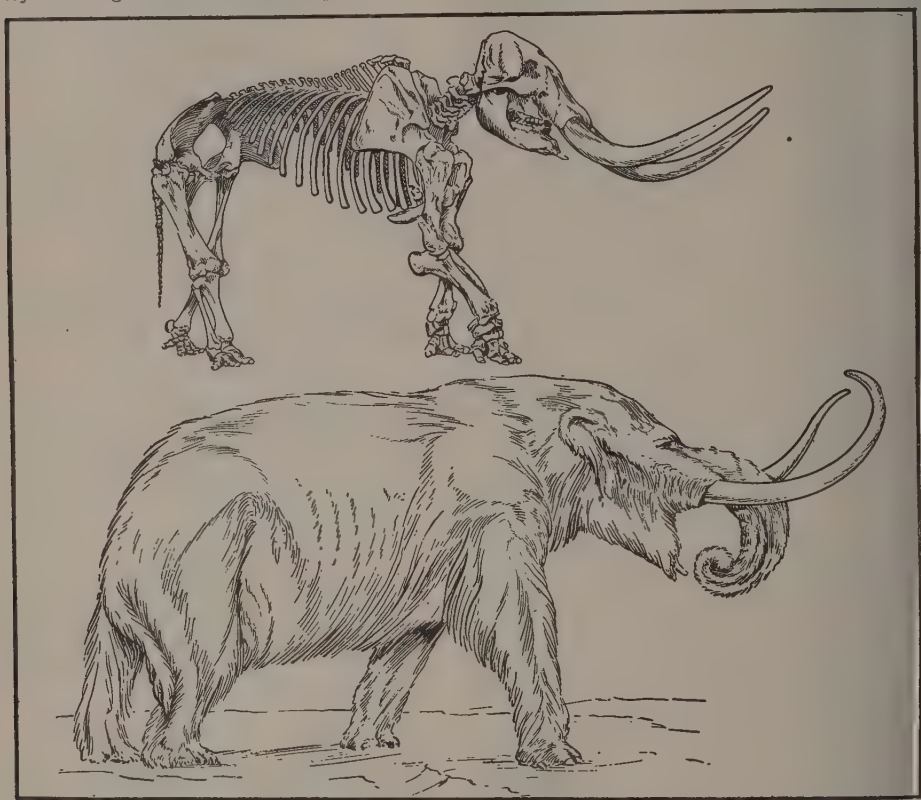
The mastodonts were characterized by elongated noses or probosces, as were all but the most primitive of the proboscideans, and by tusks. In many of the mastodonts there were four tusks, two in the skull and two in the lower jaw. These tusks showed a great variety of development; they were straight, upcurved, or downcurved, long or short. In some of the mastodonts the lower tusks were even broadened and flattened to form a sort of scoop or shovel. The lower tusks of some of the later mastodonts were suppressed and in certain genera they disappeared completely. The tusks were invariably enlarged upper and lower second incisor teeth. The grinding teeth in the mastodonts were somewhat elongated and multicuspidate, and in some genera adjacent cusps of each tooth were joined by a process of transverse growth through time to form strong cross-ridges.

Perhaps the commonest use of the word *mastodon* is its application to remains of the American mastodon, *Mastodon americanus*. (Strict application of the International Rules of Zoological Nomenclature requires that the designation be *Mammut americanum*, but this usage is not commonly followed.) The American mastodon lived throughout much of North America during the Pleistocene period—the last great ice age of geologic history. Remains are found as far south as the southern tip of Florida, and as far north as Alaska. There is some evidence to indicate that this mastodon was present also in parts of

Asia. Fossils of the American mastodon are commonly found in bog deposits and swamps, in river and lake beds, and even on the floor of the Atlantic Ocean along the continental shelf. Some of the remains are remarkably fresh, and it is evident that this proboscidean persisted until a very late stage of the Pleistocene period.

by The American Museum of Natural History New York City, through the munificence of M J. P. Morgan, and it is now exhibited in tha institution.

Careful archaeological and paleontological in vestigations of the past few decades have af forded increasing evidence that the America



Upper: skeleton of the Warren Mastodon, male, estimated shoulder height 9 feet 2 inches in the flesh. Found in the Hudson Highlands near Newburgh, New York. Lower: restoration of male *Mastodon americanus*, estimated shoulder height 10 feet 2 inches in the flesh. Both illustrations after Osborn's *Proboscidea*, Vol. 1, American Museum of Natural History.

Mastodon americanus was a large, bulky proboscidean. Large skeletons are as much as nine or ten feet in height at the shoulder. A mastodon of this size would have been much heavier than a modern elephant of similar height. The skull is rather low for a proboscidean, and it is armed with a pair of large tusks curving upward and outward. The teeth are strongly ridged by transverse cross-crests, there being three such crests in the milk molars and the first two molars, and four or five crests in the third molars. Specimens that have been frozen in the muck of Alaska show that the mastodon was covered by a heavy coat of coarse, reddish-brown hair.

Probably the most complete and famous mastodon skeleton to be discovered is the so-called Warren mastodon, unearthed a century ago from a swamp near Newburgh, New York. This skeleton was first exhibited in many towns and cities of eastern North America, but in time it came to rest in the private museum of Dr. John C. Warren of Boston. In 1909 it was purchased

mastodon was contemporaneous with early ma in North America. There is good reason t think that the mastodon persisted until a ver late geologic time; it was almost certainly li ing on the continent ten thousand years ago, a it may have lingered on until as late as four five thousand years ago. Mastodon bones ha been found in undoubted association with art facts, and there are some objects of early India art that may represent crude attempts to depi the mastodon. However, there are no u equivocal legends among the Indians of the ma todon. See also ELEPHANT; MAMMOTH.

Consult Osborn, H. F., *Proboscidea*, vol. 1 (New Yo 1936); Romer, A. S., *Vertebrate Paleontology* (Chica 1945).

EDWIN H. COLBERT,
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MASTODONSAURUS, măs-tō-dŏn-sō'rŭ a fossil labyrinthodont batrachian found in th

Triassic formations of England, Württemberg and India. It is the largest type known, the head having a length of four feet with a body extending to a length of 10 feet, on short, tiny limbs. The skull was greatly flattened and the eyes looked directly up.

MASUDI (Abu-l Hasan 'Ali ibn Husain ibn 'Ali ul-Mas'udi), Arabic geographer and historian: b. Bagdad, near the close of the 9th century; d. Fostat, about 956 A.D. Receiving a good education he set out to study the history, manner of life, and customs of every land at first hand. This quest took him to Persia and Kerman, in 915 to Istakhr, to Multan and Mansura in 916. From there he journeyed to Cambay, Saimur and Ceylon, to Madagascar and back via Oman. He also visited the shores of the Caspian; journeyed to Tiberias in Palestine. He visited Antioch in 943 and Damascus in 945. The last decade of his life was spent in Egypt and Syria. Of the Mo'tazilite sect, he was free from bigotry, studied Christianity and Judaism and was well versed in the history of the principal nations of both Orient and Occident. He wrote a universal history in 30 volumes, entitled *Kitab akhbar uz-Zaman,* followed by a supplement in *Kitab ul-Ausat,* a chronology of general history. The two works were combined by the author in *Muruj udh-Dhahab wa ma'adin ul-Jawahir* (*Meadows of Gold and Mines of Precious Stones*) in 947. Editions have been published at Bulak (1866) and at Cairo (1886). The original with French translation by C. B. de Maynard and A. de Courteille has appeared, 9 vols. (Paris 1861–77; vol. 1, in English by A. Sprenger, London 1841). An enlarged edition of this work finished by Masudi in 956 appears to be now lost. Another work, written in 956, is *Kitab ut-Tanbih wal Ishraf* (*Book of Indication and Revision*) is a summary with corrections of his other writings. It was edited by M. J. de Goeje (Leyden 1894) and there is a French translation by Carra de Vaux (Paris 1896) and a partial translation by De Saaj's memoir to Meynard's edition of *Muruj.* Consult Brockelmann, Karl, *Geschichte der arabischen Literatur,* vol. 1 (Weimar 1899); Weld, C., *Tales of the Caliphs* (1909); Nicholson, R. A., *Literary History of the Arabs* (Cambridge 1907).

MASULIPATAM, or **BANDAR,** British India, capital of the district of Kistna, Madras, situated at the mouth of the Kistna, on the Bay of Bengal. It was the earliest English settlement on the Coromandel coast, an agency being established there in 1611. Subsequently the town was held for some years by the French; it was taken by storm by Forde in 1759. A storm wave inundated the town in 1864, and about 30,000 lives were lost. Weaving, bleaching and cloth printing are the principal industries, but do not enjoy their former importance. Noble College is the chief educational institution. The port is merely a roadstead in which vessels anchor five miles off shore. Masulipatam is reached by a branch of the Southern Mahratta Railway from Bezwada. Pop. (1941) 59,146.

MASURIAN LAKES, Battle of. See War, European, *Eastern Front.*

MA'T, the Egyptian goddess of justice and truth. She was usually represented as wearing an ostrich feather on her head, with eyes bandaged as a sign of her impartiality. Judges and kings were at all periods her professed worshippers. The father of the goddess was Rê, the sun god. Her Greek compeer was Themis. Consult Budge, A. E. T. W., *The Gods of the Egyptians,* vol. 1, (London 1904) and Wiedemann, Alfred, *Religion of the Ancient Egyptians* (New York 1897).

MATA HARI, mä'tà hä'rē (real name Gertrud Margarete Zelle), Dutch dancer and courtesan: b. Leeuwarden, Netherlands, Aug. 7, 1876; executed by the French as a spy at Vincennes, France, Oct. 15, 1917. The convent-bred daughter of a Dutch business man, Gertrud Zelle at 18 married an elderly profligate, Capt. Campbell MacLeod, of Scottish descent and commissioned in the Dutch Colonial Army. Soon after their marriage, a son was born in Amsterdam where the couple lived in a fashionable quarter. The husband's gambling debts threatening ruin, she initiated her career of an adventuress by blackmailing a rich admirer. Another child, a daughter, was born before they sailed for Java where the captain commanded a battalion of the Colonial Army Reserve. From the outset the marriage was a miserable failure, and on their return to Holland Mrs. MacLeod instituted divorce proceedings. The courts denied the application but later granted her husband a decree. In 1903 she went to Paris, ambitious to become a dancer. While training for this profession, she earned money as an artists' model, and in other ways. During the decade preceding World War I, she gained notoriety on the vaudeville stages of Paris, Berlin, Vienna, Rome, and London. But she preferred to give private performances of her erotic dances, supposedly of symbolic religious significance, before select gatherings of persons in the upper political and social circles. Thus she came to know men who were prominent in the government and established intimate relations with them. Her middle-class Dutch origin lacking glamour, she represented herself as having been born on the Malabar coast of southern India, the daughter of a dancing girl who died in giving her birth. Named Mata Hari, meaning Child of the Dawn, she was brought up in a Brahman temple dedicated to Siva, the god of evil, and became one of his votaries. Tall, slim, and beautifully formed, with sombre eyes, black hair and amber skin, she easily convinced admirers of her Hindu pedigree, although the only Asiatic heredity she could truthfully claim was a strain of Semitic blood in the paternal line. Several years before the war she attended the German espionage school at Lorrach. In 1914, on the day war was declared she rode through the streets of the German capital with Berlin's chief of police. A citizen of a neutral country with property in France, she was able to return to France in 1915 despite the war. On this occasion she changed her role of an Oriental dancer to that of a rich woman of fashion. Before her arrival the French secret service had full reports on her both from its own agents and from the Italian secret service. They knew her relations with the Berlin police chief, the German crown prince, and other Reich officials. But lacking direct evidence they were unable to establish absolute proof of her criminality. Furthermore, among her protectors were men high in both the French and Dutch governments. For months she skillfully avoided

the numerous traps laid for her by the French Deuxieme Bureau. Finally she was arrested in a Paris hotel on Feb. 13, 1917, the day after her return from Madrid where she had been observed in frequent conferences with the heads of the German military and naval intelligence services. The evidence proving her a spy which had been accumulated over many years was at last incontrovertible. One of the most damning documents was an intercepted telegram from German Army headquarters to the embassy in Madrid instructing H21 (her code number in the German secret service) to return to Paris where 15,000 pesetas would be delivered to her. The check was found on her after her arrest. Another proof was her acceptance of 30,000 marks from the German secret service before her return to France in 1915. Her relations with French, British, and Russian officers, particularly of the flying services, had enabled her to obtain much valuable military information which she was able to forward to the Germans through seemingly innocent letters to her daughter conveyed by the Dutch diplomatic pouch from Paris. At her trial it was estimated that her espionage activities had been responsible for the death of at least 50,000 Allied soldiers. She faced a firing squad at Vincennes with surprising fortitude for a woman whose life had been a long career of debauchery. Consult: Coulson, Thomas, *Mata Hari: Courteson and Spy* (New York 1930); Morain, Alfred, "The Case of a Spy—Mata Hari" in *Underworld of Paris* (New York 1931).

MATABELELAND, mä-tä-bē'lē-länd, a region in Southern Rhodesia, Union of South Africa, between the Limpopo and Zambesi, north of the Transvaal. In 1889 it came under the administration of the British South Africa Company, against whom the natives unsuccessfully rebelled in 1893 and 1896. The Matabeli are a warlike Kaffir race, who migrated from Natal in 1827 under their chief, Umsilikatse. The country is traversed by ranges of hills—the Matoppo Hills being the chief—is watered by numerous streams. On Sept. 12, 1923, it became part of Southern Rhodesia when that country became part of the British Empire. Buluwayo is the chief town. Other towns are Girelo and Selukwe. Pop. (1936) 1,899 whites and 263,857 natives. The Cape to Cairo Railroad passes through Bukuwayo, which is 1,360 miles distant from Cape Town. Consult: Oates, Frank, *Matabele Land and the Victoria Falls* (London 1881); Montague, *Interior of Central Africa* (London 1886); Wills and Collingridge, *The Downfall of Lobengula* (London 1894); Norris, *Matabeleland* (London 1895); Baden-Powell, *The Matabele Campaign,* 2d. ed. (London 1901).

MATACHIN, măt a chēn', or **MATACHINE,** "the dance of fools," a former well-known comic dance performed by maskers in mock-military guise. It was common in France and Italy. The dance itself was merely a display of tumbling or acrobatic feats.

MATACO, a South American Indian stock, including several tribes, whose habitat is in the Vermejo River Valley in the Gran Chaco, in northern Argentina. They are of medium size with wavy hair and subsist by hunting, fishing, and cattle raising. Their dress is made of skins and they dwell in huts of brush. Consult Brinton, D. G., *Linguistic Cartography of the Chaco Region* (Philadelphia 1898); *Anales de la Sociedad Científica Argentina* (Buenos Aires 1904); Schuller, *Sobre el origen de los charrúas* (Santiago 1906).

MATADOR, in Spanish bullfights the man appointed to administer the fatal stroke to the bull. See BULL-FIGHT.

MATAGALPA, mä-tä-gäl'pä, Nicaragua, town, capital of the Department of Matagalpa, north of the central part of Nicaragua. It is situated in a fertile agricultural region, in which the chief products are tobacco, coffee, and sugar. The lack of railroads has been a hindrance to the growth of the towns, but a good highway is under construction to connect it with Managua, the capital, and other cities. The inhabitants are mostly Indians. Pop. (1940 est.) 8,506.

MATAMOROS, Mariano, mä-rē-ä'nō mätä-mō'rōs, Mexican patriot: b. Mexico, about 1770; d. Valladolid, Feb. 3, 1814. He first appears in 1810 as substitute priest of the parish in Jantelolco, a village south of Mexico City. In 1811 he identified himself with the revolt of Hidalgo (q.v.), and became the principal commander under Morelos (q.v.). He attained the rank of lieutenant general on April 19, 1813. On Oct. 14, 1813, he gained the victory of San Augustin del Palmar, and on Jan. 5, 1814, was captured at the defeat of Puruarán. He was executed in Valladolid market place. The town of Matamoros, on the United States frontier, was named in memory of this sterling patriot.

MATAMOROS, Mexico, a frontier town and river port opposite Brownsville, Texas, in Tamaulipas, on the right bank of the Rio Grande del Norte, about 30 miles above its mouth in the Gulf of Mexico. It consists chiefly of brick houses; around the public square stand the church, townhouse, customhouse, and a number of elegant private dwellings. A considerable trade is carried on with the United States; horses, hides, wool, and cottonseeds are exported, and manufactured goods imported. In normal years its commerce is valued at about $4,000,000. During the Mexican War in 1846 the town was occupied by American troops under General Taylor, on May 18. Pop. (1940) 15,699.

MATANE, ma'tán, Canada, town in Matane County, Province of Quebec, on the Canadian National Railroad. Steamers ply between it and Montreal and Gaspé. The town has large sawmills and extensive lumber interests. Matane is in a good hunting and fishing region. Pop. (1941) 4,633.

MATANUSKA RIVER, an affluent of Knik Arm, Cook Inlet, Alaska. The valley of this stream has extensive coal deposits which have been the subject of federal legislation in recent years. See ALASKA, and consult Martin, "Matanuska Coal Field," (*United States Geological Survey,* Bulletin 239), and "Railway Routes in Alaska," *Document 1346,* House of Representatives, 62d Congress, 3d session.

MATANZAS, mä-tăn'zas (Sp. mä-tän'thäs), Cuba, a seaport city on the north coast, capital of Matanzas province, 52 miles by rail east of

Havana. It is situated on Matanzas Bay, one of the largest, safest, and most convenient harbors of the Western Hemisphere. The city is well built with wide, regular and paved streets, handsome plazas and public buildings, and good railway communications. The caves of Bellamar and Yumuri Valley, in the neighborhood, are two popular natural resorts. Matanzas ranks in importance next to Havana in the export of sugar, molasses, rum, and coffee. It has several mills, distilleries, oil refineries, tanneries, shoe factories, and machine shops. It was founded in 1693. The city was bombarded by the United States warships during the Spanish American War in 1898, the only casualty, widely telegraphed, being an injury to a "Matanzas mule," which made the animal famous. Pop. (1943) 49,591.

MATAPAN, măt'ă-păn, **Cape** (modern Greek TAÍNARON; ancient TAENARUM), a promontory of Greece, forming the southern extremity of the Peloponnesus, in latitude 36° 23′ N. and longitude 22° 29′ E. It was sacred to Neptune, whose temple stood nearby. The British sank two Italian destroyers, three cruisers, and damaged a battleship near here in a naval battle in March 1941.

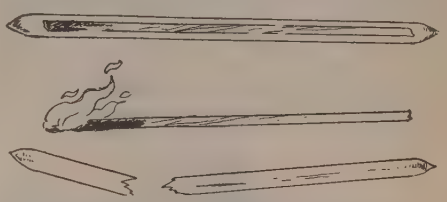
MATAS, Rudolph, American surgeon: b. Bonnet Carre, near New Orleans, La., Sept. 12, 1860. He was educated at Barcelona, Spain; Paris, France; Brownsville, Texas; Soule's College, New Orleans; St. John's Literary Institute, Matamoros, Mexico and at Tulane University. After his graduation he practiced in New Orleans. In 1895 he was appointed to the chair of surgery at Tulane University where he served until 1927. Dr. Matas was senior surgeon of Touro Infirmary (1905–1935); and honorary chief surgeon since 1935, and senior visiting surgeon at the Charity Hospital until 1928 when he became a consultant. He was president of the American Surgical Association in 1910; and of the Southern Surgical and Gynecological Association in 1911. From 1883 to 1895 he edited the New Orleans *Medical and Surgical Journal.*

MATCH INDUSTRY. It was in 1669 that the Hamburg alchemist, Hennig Brand (Brandt) discovered phosphorus while experimenting with an olio he hoped he could reduce to gold. But while phosphorus was soon used in several briefly popular fire-producing forms, it was not adapted to the manufacture of matches for about 160 years.

In 1680 both Godfrey Haukwitz and Robert Boyle sold coarse sheets of paper coated with phosphorus in combination with splinters of wood tipped with sulphur. When the splinters were drawn through a fold of the paper they burst into flame. Since the price of an ounce of phosphorus in those days was the equivalent of $250 today, the clientele for these early matches was limited to the extremely wealthy, and when their interest in the novelty ebbed, both sales and experiments ceased.

Disinterest in phosphorus continued for a century, during which the world continued to rely chiefly upon flint and steel for sparks to be nursed into the fires it needed for warmth, cooking, and manufacture. Then, in 1781, began a cycle of inventiveness which was to produce modern matches.

The first of these inventions was the *Phosphoric Candle* or *Ethereal Match* which appeared in France in that year. It consisted of paper tipped with phosphorus, sealed in a glass tube. Admission of air when the glass was broken set the paper to flaming. The *Pocket Luminary* (Italy, 1786) was a small bottle lined with oxide of phosphorus. Sulphur-tipped wood splints ignited when rubbed on this coating and withdrawn. The *Instantaneous Light Box,* invented in 1805, was highly popular with American gentlemen up to the time of the Mexican War, despite obvious dangers. Like the luminary, it involved a small bottle, this one filled with sulphuric acid. The splints, treated with a composition of potassium chlorate, sugar, and gum arabic, were called *Empyrion* or *Oxymuriated Matches* in the United States and retailed for $2 for 50 together with the "box."



The Ethereal Match (1781) comprised of paper, tipped with phosphorus and sealed in a glass tube.

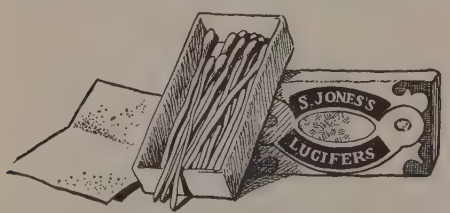
The last of these elaborate early matches was the *Electropneumatic Fire Producer,* involving the principle of the ignition of a fine jet of hydrogen gas by a spark from charged rosin. The German chemist, Johann W. Döbereiner, produced several types. He created gas by the action of sulphuric acid on zinc and directed it in a thin stream upon a platinum sponge in contact with the air. Several of Döbereiner's models still survive in museums.

Even after the birth of the match in its original modern form in 1827, inventors continued to contrive unusual means of producing fire. Self-lighting cigars of two types were introduced in Austria in 1839. In some of these a short splint of wood with a matchhead decorated with rosettes of linen was inserted in the tips. When the cigar was struck, the smoker inhaled a combination of the fumes of match composition, burning wood and linen, but he had a light. Another type wore a frilly cap of treated paper much like the lacy "socks" placed on lamb chops in some restaurants. Pellet matches (1850) made of sawdust, flour, and match composition were exploded by a plunger machine carried by users. Another pellet match came in strips like caps for a Fourth of July pistol and when detonated set fire to the paper holding them. *Wire Fixed Stars, Chinese Lights, Prussian Wax Fusees,* and *Latchford's Bone Stem Cigar Lights Which Will Never Fall Off, Break Or Burn The Fingers in Using* are the names of some of the novel lights appearing in the 1860's.

As late as 1882, the Diamond Match Company bought the patent for the *Drunkard's Match,* the splint of which was treated chemically so that it would not burn beyond midpoint. This match was highly popular with American *bons vivants* for twenty years. Much later the match inventors produced the *repeatedly ignitible* or *everlasting* match. In 1932, Rudolf Koenig and Zoltan Foldi, Austrian chemists, patented a

repeatedly ignitible rod resembling a styptic pencil wrapped in Cellophane. Actually it was an elongated match head, loaded with fire retardents to make it burn more slowly. Each of these matches was good for 40 lights if carefully nursed, and packets of three were sold in Europe for approximately 5 cents. Tried out in Holland, these repeatedly ignitible rods proved unsuccessful commercially.

The Friction Match.—While Döbereiner was still manufacturing his elaborate Fire Producers, the first friction match had already been made and sold in England (1827). The records of an apothecary, John Walker of Stockton-on-Tees, show that he sold to a Mr. Hixon "100 Sulphurata Hyperoxygeneta Frict." Later analysis indicated that Walker's friction matches were tipped with antimony sulphide, potassium chlorate, gum, and starch. They were three inches long and were ignited by drawing them through a pleat of "glass paper." Two years later when Walker exhibited his matches to amazed Londoners, one of the spectators, Samuel Jones, was not too excited to note there was no protecting patent and he promptly set himself up in the match business. Jones named his



Samuel Jones' *Lucifers* appeared in London in 1829 and smelled so badly he warned users to avoid the fumes.

matches *Lucifers*. Their ignition was accompanied by a series of small showers of sparks and odors so offensive that this warning was printed on their boxes: "If possible, avoid inhaling gas that escapes from the combustion of the black composition. Persons whose lungs are delicate should by no means use Lucifers."

In 1830, about 160 years after its discovery, phosphorus was adapted by Dr. Charles Sauria of France as an ingredient for match heads. Sauria substituted it for antimony sulphide in the Walker formula and in so doing improved the efficiency of matches but set off a wave of necrosis which was to exact a fearful toll of life among match makers and users for 80 years. Necrosis, called "phossy jaw" by workers, attacked the bones, particularly of the jaws and resulted in maiming or death. In addition, innocent persons, babies especially, were poisoned by ingesting match heads containing phosphorus, and they furnished a widespread and easily available source of poison for suicide and even murder.

This dreadful occupational hazard plagued American factories until 1911 when William A. Fairburn of the Diamond Match Company adapted harmless sesquisulphide of phosphorus to United States climatic conditions. The new nonpoisonous formula was presented to the government for the use of all rival companies, a humanitarian gesture which won public commendation from President William Howard Taft and for which Mr. Fairburn and his company were given the Louis Livingston Seaman Medal "for the elimination of occupational disease."

Substitution of sesquisulphide of phosphorus in the formula accomplished other things. It raised the point of ignition more than 100 degrees, a considerable safety factor, and it ended fires caused by rodents. Experiments conducted by Mr. Fairburn proved conclusively that while rats and mice would gnaw on phosphorus matches, thus igniting them sometimes, they would not touch the new match heads even when starving.

Manufacture of the dangerous phosphorus matches began in the United States in 1836 when Alonzo Dwight Phillips, a Springfield, Mass., powder maker, secured a patent for "new and useful improvements in modes of manufacturing friction matches for instantaneous light." Phillips made his phosphorus matches by hand and when he had a wagon load, sold them himself from door to door thus founding an industry which now produces about 500 billion matches each year in the United States.

At that time, only one type of match existed, the wooden strike-anywhere that is sometimes called the "kitchen" match today. The discovery of red or amorphous phosphorus by Professor Anton von Schrotter in 1845 led to the development of another type of match, the safety, by J. E. Lundstrom 10 years later. The safety match differs from the strike-anywhere only in one regard: part of the ingredients necessary to create fire are in the head of the safety match, part in the striking surface on the box.

The third basic form of modern match, the paper book variety, was the invention in 1892 of an attorney, Joshua Pussey. His books contained 50 matches, had the striking surface on the inside where sparks frequently ignited the remaining matches, a danger quickly corrected by the Diamond Match Company which bought the patent in 1895. Unpopular at first and made by hand, book matches became big business in 1896 when a brewing company ordered 10,000,000 books to advertise their brews, forcing creation of machinery for swift production in volume. Today the industry manufactures 200 billion book matches annually in the United States with about 196 billion being handed out free to customers of cigar stores, hotels, restaurants and railroads, a practice unknown in any other country.

At the time of the Phillips patent, matches all over the world were made by hand on a piecework basis in the homes of the poor, a condition which led to the infection by necrosis of a considerable segment of the populations in industrial areas. The boxes also were made by hand in homes. The first American patent for a machine to cut round splints was granted to Chauncey E. Warner in 1841.

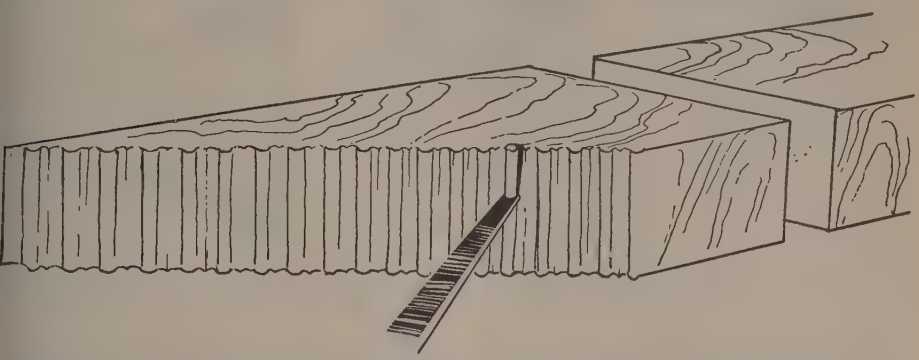
The trend toward mechanization of the industry and the centralization of efforts in factories instead of homes began in 1842 with the invention of a machine by Reuben Partridge, which cut the wooden splints in bulk, ending tedious hand methods for this important process. Other inventors contributed to match machines, each performing a function, but real mechanical impetus came in 1883 when Ebenezer Beecher of Connecticut designed three "continuous" automatic match-making machines by combining all

functions in one device. Beecher made these machines for Ohio Columbus Barber, of the newly formed Diamond Match Company, and they became the models for all future equipment in the industry.

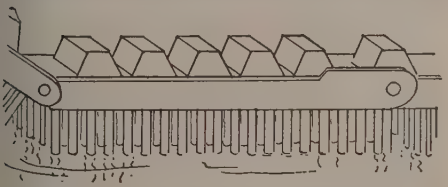
Modern Methods of Manufacture.—The methods used to manufacture all types of matches are basically the same. The wood or paper for the splints must be cut into proper size, dipped to create the heads, dried and assembled in books or boxes for retail sale.

suring a flat pack. The boxes, covers, and wrappers for the matches are made in the same factories as the matches and the output is synchronized so that matches and containers reach the packaging machinery simultaneously.

Some United States factories have as many as 20 continuous automatic match machines, each capable of producing 10,000,000 matches in an eight-hour shift, a factory total of 200,000,000 each one-shift day. Shipment of a day's output would require five freight cars.



Razor-sharp dies hew the match splints from pine blocks, then lodge them in perforations in the steel plates of an endless chain.

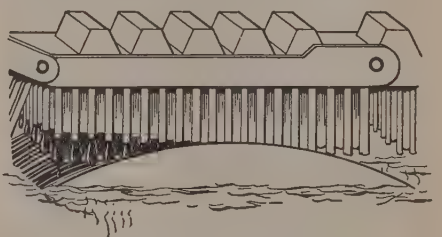


Cut from straight-grained white pine, match splints are carried on an endless chain until completed, then counted automatically into boxes.

Hence, the making of the strike-anywhere match on the modified Beecher machine gives a good overall picture of the processes involved.

The machines, 60 feet long, two stories high, convert blocks of straight-grained pine into packaged matches in 60 minutes at a rate as high as 1,125,000 an hour. The pine blocks, cured from 12 to 18 months, are fed into the head of the machine where a row of from 42 to 57 dies cuts the splints and fixes them into perforations in an endless chain of metal plates, each with 12 rows of perforations. It is this operation which creates the visible indented collars at the holding tips of all round wooden matches.

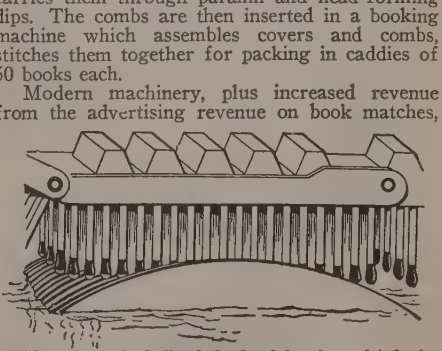
The dies cut 350 rows of 42 to 57 splints each minute, setting them into the plates on which they ride through a series of five dips and baths which treat the wood against afterglow, provide a collar of paraffin to speed combustion, put on the main bulb and its "eye" and finally dip the heads with a solution which protects them from weather changes. Punched out of their plates after the final drying, the matches pour down a trough to drop into endless chains of boxes waiting for them. On the larger-size boxes an ingenious device turns the matches so that approximately half the heads are to the right, and the balance to the left, as-



Riding upside down on steel plates, the match splints pass through grooves in a roller rotating in a vat of composition which creates the main bulb of the head.

Book matches are not made on a single continuous machine but in two separate operations under the same roof. The first machine, called "cut, set and dip," slices rolls of pretreated cardboard into combs of 60 matches each then carries them through paraffin and head-forming dips. The combs are then inserted in a booking machine which assembles covers and combs, stitches them together for packing in caddies of 50 books each.

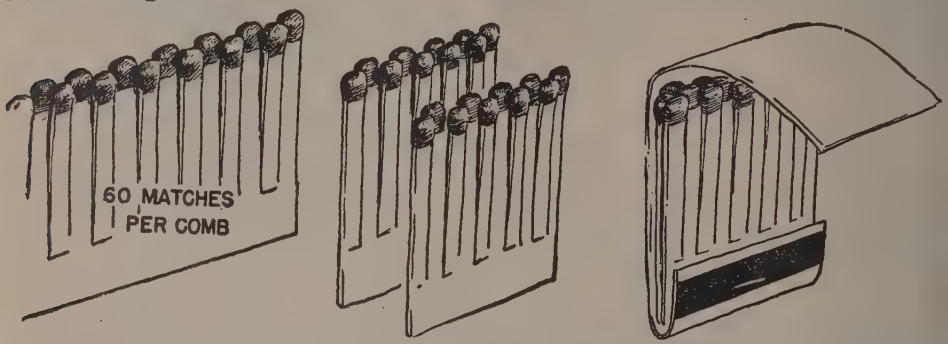
Modern machinery, plus increased revenue from the advertising revenue on book matches,



After the main bulb of the head has been dried, the matches pass through another tip which fashions the "eye" of sesquisulphide of phosphorus.

has kept United States production costs at a minimum. As a result match prices, unlike those of most other household necessities, have remained the same for a half century despite increased labor and material charges. Five cents for a box of strike-anywhere matches and a penny for safety matches has been standard for more than two generations.

logical Warfare Branch selected book matches to carry morale-lifting messages to nations held captive by the Axis early in the war. Millions of these books with messages in Burmese, Chinese, Greek, French, Spanish, Dutch, Italian, and English printed on their covers were dropped by Allied planes behind the enemy lines. Before the invasion of the Philippines, when native



Book matches are sliced in "combs" of 60 from a roll of pretreated cardboard. After the heads have been put on, the "combs" are cut into proper widths, usually 10 matches, and stapled in two layers between the paper covers.

Since the turn of the century, match machinery has been constantly improved, and there have been three outstanding advances in American matches. The first of these, the nonpoisonous match, has already been discussed. The second was an improvement in the safety factor. It had been known, long before 1912, that match splints treated with an aqueous solution of ammonium phosphate retained no ember or afterglow when the match was blown out. Matches made under the veneer method (cut separately and dipped in composition in bundles) had been impregnated against afterglow simply by tossing them into vats of solution. But American matches were cut and made on a single machine which barred this method. But in 1912, fresh from his triumph with the nonpoisonous match, William A. Fairburn, developed a spray attachment for the continuous match machine which would impregnate matches in course of manufacture. As with his previous development, Fairburn gave blueprints to the rivals of Diamond Match Company in the interests of fire prevention.

World War II produced another advance, the waterproof match, dream of matchmakers since the birth of the industry. The United States War Department needed a match that would function in the long rainy seasons of the South Pacific and called on the industry for help. Raymond Davis Cady, chief chemist for Diamond Match, produced a formula, approved by the army, which resulted in matches which can remain under water eight hours yet still function. The match went into production Dec. 7, 1943, and was supplied at the rate of more than 10,000,000 daily to the armed forces. The Quartermaster Board, United States Army, was offered the formula for lending to other manufacturers in the war effort. Universal and Ohio Match companies were also large producers of water resistant matches for the services.

Another war service performed by matches was in the propaganda field. Because of their compactness, cheapness, and scarcity (even in normal times) in foreign countries, the Psycho-

morale was at low ebb, American aircraft scattered 4,000,000 books of matches to notify the enslaved natives: "I Shall Return—Douglas MacArthur."

Labor and material shortages upset production figures in the United States during the war, but normally America makes 200 billion each of book and strike-anywhere matches and 100 billion safety matches annually, the largest national output in the world. Other large manufacturers are Great Britain, Russia, and Sweden. Before the war, Japan ranked high in match volume and for a period flooded the United States and other countries with cheap matches, packaged in containers so nearly like those of leading manufacturers that only close scrutiny revealed their real origin.

Except for a period of six months during the war when the United States Army and Navy requisitioned 100 per cent of the safety and 35 per cent of the book matches, there has never been a match shortage in the United States.

One of the interesting features of the match industry is that more than half of the value of the goods it makes represents wages paid to its employees. For most products labor's wages represent only a small percentage of the value.

STUART LITTLE.
Writer and Publicist.

MATE.—A deck officer in the Merchant Marine ranking below the captain. If there is more than one mate, they are designated first mate, second mate, and so on. See PETTY OFFICER.

MATÉ or PARAGUAY TEA. The dried and powdered leaves of *Ilex paraguayensis,* infused and sweetened with sugar. It is sucked up through a special tube which strains off the leaf particles, is aromatic and somewhat bitter, and has refreshing and restorative effects. Large quantities are grown and consumed in Parana, Brazil. *Ilex paraguayensis* is a tree allied to the holly, *Ilex aquifolium.* The exportation of maté

is to Paraná what the exportation of coffee is to the neighbor state of São Paulo: the basis, practically, of economic achievement. Brazil alone produces about 200,000 tons annually, exporting 40 per cent to her neighbors.

MATEHUALA, mä-tä-wä'lä, Mexico, a southern town of the state of Nuevo Léon, with silver-melting establishments and important silver mines in the vicinity. Gold and copper are also found nearby in paying quantities. The city is well built, has several plazas and wide streets. Pop. 12,000.

MATERIA MEDICA (Lat. «medical matter»), that division or branch of medical science which treats of drugs, their origin, classification as natural products, preparation, purification, action on the animal economy, together with the mode of administering them for the relief and cure of disease. The action of the various agents in the materia medica upon the human family has been ascertained by experience, sometimes by experiment, especially by administering various drugs to some of the lower order of animals such as dogs, cats, rabbits, guinea pigs, rats and mice. Perhaps the best general classification of medicine is as stimulants, sedatives, narcotics, emetics, alteratives, tonics, anæsthetics, antispasmodics, astringents, spinants, cathartics, diaphoretics, diuretics, blennorrhetics, emmenagogues, hæmatinics, antacids, irritants, demulcents, coloring agents and anthelmintics. This classification is based upon the direct effect of the different drugs upon the tissues of the human economy under the various headings which drugs may be conveniently grouped under four general sections, namely: 1. Those which have a special action on the brain, spinal cord and the general nervous system. 2. Those which have a special action on the secretions. 3. Those which change the blood. 4. Those which act locally, when applied to the surface of the body. Section (1) includes antispasmodics, anæsthetics, astringents, narcotics, tonics, sedatives, spinants and stimulants. Section (2) includes the emetics, emmenagogues, blennorrhetics, diuretics, diaphoretics and cathartics. Section (3) includes alteratives, antacids and hæmatinics. Section (4) includes anthelmintics, coloring agents, demulcents and irritants. See PHARMACOPŒIA; THERAPEUTICS.

MATERIALISM, the philosophical theory that everything which exists is ultimately material in nature, or that whatever is real can be derived and explained in accordance with the laws of material phenomena. This, of course, carries with it a denial of the reality of any finite or infinite spirit as an immaterial substance and a repudiation of all forms of idealism, which uses thought or intelligence as a principle of explanation. Materialism, however, may be more or less explicit and may maintain either absolutely, or with various modifications, the primary and all-embracing character of matter. Thorough-going materialism asserts that nothing exists but physical bodies and physical processes. What are called immaterial substances and processes it either declares to be unreal, or explains away as ultimately not different in nature from physical substances and processes. Moreover, for materialism of this consistent and uncompromising type, matter is dead and moved only by mechanical forces. It has no «psychic side,» and the laws which it obeys are the expressions of a blind physical necessity. This extreme view is perhaps no longer maintained by any philosophical thinker of reputation, but in various modified forms it still exists as a tendency to subordinate mental phenomena to physical processes. The more important of these modifications and limitations may be brought under the following heads. (1) The subordination of mental phenomena, while still acknowledging more or less explicitly their distinctive character, to physical, and especially to physiological processes as their determining causes. This position does not usually avoid any of the practical consequences of materialism, and always tends, when thought out, to revert to the strict ontological form of the theory. For it is an easy transition from the view that physical processes are able to cause mental modifications to the opinion that the mind is not fundamentally different in character from the matter which affects it. (2) The view that matter is not a dead lump or mass that moves only when acted upon by some external body, as the older theories assumed, but that every particle of matter—every atom, or it may be every cell—is «conjoined with a soul,» or has a «psychical side,» or «contains a certain element of mind-stuff.» By thus introducing an element which is different in character and in mode of operation from matter, this theory seems to differentiate itself in principle from materialism. Nevertheless, it is usually assumed tacitly by representatives of this modern Hylozoism that within the atom or cell the material side is the primary and determining element, while the physical is secondary and subordinate. Moreover, the whole mode of conception usually remains at the mechanical stage, since the immaterial element never comes to its rights as an ideal principle, but is conceived as a mere moving force or instinct, and also since it is assumed that the complex mental life can be built up by the composition of psychic elements just as a material body is constituted by the combination of its parts. (3) The position of energism. Recently an attempt has been made to find in energy an ultimate reality in terms of which both mental and material phenomena may be expressed. It cannot be maintained, however, that the conception of energy has yet been clearly defined, nor is everyone prepared to accept the assurance of Professor Ostwald, the chief representative of the theory, that energy is the concrete reality which we directly experience. To many it may appear to be merely an abstract conception built out of the data of experience. Apart from this difficulty, however, energism does not avoid materialism merely by dematerializing its fundamental principle. In Professor Ostwald's hands, it appears to remain essentially materialistic; since the conceptions employed and the laws which the transformations of energy obey are those of physical science.

If the period of the Middle Ages is excepted, when philosophical thought was determined mainly by theological conceptions, materialism may be said to have held a place throughout the whole history of philosophy. We have already noticed some of the forms in which this

mode of thought continues to appear at the present day, and may now refer briefly to its more important historical representatives. The systems of the early Greek philosophers who found the fundamental principle of things in some physical substance, such as water, air or fire, cannot properly be classed as materialism. For as yet there was no opposition between the material and the spiritual. Neither the conception of matter as lifeless and unintelligent substance, nor of mind as an immaterial directing principle, had yet been formed. Atomism, as developed by Democritus of Abdera, is the first thoroughgoing system of materialism. Democritus taught that the soul, like everything else, is an aggregate composed of atoms. The soul-atoms differ from all the others in being the finest, smoothest and most mobile. When they are in isolation, they are insensible, but from their union sensation arises. From sensation all the other processes of the mental life originate. The same conclusions were maintained by the Epicureans, who adopted without any essential modification the theory of atomism. In spite of the statement of the Stoics that whatever exists is corporeal, their system cannot properly be described as materialism. For the human soul and God, the all-embracing Logos of which the human reason is a spark of emanation, though constantly described in materialistic terms, yet function ideally as rational directing forces.

Materialism was revived in modern times by Gassendi (1592–1655) (q.v.) under the form of atomism. Modern materialism was, however, first worked out by Thomas Hobbes (q.v.), who based it upon the mechanical conceptions which in his day were being made the basis of all physical science. He did not deny the existence of immaterial things — God, angels, pure spirits — but shrewdly contented himself with showing that only that which is composed of parts, that is, bodies, can be the object of thought and so be known. All real phenomena must therefore be explained in accordance with the mechanical theory and in terms of the movement of bodies. Under the influence of the developing physical sciences and especially of the dominant conception of mechanism, materialistic tendencies played an important part in the thought of the 18th century. David Hartley (1704–57) and Joseph Priestley (1733–1804) (q.v.) definitely subordinated the mental life to the bodily processes, though the latter attempts to reconcile his materialism with Christianity and even to support it by appealing to the Bible. It is in France, however, in the systems of La Mettrie (1709–51), Baron d'Holbach (1723–89), and Cabanis (1757–1808) (q.v.) that we find in this century representatives of materialism who do not hesitate to draw the most extreme consequences of their doctrine, to deny the existence of God and to reduce man to a mere piece of physical mechanism. Again, in the middle of the 19th century, a revival of materialism occurred in Germany which had an important popular influence. The most important names connected with this movement are Carl Vogt, J. Moleschott, H. Czolbe and Louis Büchner (whose book, 'Kraft und Stoff'—'Force and Matter'— has been called the Bible of German materialism, and has passed through numerous editions in its English translation). The general adoption of the evolutionary point of view was in the beginning at least favorable to materialism. The philosophical problem seemed to be to derive from some primitive form of matter all the various modes of existence in accordance with the established laws of physical evolution. To this task Herbert Spencer (q.v.) devoted his life with a result that is variously estimated in different quarters. It can at least be said that at present thinkers are more inclined than formerly to question the adequacy of physical science to furnish a complete and final explanation of the nature of the evolutionary process.

Bibliography.— Lange, 'Geschichte des Materialismus' (Eng. trans., 3 vols., London 1878–81); Büchner, 'Force and Matter' (London 1864); Haeckel, 'The Riddle of the Universe' (New York 1899); Paulsen, 'Introduction to Philosophy' (New York 1895).

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MATHEMATICAL INDUCTION. See INDUCTION, MATHEMATICAL.

MATHEMATICAL SIGNS AND SYMBOLS, *in mathematics,* a symbol employed to denote an operation to be performed, to show the nature of a result of some previous operation, or to indicate the sense in which an indicated quantity is to be considered. The present mathematical symbolism is due to the labors of many men — men having different habits of thought, men living in different ages, men speaking different languages. A physicist will employ sine *a* and sine *b* to calculate the angle of refraction of light. Now certainly there is neither sine *a* nor sine *b* in reality; yet there are most certainly *relations of reality* which are accurately described in these expressions, sine *a* and sine *b*. Such is the function of all signs, symbols or characters. Whenever the eye can be brought to the aid of one's imaging faculty, a success in grasping a thought may often be gained which would otherwise be a failure. This is in particular true in mathematics where the subject matter, while objective, is non-sensible. In this way signs, and symbols, stand for the emphatic presentation of mathematical ideas, often very subtle even when symbolized; and with such signs these ideas become, as it were, easy to exhibit, that is, in thought; and the relations of these ideas become thinkable, even very often to the whole complex train of ideas in which they occur.

One very important property for symbolism to possess is that it should be concise, so as to be visible at a glance of the eye and to be rapidly written. A sign should if possible always represent the same object, and the same object should always be represented by the same sign. If a new sign be advisable, permanently or even temporarily, it should carry with it always some mark of distinction from that which is already in use, unless it be a demonstrable extension of the latter (De Morgan). The importance of notation is recognized when it is remembered, for example, how great an advance toward the solution of the famous problem of the three bodies was made when special attention was given to it, and a special symbolism chosen for it. And the invention of the symbol $\equiv$ by Gauss affords

a fine example of the advantage which may be derived from a good notation; it, without exaggeration, marks an epoch in the development of the science of arithmetic. The language of analysis, says Laplace, being in itself a powerful instrument of discoveries, its notations, especially when they are necessarily and happily conceived, are so many germs of new calculi.

Nowadays we have a symbol for each mathematical operation. Sometimes, even a choice of symbols. And most of the letters of the English alphabet are now engaged for special mathematical purposes. Thus:

a signifies sometimes a finite quantity; at other times a known number, the side of a triangle opposite A; also an intercept on the axis of x, and, finally, altitude.

b like a signifies a known number, and also a side of a triangle, the one opposite B; it also stands for base; and lastly, for an intercept on the axis of y.

c signifies constant.

e signifies the base of the Napierian logarithms.

A considerable inroad has been made, also, into the Greek alphabet:

γ signifies the inclination of the axis of x;

π stands for the ratio 3.14159;

ε is used for sum of tens similarly obtained; and

σ indicates the standard deviation in the theory of measurements.

Some examples of reading notation may be given:

$a+b$, $a-b$, $a \div b$, $a \times b$, and $a \sim b$ are read a plus b, a minus b, a divided by b, a multiplied by b, and the difference between a and b.

Further:—$a > b$, $a < b$, $a = b$, $a \sim b$, and $a \equiv b$ are to be read a greater than b, a less than b, a equal to b, a approximating to b, and (Gauss' symbol) a identical with b.

Our present day symbols of operation, + (plus) and − (minus), appear to be among the oldest. Both are found in Widmann's Arithmetic published in 1489, at Leipzig. In the time of Widmann, the symbols ( ), ×, ÷, > and < were unknown. Rudolff had already begun to employ the radical sign. But = had not yet appeared. In those days almost everything was expressed by words, or mere abbreviations. Yet even then both cubic and biquadratic equations had already been solved; the methods even were published. Oughtred used the term «separatrix» in sense of a mark between the integral and fractional parts of a number written decimally. His symbol for a separatrix was ⌊. Stevens had already used a figure a circle over or under each decimal place to indicate its order. And of the various separatrixes that have been employed by mathematicians, four are still employed: (a) A *vertical line* is still employed to separate cents from dollars in ledgers, etc. Such a separatrix appears already in 1613, employed in a work by Richard Witt. Napier also used a vertical line for the same purpose in his 'Rabdologia,' in 1617; (b) a *period*, still employed as a separatrix, is so used as early as 1612 in the trigonometry of Pitiscus, a German. Napier, in his 'Rabdologia,' speaks of also employing a period or comma. The period has always been the prevailing form of the decimal point in America; (c) the Greek colon, or dot above the line, was advocated as a separatrix by no one less than Sir Isaac Newton. His desire was to prevent it from being confounded with a period used as a mark of punctuation. This form of the decimal point is now commonly used in England; (d) Pitiscus is the author of an Italian work on trigonometry. He, in this work, published in 1608, uses a comma as a decimal point. Kepler, in 1616, seems to have introduced this mark, the comma, into Germany for the same purpose. Briggs likewise used a comma in his logarithmic tables, in 1624; and several other early English writers generally employed the comma as a decimal point. But to-day the comma is customary form of the decimal point, *not* in England, but in countries upon the mainland of the European continent.

For example: $1\frac{50}{100}$ would in America be written decimally as 1.50; in England as 1·50; and in Germany, France and in Italy as 1,50.

Symbols in general may now be mentioned: The sign of cancellation is simply drawn across the factors cancelled, like the one drawn across the zeros above. These with the ordinary Arabic and Roman numerals and the abbreviations for the names of things, like £, s, d, $, ¢, °, ′, ″, constitute the main symbols of ordinary arithmetic. In algebra there are four kinds of symbols: symbols of quantity, of operation, of relation and of abbreviation. Known quantities are represented by the first letters of the alphabet; or by the final letters with one or more accents, as x', y'', z'''. Besides letters of Greek and even of the Hebrew alphabet are employed. Thus M stands for «modulus» of any system of logarithms. π has been spoken of.

Of symbols of operation, multiplication may be indicated by placing a point between the factors when both are expressed by letters, as $a \,.\, b$. In a series multiplication between factors expressed even by numbers, may be expressed by a point between such factors. When $\sim$ is used between two quantities, it denotes difference, but not which quantity is to be subtracted from the other. Division has been sometimes indicated thus: $a \mid b$. The radical sign, $\sqrt{\ }$, when placed over a quantity indicates that its root is to be taken. Thus $\sqrt{a}$ denotes the square root of a. In the same manner $\sqrt[3]{a}$ and $\sqrt[n]{a}$ are read the *cube root* and the *nth root* of a, respectively. Here ^{3} and ^{n} give the *index* of the radical. A vinculum, ———, a bar |, brackets [ ], and parentheses ( ) all indicate that the quantities enclosed by them are to be regarded together as wholes. In algebra, Σ denotes that the algebraic sum of several quantities of the same nature as that to which the sign is prefixed is to be taken. The letter f, F and ϕ, written before any quantity, or quantities, separated by commas, as

$$F(x),\ f(x,y),\ \phi(x,y,z),\ \text{et cetera,}$$

denote quantities depending upon the quantities, or the quantity, within the parenthesis, without designating the nature of the relation. The signs of proportion, : :: :, when placed between quantities show them to be in proportion. R, r and ρ, and other symbols, denote *radii* of circles. L, l and λ may denote latitude. The leading letters of the Greek alphabet are also

sometimes used to denote known angles; and the final letters of the same alphabet to denote unknown angles. And when several quantities of the same kind are involved in an investigation, they may be designated by the same letter differently accented; thus: a' a'' a'''; a_1 a_2 and a_n. An older usage of o denotes an infinitely small quantity; and only sometimes absolute zero. Clearer thinking has impelled moderns to use ι (iota) or i for an infinitesimal, and to denote by o, *absolute zero,* and that only. The symbol ∞, first employed by Wallis in the 17th century, has long been used both for a *variable increasing without limit* and for *absolute infinity.* Taylor, in 1898, introduced the symbol $\aleph_0$, a contraction of % for an *infinite,* the reciprocal of an infinitesimal. The sign $\therefore$ denotes *then* or *therefore;* and the sign $\because$, *since* or *because.* The $y = f(x)$ is a general sign, indicating that there is a *general relation* between y and x — that is, y and x are so connected that x cannot change without y changing at the same time. The symbol $F(x, y, z,) = 0$ implies that there is a general relation between x, y and z, without specifying the relation. The symbols *sin, cos, tan, co-tan, sec, co-sec, ver-sin, co-ver-sin,* are abbreviations used, respectively, for the words "sine," "cosine," "tangent," "cotangent," "secant," "co-secant," "versed-sine" and "co-versed-sine." When the arc is supposed, as in trigonometry, to depend for its value upon any of the trigonometric lines, the function is called the inverse trigonometric function. The following symbols are used to denote this kind of a relation:

$$sin—^{1}y,\ cos—^{1}y,\ tan—^{1}y,\ cot—^{1}y,\ sec—^{1}y,\ co\text{-}sec—^{1}y,\ ver\text{-}sin—^{1}y,\ co\text{-}ver\text{-}sin—^{1}y.$$

These stand, respectively, for the arc whose sine, cosine, tangent, co-tangent, secant, co-secant, versed-sine and co-versed-sine, is y. The principle of notation has been extended to all inverse functions; thus:

$$\log {}^{1}y,\ d—^{1}(x\,d\,x), \text{ etc.}$$

These stand, respectively, for the quantity whose logarithm is y, and the quantity whose differential is $x\,d\,x$, etc. The differential of a function, or independent variable, is denoted by d, thus:

$$d(y^2) = 2ydy.$$

If we suppose the form of a function to vary, the symbol employed to denote the variable is δ, thus:

$$\delta u,\ \delta y,\ \delta x.$$

If both the form of the function and the independent variable of the function vary together, the resulting variation is denoted by the symbol D, thus:

$$D f(x,y) \ldots\ldots$$

The differential is the difference between two consecutive states of the quantity differentiated. If it is desired to represent the difference between two states of a function which are not consecutive, the symbol Δ is employed. Successive finite differences are represented by the symbols:

$$\Delta u,\ \Delta^2 u,\ \Delta^3 u,\ \Delta^4 u, \text{ etc.}$$

We have already spoken of Σ as used in algebra, where it denotes an algebraical sum. Its use in the calculus is principally restricted to the denotation of the *sum of the finite differences of a function.* The symbol $\int$ denotes an integration to be performed; while the symbol $\int_a^b$ is used to denote *a definite integral* taken between the limits a and b. The symbol $\Gamma(x+1)$ stands for the integral $\int e^{-v} v^{x-1} dv$. The vector sign is U. $\Gamma\beta$, in quaternions, should be read tensor of B.

In the foregoing list nearly all the symbols commonly employed by American mathematicians, have been enumerated; as well as some used abroad.

MATHEMATICAL SOCIETIES AND JOURNALS. The oldest of the sciences mathematics has always been cultivated and fostered, often with a degree of preferment over the later branches of the tree of knowledge, by the universities, the great academies and the other scientific bodies of a general scope throughout the civilized world. The indispensable condition for satisfactory progress facility of publication, has been provided for mathematicians in a very large degree by the 'Transactions' and 'Proceedings' of learned societies representing a wide scientific field. The specialist will usually prefer the mathematical journals proper, which indeed send out in a steady flow the finest product of the mathematical genius of the age. Theirs is the post of honor; it lies with them, by critical encouragement or repression, to maintain the standard of excellence of a great profession.

But there remains another set of functions, which are more and more efficiently performed by the mathematical societies. These include in their membership nearly every mathematician of standing in the four quarters of the globe. They provide a professional forum for the discussion of mathematical questions and of mathematical interests, and furnish the powerful stimulus of association and solidarity. Their activities cover a wide range, including the presentation and publication of papers and memoirs, the encouragement of bibliographic and encyclopedic undertakings, the organization of international congresses, special conferences and lectures, the exercise of a beneficial advisory influence on the mathematical curricula and equipment of the schools and universities, the diffusion of a better understanding of the science in the educated world, the formation of libraries, collections of models, and the promotion of agreeable social and personal relations among mathematicians.

The following list comprises the principal mathematical societies of the world, arranged in chronological order of foundation, with mention of their several publications:

1690. Mathematische Gesellschaft in Hamburg. Mitteilungen, 1881—.
1778. Wiskundig Genootschap te Amsterdam. Wiskundige Opgaven mit de Oplossingen, 1855—; Nieuw Archief voor Wiskunde, 1875—; Revue Semestrielle des Publications Mathématiques, 1892—.
1866. London Mathematical Society, Proceedings, 1865—.
1866. Moscow Mathematical Society, Transactions, 1869—.
1873. Société Mathématique de France, Bulletin, 1873—.
1883. Mathematical Society of Edinburgh, Proceedings, 1884—.
1884. Circolo Matematico di Palermo, Rendiconti, 1884—.
1886. Mathematical Society of Charkow, Bulletin, 1879.
1888. American Mathematical Society, Bulletin, 1891—; Transactions, 1900—; Mathematical Papers of the Chicago Congress, 1896; Colloquium Lectures on Mathematics, 1905, 1910, 1913, 1914.
1890. Deutsche Mathematiker-Vereinigung, Jahresbericht, 1892—.

895. British Mathematical Association, Mathematical Gazette, 1894—.
909. Indian Mathematical Society, Journal, 1909—.
909. Calcutta Mathematical Society, Bulletin, 1909—.
911. Sociedad Matematica Española, Revista, 1911—.
915. Mathematical Association of America, American Mathematical Monthly, 1894—.

A history of the Hamburg Society, prepared in connection with the celebration in 1890 of its 200th anniversary, may be found in volume II of the 'Mitteilungen.'

The 'Wiskundig Genootschap' renders an especially valuable service in the mathematical world by the publication of the 'Revue Semestrielle,' a condensed abstract of all the mathematical papers published in the various journals, constantly brought up to within a few months of the current date. The value to a productive mathematician of this great labor-saving device is quite inestimable.

The first president of the London Mathematical Society was the illustrious De Morgan, and the roll of members has included the names of Cayley, Sylvester, H. J. S. Smith, Clifford, Salmon, Stokes, Kelvin and most of the other eminent British mathematicians of the time. The secretary's office was efficiently filled for the long period of 34 years (1867–1901) by the late Robert Tucker. The 'Proceedings,' which is the leading British mathematical journal, has recently been enlarged in size. The membership of the society is about 300.

The Société Mathématique de France has about the same membership. The meetings are held twice a month at the Sorbonne. The president of the society for 1916 is M. Fouché, the secretaries are MM. Lévy and Montel. The council includes Appell, Borel, Jordan, Painlevé and Picard. The 'Bulletin' is issued quarterly.

The Deutsche Mathematiker-Vereinigung represents in full measure the fruitfulness and vigor of German mathematics. Its organization had been foreshadowed for many years, but was actually brought about in 1890 by the initiative of members of the mathematical-astronomical section of the older Society of German Natural Scientists and Physicians, in affiliation with which the Vereinigung still continues to hold its annual meetings. The appearance of the 'Jahresbericht,' whose volumes were originally issued in parts of book form, signalized the beginning of a series of invaluable reports on various branches of mathematics, beginning with the celebrated report by W. F. Meyer on 'The Present Status of the Theory of Invariants' (Vol. I, 1892). These reports and other undertakings of a bibliographical, critical and statistical character ultimately led to the plan of the 'Encyclopedia of Mathematics,' now in course of publication by Teubner, under the auspices of academies of science of Munich, Vienna and Göttingen. The Vereinigung has also played an active part in the organization of the international congresses of mathematicians, notably those of Zürich (1897) and Heidelberg (1904). It has interested itself effectively in the questions concerning the teaching of mathematics in the schools, universities and technical institutes, the training of teachers, the correlation of instruction in pure and applied mathematics and other matters of reorganization and progress in education, some of which are phases of an international reform movement. A history of the Vereinigung by the former secretary and present editor of the 'Jahresbericht,' Prof. A. Gutzmer of Jena, was issued on the occasion of the Heidelberg congress. The society has at present about 650 members. Meetings are held annually. It recently received from B. G. Teubner the gift of a complete set of his extensive mathematical publications as the nucleus of a library. The 'Jahresbericht,' now published monthly with occasional double bimonthly numbers, contains, beside the earlier reports mentioned above and a record of the society's activities, addresses, biographies and necrologies, original papers, criticisms, discussions and reviews and notes on current events. More extensive papers are published as separate volumes.

The American Mathematical Society was originally organized as the New York Mathematical Society in 1888 and was reorganized under its present national title in 1894. Sylvester's work at Baltimore (1877–84) and the influence of young mathematicians returning from study in Germany had produced a tidal movement of which the society has since its early days been the forefront and exemplar. Its membership, now about 740, includes practically every mathematician in the United States, and a considerable number of foreign representatives. The 'Bulletin,' published since 1891 in monthly numbers from October to July, is of the type later adopted by the 'Jahresbericht,' but contains also the official reports of the frequent meetings of the society, with abstracts of the papers presented and a complete bibliography of recent mathematical publications. Another special feature of the 'Bulletin' is the extensive «Notes» on current events in the mathematical world. The 'Transactions,' founded in 1900, is the official organ of the society for the publication of the more important papers read before it. The library of the society, now including 5,000 bound volumes, is deposited in the Columbia University Library.

Regular meetings are held four times a year in New York and twice a year in Chicago. Officers are elected at the annual meeting in December. A summer meeting is also held each year at some specially chosen place. At intervals of two or three years the summer meetings are reinforced by colloquia, or courses of lectures by specialists on recent advances in their particular lines of work. The rapid growth of mathematical interest in the Central and Western sections of the country have led to the organization of a Chicago Section (1898), a San Francisco Section (1902) and a Southwestern Section (1907). The sections meet once or twice each year.

The presidents of the society have been J. H. Van Amringe, 1888–90; Emory McClintock, 1890–94; G. W. Hill, 1894–96; Simon Newcomb, 1896–98; R. S. Woodward, 1898–1900; E. H. Moore, 1900–02; Thomas S. Fiske, 1902–04; W. F. Osgood, 1904–06; Henry S. White, 1906–08; Maxime Bocher, 1908–10; H. B. Fine, 1910–12; E. B. Van Vleck, 1912–14; E. W. Brown, 1914–16; L. E. Dickson, 1916–. The secretaries have been Thomas S. Fiske, 1888–95, and F. N. Cole, 1895–. The business of the society is transacted by a council composed of the officers, ex-presidents, editorial committee of the

'Transactions,' secretary of the Chicago Section and 12 other members elected for a term of three years.

While the society is more especially devoted to the advancement of the higher branches of mathematics, it exerts a considerable influence both directly and through its members on the teaching of the subject in the schools and universities. The report of a committee of the society on college entrance requirements in mathematics has been adopted by the College Entrance Examination Board. A report on the requirements for the master's degree, presented to the Chicago Section, has been favorably recognized by several of the Western universities. The society has also contributed materially to bring about the organization of associations of teachers of mathematics throughout the country, a movement especially stimulated by Professor Moore's presidential address in 1902.

Historical notices of the society may be found in the presidential addresses of Dr. McClintock ('Bulletin,' January 1895) and Professor Fiske (ib., February 1905). Other notices are scattered through the secretary's reports. The society, which has increased its membership by 50 per cent in the last 12 years, serves to-day to bring together in a harmonious whole all the mathematical activities of America. It is a centre not only of scientific activity but also of professional good feeling and agreeable personal relations.

The British Mathematical Association, formerly known as the Association for the Improvement of Geometrical Teaching, is devoted to improved instruction in elementary mathematics.

The Mathematical Association of America, organized in 1915 to represent the field of collegiate mathematics, has now over 1,100 members. It has adopted as its official organ the *American Mathematical Monthly*. The presidents of the Association have been E. R. Hedrick, 1915–17, and Florian Cajori, 1917–). The secretary-treasurer is W. D. Cairns. Meetings are held twice a year, usually in connection with those of the American Mathematical Society. Nine local societies have thus far been organized, holding meetings usually twice a year.

The international congresses of mathematicians have been mentioned above. While these are individually but temporary gatherings, they had come, before the war, to be an established institution of great and permanent value. Their sequence of time and place is: Paris, 1889; Chicago, 1893; Zürich, 1897; Paris, 1900; Heidelberg, 1904; Rome, 1908; Cambridge, 1912.

The exchanges of the American Mathematical Society include about 140 journals which regularly publish mathematical papers of appreciable value. In the notices appended to his collection of abbreviated titles of journals ('Jahresbericht der Deutschen Mathematiker-Vereinigung,' Vol. XII, 1903, pp. 426–444) Felix Müller sets the grand total ever published of all journals of a fairly mathematical complexion at about 1,200, of which over 600 now survive. More than 300 journals are cited in the references of the early numbers of the 'Encyclopedia of Mathematics.' The 'Revue Semestrielle' reports the contents of some 250 journals; the 'Fortschritte' list is about 170.

The oldest journals in Müller's list are the 'Philosophical Transactions' and the 'Journal des Savants,' both dating from the year 1665. Following these are the publications of the academies of Paris (1666) and Bologna (1690). From the 18th century there still survive, beside the journals of the academies (Berlin 1700; Petersburg, 1724; Göttingen, 1751; and others), also the 'Memorie di Matematica e di Fisica' (1782) of the Societá Italiana, the 'Bulletin' (1789) of the Sociétá Philomatique of Paris, and the 'Journal de l'Ecole Polytechnique' (1794). Among the extinct journals may be mentioned the 'Ladies' Diary' (1704), 'Gentlemen's Diary' (1741), these two uniting in the 'Lady's and Gentlemens Diary' (1841–71); the 'Cambridge Mathematical Journal' (1839–45), the forerunner of 'Sylvester's Quarterly Journal'; Gergonne's 'Annales de Mathématique' (1810–31); Tortolini's 'Annali' (1850–57), superseded by the present 'Annali di Mathematica'; and the various journals (1786–1825) of Hindenburg, Breithaupt, Bessel, Kretschmar. In America the ephemeral existences are chronicled of the 'Mathematical Correspondent' (1804–06), 'Adrain's Analyst' (1808), and 'Mathematical Diary' (1825–32), 'Mathematical Companion' (1828–31), 'Mathematical Miscellany' (1836–39), 'Cambridge Miscellany of Mathematics, Physics and Astronomy' (1842–43), 'Runkle's Mathematical Monthly' (1858–61). The publication of the 'Analyst' (1874–83) marked a substantial advance. Martin's 'Mathematical Visitor' (1877) and 'Mathematical Magazine' (1882), the 'Mathematical Magazine' (1882) and 'Mathematical Messenger' (1884) are extinct.

The following list gives the date of foundation, the title and the present place of publication of the strictly mathematical journals now in existence and not already cited in connection with the list of mathematical societies above:

1826. 'Crellès Journal für die reine und angewandte Mathematik,' Berlin.
1836. 'Liouville's Journal de Mathématiques pures et appliquées,' Paris.
1842. 'Nouvelles Annales de Mathématiques.'
1855. 'Quarterly Journal of Pure and Applied Mathematics,' London.
1858. 'Annali di Matematica pure ed applicata,' Milan.
1863. 'Giornale di Matematiche di Battaglini,' Naples.
1868. 'Mathematische Annalen,' Leipsic.
1870. 'Bulletin des Sciences Mathématiques,' Paris.
1871. 'Jahrbuch über die Fortschritte der Mathematik,' Berlin.
1872. 'Messenger of Mathematics,' London.
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MATHEMATICAL SOCIETY, The American. See AMERICAN MATHEMATICAL SOCIETY, THE.

MATHEMATICAL SOCIETY, The London, an association formed in the English capital in 1865 by a number of English professors of mathematics for the promotion of that science. It was incorporated in 1894. Since its formation it has regularly published 'Proceedings' and papers on mathematical subjects. It has an excellent library of scientific works. The Society meets monthly from November to June, the anniversary meeting being held in November.

MATHEMATICS. The science of mathematics — what shall it be said to be? A question much discussed by philosophers and mathematicians in the course of more than 2,000 years, and especially with deepened interest and insight in our own times. Many have been the answers, but none has approved itself as final. All of them, by nature belonging to the «literature of knowledge,» fall under its law and tend to «perish by supersession.» Naturally enough conception of the science has had to grow with the growth of the science itself. For it must not be inferred that mathematics, because it is so old, is dead. Old it is indeed, classic already in Euclid's day, being surpassed in point of antiquity by but one of the fine arts and by none of the «natural» sciences; but it is not only the oldest science, it is also as new as any, living and flourishing to-day as never before, advancing in a thousand directions by leaps and bounds. It is not merely as a giant tree throwing out and aloft myriad branching arms in the upper regions of clearer light and plunging deeper and deeper root in the darker soil beneath. Rather is it an immense forest of such oaks, which, however, literally grow into each other, so that, by the junction and intercrescence of limb with limb and root with root and trunk with trunk, the manifold wood becomes a single living organic growing whole. A vast complex of interpenetrating theories — such the science now actually is, but it is more wondrous still potentially, component theories continuing more and more to grow and multiply beyond all imagination and beyond the compass of any single genius, however gifted. What is this thing so marvelously vital? What does it undertake? What is its motive? How is it related to other modes and interests of the human spirit?

One of the oldest, at the same time the most familiar, of the definitions conceived mathematics to be the science of magnitude, where magnitude, including multitude as a special kind, signified whatever was «capable of increase and decrease and measurement.» Capability of measurement was the essential thing. That was a most natural definition of the science, for magnitude is a singularly fundamental notion, not only inviting but demanding consideration at every stage and turn of life. The necessity of finding out how many and how much was the mother of counting and measurement and mathematics, first from necessity and then from joy, so busied itself with these things that they came to seem its whole employment. But now the ordinary notion of measurement as the repeated application of a constant finite unit has been so refined and generalized, on the one hand through the creation of the so-called irrational and imaginary numbers (see ALGEBRA; COMPLEX VARIABLE), and on the other by use of a scale, as in non-Euclidean geometry (see NON-EUCLIDEAN GEOMETRY; ANALYTICAL METRICS), where the unit appears to suffer lawful change from step to step of its application, that to retain the old words and call mathematics the science of measurement seems quite inept as no longer telling either what the science has actually become or what its spirit is bent upon.

Moreover, the most striking measurements, as of the volume of a planet, the valency of atoms, the velocity of light or the distance of star from star, are not done by *direct* repeated application of a unit. They are all accomplished by indirection. Perception of this fact it was which led to the famous definition by the philosopher and mathematician, Auguste Comte, that mathematics is the «science of *indirect* measurement.» Here doubtless we are in presence of a finer insight and a larger view, but the thought is not yet either wide enough or deep enough.

For it is obvious that there is much admittedly mathematical activity that is not in the least concerned with measurement whether direct or indirect. In projective geometry (which see), for example, it was observed that *metric* considerations were either absent or subordinate. The fact, to take a simplest example, that the two points determine a line uniquely, or that the intersection of a sphere and a plane is a circle, is not a metric fact: it is not a fact about size or quantity or magnitude. In this field it was *position* rather than size that to some seemed the centre of interest, and so it was proposed to call mathematics the science of magnitude or measurement and position.

Even as thus expanded, the definition yet excludes many a mathematical realm of vast, nay, infinite extent. Consider, for example, that immense class of things known as *operations*. These are limitless alike in number and in kind. Now it so happens that there are systems of operations such that any two operations of a given system, if thought as following one another, together thus produce the same effect as some other single operation of the system. For an illustration, think of all possible straight motions in space. The operation of going from a point A to a point B, followed by the operation of going from B to a point C, is equivalent to the single operation of going from A to C. Thus the system of such operations is a closed system: combination of any two operations yields a third not without but within the system. Now the theory of such closed systems — called groups (see GROUPS) of operations — is a mathematical theory of colossal proportions. But it is obvious that an abstract operation, though a very real thing, is neither a position nor a magnitude.

This way of trying to come at an adequate conception of mathematics, viz., by attempting to characterize in succession its distinct domains, or varieties of content, or modes of activity, is not likely to prove successful. For it demands an exhaustive enumeration, not only of the fields now occupied by the science, but also of those destined to be conquered by

it in the future, and such an achievement would require a prevision that none may claim.

Fortunately there are other paths of approach that seem more promising. Every one has observed that mathematics, whatever it may be, possesses a certain mark, namely, a degree of certainty not found elsewhere. So it is, proverbially, the exact science par excellence. Exact, no doubt, but in what sense? To this an excellent answer is found in a definition of the science given about one generation ago by a distinguished American mathematician, Prof. Benjamin Pierce: mathematics is the science which draws necessary conclusions — a formulation of like significance with the fine *mot* by Prof. William Benjamin Smith, to wit: mathematics is the universal art apodictic. These statements, though neither of them may be entirely adequate, are, both of them, telling approximations, at once foreshadowing and neatly summarizing for popular use the conclusion reached by the creators of modern logic (see SYMBOLIC LOGIC), that mathematics is included in, and, in a profound sense, may be said to be identical with, symbolic logic. Observe that the emphasis falls on the equality of being "necessary," or logically *correct.* Naught is said about the conclusions being true. That is another matter for subsequent consideration.

But why are mathematical conclusions correct? Is it that the mathematician has a reasoning faculty essentially different in kind from that of other men? By no means. What, then, is the secret? Reflect that conclusion implies premises, that premises involve terms, that terms stand for ideas or concepts or notions, and that these latter are the ultimate material with which the spiritual architect, called the reason, designs and builds. Here, then, one may expect to find light. The apodictic quality of mathematical thought, the correctness of its conclusions, are due, not to any special mode of ratiocination, but to the character of the concepts with which it deals. What is that distinctive characteristic? The answer is: precision, sharpness, completeness of determination. But how comes the mathematician by such completeness? There is no mysterious trick involved: some ideas admit of such precision and completeness of determination, others do not; and the mathematician is one who deals with those that do. Law, says Blackstone, is a rule of action prescribed by the supreme power of a state commanding what is right and prohibiting what is wrong. But what are a state, and supreme power, and right and wrong? If all such terms admitted of complete determination as do, for example, such terms as triangle and circle, then the science of law would be a branch of pure mathematics. And such, too, to take another example, would be psychology, were consciousness, mind, perception, imagination, and all kindred terms, as completely determinable as the notion sphere. It will be asked, does not the lawyer sometimes arrive at correct conclusions? It may be admitted that he does sometimes, and so, too, of the psychologist or historian or sociologist. When this happens, however, when these students arrive, it is not meant at truth, for that may be by happy chance or by intuition, but when, strictly speaking, they arrive at conclusions that are correct, at conclusions, i.e., that follow logically from completely ascertained data or premises, then that is because they have been for the time acting in all literalness the part of mathematician. That is not to aggrandize the science of mathematics. Rather is it to credit to all serious thinking that, in any considerable garment of thought, one may find here and there, rarely enough sometimes, a mathetic fiber, woven in some perhaps exceptional moment of precise conception and rigorous reason. To think aright is no characteristic striving of a class of men. It is a common aspiration. Only, as before said, the stuff of thought is mostly intractable, formless, nebulous, like some milky way awaiting analysis into distinct star forms of completely determinate ideas.

The mentioned aspiration and the tendency of all thought, of all science, to assume the character of mathematics admit of many illustrations, which at the same time serve to show clearly the ultimate distinction between that thought which is mathematical and that which is not. One or two such illustrations must suffice.

There is no more common or more important scientific notion than that of function. The term is applied to either of two variable things (including constants conceived as special variables, whose variation is zero in amount) so related that to any value or state of either there corresponds one (or more) value (values) or state (states) of the other. Any two corresponding values or states are said to constitute a pair of values or states, and any two functionally related variables may be called a function-pair. Examples of such function-pairs abound on every hand, as the radius and the area of a circle; the corresponding values of x and y in an equation, $2x-3y+5=0$; elasticity of medium and velocity of sound or other undulation; the amount of sodium chloride formed and the time occupied by the reaction that generates it; the prosperity of a given community and, *ceteris paribus,* the intelligence of its patriotism. Indeed it may be that there is no thing which is not in some sense a function of every other. Be this as it may, one thing is very certain, namely, a very great part, if not the whole, of our thinking is primarily concerned with functional relationships, deals, that is, immediately or mediately, with pairs or systems of corresponding values or states or changes. Behold, for example, how the parallelistic psychology searches for correlations between psychical and physical phenomena. Witness, too, the sociologist seeking to determine a law of correspondence between the homogeneity of a population and its peacefulness; the anthropologist attempting to find a formula correlating mental power and brain-weight; the physicist's determinations of dependence between pressure and volume of a gas; and so on and so on. It is, then, here, in the immense and wondrously diversified domain of correspondence, the answering of value to value, of change to change, of condition to condition, of state to state, that the knowing activity, the intellect, finds its field.

What is it precisely that we seek to do by means of a correlation? The answer is: when one or more facts are given or known, to pass with absolute certainty to the correlative fact or

facts. For example, if $y = \sin x$, then, if a value be assigned to x or y, the corresponding value or values of y or x are determined by the equation, or definition, of the functional correspondence between the assemblage of values which x may take and the assemblage that y may assume. To effect the desired transition from the given or known to the dependent ungiven or unknown obviously requires one or more formulæ or equations which shall serve to define precisely the manner of correspondence, the law of dependence. Where do such defining formulæ or equations come from? Strictly speaking, they are never *found*, they are always *assumed*, assumed immediately or else mediately, that is, in the latter case, derived by assumed logical processes from such as belong to the former case. This statement is valid in every field of logical thought. In every field it is true that from nothing assumed nothing can be derived. Now, nothing is easier than to write down a perfectly definite formula that does not tell how cheerfulness depends on climate or retentiveness on interest or the volume of a cube on its dimensions. The mentioned inapplicability or "inutility" does not, however, at all tend to invalidate the formula regarded as defining a certain law of correlation. Indeed a given formula may be perfectly intelligible in itself; it, alone or joined with others in similar case, may state a perfectly intelligible law of correspondence, which, nevertheless, may have no validity whatever in the physical or in the sensuous universe. What is it, then, that guides in the choice of formulæ? For such determination or choice seems hardly referable to chance alone. The answer is that, broadly speaking, choice is determined by curiosity, and curiosity is itself not determined by choice, but is rather matter of native gift or predilection.

Just here we are in position where we have only to look steadily a little in order to perceive clearly the sharp and ultimate distinction between mathematics, on the one hand, and physical or other science, on the other. These are discriminated according to the kind of curiosity whence they spring. The mathematician is curious about definite abstract relationships, about logically possible modes of order, about varieties of abstract implications, about completely determined or determinable functional relationships considered merely in and of themselves, that is, without the slightest concern about the question whether or no they have external or sensuous or other sort of validity than that of being logically thinkable. It is the aggregate of logically thinkable relationships that constitutes the mathematician's universe, an infinitely infinite universe, worlds in worlds worlds in worlds of wonders, inconceivably richer in mathetic content than can be any greater world of sense. Immense indeed and marvelous is our own world of sense with its rolling seas and stellar fields and undulating air. But compared, one need not say with the entire world of mathesis, but only with the hyperspaces (see HYPERSPACES) explored by the geometrician, the whole vast region of the sensuous universe is literally as a merest point of light in a shining sky.

Now this mere speck of a physical universe, which the chemist, the physicist, the astronomer, the biologist, the sociologist, and the rest of nature students, find their great fields, may be, as it somewhat seems to be, a realm of invariant uniformities or laws; it may be a mechanically organic aggregate, connected into an order whole by a tissue of completely definable functional relationships; and it may not. In other words, it may be that the universe eternally has been and is a genuine cosmos, that the external sea of things immersing us, although it is ever changing infinitely, changes only lawfully, in accordance with a system of immutable laws, constituting an *invariant* (see INVARIANTS AND COVARIANTS) at once underived and indestructible and securing everlasting harmony through and through; and it may not be such. The student of nature assumes, he rightly assumes, that it is, and, moved and sustained by appropriate curiosity, he endeavors to find in the outer world what are the elements and relationships assumed to be valid there. "Natural science," said Bernhard Riemann, "is the attempt to comprehend nature by means of exact concepts." The mathematician, as such, does not make that assumption and does not seek for relationships in the outer world.

Is the assumption correct? Undoubtedly it is admissible, and as a working hypothesis it is undoubtedly very useful or even indispensable to the student of external nature; but is it true? The mathematician, as man, does not know although he greatly cares. Man, as mathematician, neither knows nor cares. The mathematician does know, however, that, if the assumption be correct, every relationship that is valid in nature is, *in abstractu*, an element in his domain, a subject for his study. He knows, too, at least he strongly suspects, that, if the assumption be not correct, his domain remains the same absolutely. The two realms, of mathematics, of natural science, like the two attitudes, the mathematician's and that of the nature student, are fundamentally distinct and disparate. To think logically the logically thinkable — that is the mathematician's aim. To assume that nature is thus thinkable, an embodied rational logos, and to discover the thought supposed incarnate there — these are at once the principle and the hope of the student of nature.

Suppose the latter student is right, suppose the outer universe really is an embodied logos of reason, an infinitely intricate garment ever weaving and ever woven, warp and weft, of logically determinate relationships, does that imply that all of the logically thinkable is incorporated in it? It seems not. A cosmos, a harmoniously ordered universe, one that through and through is self-compatible, can hardly be the whole of reason materialized and objectified. There appears to be many a rational logos. At any rate the mathematician has delight in the construction and contemplation of divers systems that are inconsistent with one another, though each is composed of consistent relationships. He constructs in thought, as witness the geometry of hyperspaces, ordered worlds, worlds that are possible and logically actual, and he is content not to know if any of them be otherwise actual or actualized. There is, for example, a Euclidean geometry and there are infinitely many kinds of non-Euclidean (see NON-EUCLIDEAN GEOMETRY). These theories

regarded as "applied" mathematics, regarded, that is, as *true* descriptions of some one actual space, are incompatible. In our universe, to be specific, if it be, as Plato thought and nature science takes for granted, a geometrized or geometrizable affair, then one of these geometries may be objectively valid in it. But in the vaster world of thought, in the world of pure mathesis, all of them are valid; there they coexist, and interlace among themselves and others as differing strains of a hypercosmic harmony.

A geometry, indeed any mathematical theory, consists of a definite system of determinate compatible principles or assumptions or hypotheses or postulates (commonly called axioms) together with their implications, their logically deducible consequences. Accordingly, natural science, the term being broadly employed to signify knowledge that is ultimately dependent upon "observation and experiment," cannot be or become strictly mathematical. It aspires to the *character,* and approximates and imitates the *form,* of mathematics, but it can never really attain either. Mathematics is concerned with implications, not applications. Such terms as "applied mathematics," "mathematical physics," and the like, are indeed in common use, but the signification, rightly understood, is always that of a mixed doctrine, a doctrine that is thoroughly analyzable into two disparate parts: one of these consists of determinate concepts formally combined in accordance with the established canons of ratiocination, i.e., it is pure mathematics and not natural science; the other is matter of observation and experiment, i.e., it is natural science and not mathematics. No fibre of either component is a filament of the other. Whether the behavior of natural phenomena is or is not exactly descriptible by mathematical formulæ can never be ascertained, for the means to "natural knowledge," viz., observation and experiment, are fallible by nature, and, however refined or prolonged, are incapable of yielding absolute exactness or certainty. Of any so-called law of nature, "the most, the last, the best that can be said" is that its agreement with the facts is so nearly perfect that every discrepance, if any there be, has escaped detection.

Cannot the like be said of mathematics? In the foregoing conception of mathematics it has indeed been tactily assumed that some ideas are completely determinable, that there are possible systems of postulates absolutely free alike from obscurity and from interior contradiction, that the postulates of such a system import a perfectly definite body of ascertainable implications, and that there is a perfect standard of logic quite independent of time and place and of the defects and idiosyncrasies of individual reasoners. May not these assumptions, some or all of them, be incorrect? There are some grounds, historical and biological, for suspecting that such may be the case. Such an admission, however, whether tentative or unconditioned, has by no means the effect of undefining mathematics or of dethroning the science from its commanding position among the knowledges. It would indeed leave man without the possession, even without the hope, of *absolute* knowledge, but, among all the forms of actual or potential proximate knowledge, mathematics would still rightly rank as highes It would indeed be marked by a degree of u certainty or indeterminateness or relativity inexactness, viz., that degree of inexactne which by supposition would belong to *all* mea ings and standards. Hence it would not peculiar to mathematics, but would be comm to it and every other science. But every su "other science" has an *additional* mark of i determinateness, the characteristic inexactne of all possible observation and experiment. any case, then, the observational and exper mental sciences are, in respect to certainty a exactness, hopelessly inferior to mathematics.

But in all ages it has been the faith of t mathematician that complete determination concepts and absolute rigor of demonstrati are in fact attainable, not, however, in t realm of observation and experiment, but the world of pure thought. It is, then, in th world, where all *entia* dwell, where is eve type of order and every manner of correlati and every variety of relationship and eve form of implication, it is in this infinite e semble of eternal verities whence, if there one cosmos or many of them, each derives character and mode of being,— it is there th the spirit of mathesis has its home and its lif

Is it a restricted home, a narrow life, stat and cold and gray with logic, without artist interest, devoid of emotion and mood a sentiment?

That world, it is true, is not a world of sol light, it is not clad in the colors that glori the things of sense, but it is an illuminat world, and over it all and everywhere throug out are hues and tints transcending sens painted there by radiant pencils of psych light, the radiance in which it lies.

It is a silent world. Nevertheless, in respe to the highest principle of art — the inte penetration of content and form, the perfe fusion of mode and meaning — it even riva music.

In a sense, it is a static world, like those the sculptor and the architect. The figure however, which reason constructs and t mathetic vision beholds, transcend the temp and the statue, alike in simplicity and in i tricacy, in delicacy and in grace, in symmet and in poise.

Not only are this home and this life, th rich in æsthetic interests, really controlled a sustained by motives of a sublimed and supe sensuous art, but the religious aspiration, to finds there, especially in the beautiful doctri of invariants, the most perfect symbols of wh it seeks — the changeless in the midst of chang abiding things in a world of flux, configuratio that remain the same despite the swirl and stre of countless hosts of curious transformation

Literature.— The literature having for object the exposition of the nature and pri ciples of mathematics is extensive. By f the most important recent contribution, whi at the same time serves to introduce the read to the chief memoirs in the field, is B. Russell 'The Principles of Mathematics,' Vol. I. F an excellent critical review of the princip modern attempts to define mathematics, t reader may be referred to Prof. M. Böche 'The Fundamental Conceptions and Metho of Mathematics' ('Bull. of the American Mat Soc.,' Vol. XI). Consult also Whitehea

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MATHER, măt'h'ĕr, Cotton, American colonial clergyman, son of Increase Mather (q.v.): b. Boston, 12 Feb. 1663; d. there, 13 Feb. 1728. He entered Harvard College at 11, and at his graduation in 1678 President Oakes expressed his expectation that he would resemble his venerable grandfathers, John Cotton and Richard Mather, who should be united and flourish again in him. He was early distinguished for piety, and in his 14th year began a system of rigid and regular fasting and vigils which he continued through life. He was occupied after leaving college with teaching, in 1680 became the assistant of his father in the pastorate of the North Church, Boston, and in 1684 was ordained as his colleague. When, at the report of the landing of the Prince of Orange in England, Governor Andros was seized and imprisoned in Boston, Cotton Mather prepared the public declaration justifying the measure. But it is in connection with proceedings concerning witchcraft that he is most generally known. In 1685 he published his 'Memorable Providences relating to Witchcraft and Possessions,' narrating cases which had occurred at intervals in different parts of the country; and during the witchcraft excitement in Salem in 1692 was a prejudiced investigator in the matter, publishing the next year his 'Wonders of the Invisible World,' in order to confirm believers in that kind of demoniac possession. In 1702 appeared his greatest work, 'Magnalia Christi Americana,' an ecclesiastical history of New England concerning which he was admitted to know more particulars than any other man. Though strongly marked by its partialities and prejudices, its somewhat quaint and grotesque character, its admixture of superstition, learning and ingenuity, make it still interesting. In 1713 his 'Curiosa Americana' was read before the Royal Society of London, and he was elected a member of that body, being the first American to receive this distinction. In its 'Transactions' in 1721 appeared an account of the practice of inoculation for the smallpox, introduced by Lady Mary Wortley Montagu; and it was by the efforts of Mather in connection with Dr. Boylston, against both professional and popular prejudice, that the operation was first performed in Boston. His 'Essays to Do Good' (1710) was admitted by Dr. Franklin to have influenced some of the principal events of his life; and his 'Christian Philosopher' and 'Directions for a Candidate of the Ministry' enjoyed high repute. His 'Parentator' (1724) is a life of his father, Increase. Vain and pedantic as he was and narrow and credulous as he showed himself to be in regard to witchcraft and other topics of his time, he was in many directions a useful, public-spirited citizen who deserves to be regarded more leniently by posterity than has sometimes been the case. Consult 'Life' by Samuel Mather (Boston 1729); Bond, Enoch, 'The Mather Family' (ib. 1844); Garvin, A. B., 'Life and Times of Cotton Mather' (ib. 1892); Wendell, Barrett, 'Cotton Mather' (1891); Tyler, 'History of American Literature' (Vol. II, New York 1881).

MATHER, Frank Jewett, Jr., American professor of art: b. Deep River, Conn., 6 July 1868. In 1889 he was graduated at Williams College, and subsequently studied at Johns Hopkins (Ph.D. 1892), the University of Berlin and L'École des Hautes Études, Paris. From 1893 to 1900 Dr. Mather was instructor and assistant professor of English and Romance languages at Williams College; was editorial writer on the New York *Evening Post*, assistant editor of *The Nation* in 1901–06; art critic of the *Evening Post* in 1905–06 and again in 1910–11 and American editor of the *Burlington Magazine* in 1904–06. In 1910 Dr. Mather became Marquand professor of art and archæology at Princeton University. He is the author of 'Homer Martin, Poet in Landscape' (1912); 'The Collectors,' short stories (1912); 'Estimates in Art' (1916), 'The Portraits of Dante' (1921); 'A History of Italian Painting' (1923). 'Modern Painting' (1927), also several monographs. He is a contributor to various periodicals. In 1917 he served as chief boatswain's mate in the United States Naval Reserve Fleet.

MATHER, Increase, American colonial divine, son of Richard Mather (q.v.): b. Dorchester, Mass., 21 June 1639; d. Boston, 23 Aug. 1723. He was graduated at Harvard College in 1656, and in 1658 at Trinity College, Dublin. He afterward preached in Devonshire and the island of Guernsey, and on the Restoration was urged to conform and settle in England; but he refused, and on his return to Boston was invited to preach to the North Church, of which he was ordained pastor in 1661. This office he held for 62 years. He was a member of the synod of 1679, and drew up the propositions which were adopted concerning the proper subjects of baptism. In 1681 he was elected president of Harvard College, but the reluctance of his church to relinquish him induced him to decline the position. In 1684 the office was again offered him, and he accepted it with a stipulation that he should retain his relation to his people. He continued in this station till 1701, when he retired in consequence of an act of the general court requiring the president to reside in Cambridge. He received the first diploma for the degree of D.D. that was granted in America. When in 1683 Charles II demanded that the charter of Massachusetts should be resigned into his hands, Mather was foremost in opposing the measure; and when that monarch annulled the charter in 1685, he was sent to England as agent for the colonies. He was in England during the revolution of 1688, and, having found it impossible to obtain a restoration of the old charter, accepted a new one, under which the appointment to all the offices reserved to the Crown was confided to him. He returned in 1692, when the general court appointed a day of thanksgiving for his safety and for the settlement of the dispute. He is stated to have condemned the violent proceedings which followed relating to witchcraft. He was accustomed to spend 16 hours every day in his study, and always committed his sermons to memory. One-tenth part of all his income was devoted to purposes of charity. He was the author of 92 distinct publications. His 'Remarkable

Providences' was republished in the 'Library of Old Authors' (1856), and other works by him are 'A Brief History of the War with the Indians in New England' (1676); 'Relation of Troubles of New England from the Indians' (1677; 1864); 'Cases of Conscience Concerning Witchcraft' (1693; 1862); 'Cometographia, or a Discourse Concerning Comets' (1683). Consult Pond, Enoch, 'The Mather Family' (Boston 1844); Walker, Williston, 'Ten New England Leaders' (New York 1901); Tyler, M. C., 'History of American Literature' (Vol. II, New York 1881); Sibley, 'Harvard Graduates' (Vol. I, Cambridge 1873).

MATHER, Richard, American colonial divine: b. Lowton, Lancashire, England, 1596; d. Dorchester, Mass., 22 April 1669. He became a schoolmaster at Toxteth Park, near Liverpool, at the age of 15; studied at Brazenose College, Oxford, in 1618; was ordained in the English Church soon after, and became the minister of Toxteth, in which position he remained 15 years. He was suspended for non-conformity to the ceremonies of the Established Church in 1633, and though soon restored by the influence of friends was again silenced in the following year. He therefore decided to emigrate to New England, arriving in Boston in August 1635. The next year he became pastor of the church in Dorchester, and held that position till his death. He was one of the compilers of the 'Bay Psalm Books' and assisted to frame in 1648 a model of discipline known as the Cambridge Platform. He married for his second wife the widow of John Cotton (q.v.). His 'Journal, Life and Death' was issued by the Dorchester Historical Society in 1850. See CONGREGATIONALISM and consult Mather, Increase, 'Life and Death of Richard Mather' (Cambridge 1670); Tyler, M. C., 'History of American Literature' (Vol. II, New York 1881).

MATHER, Robert, American lawyer and railroad official: b. Salt Lake City, 1859; d. 1911. In 1882 he was graduated at Knox College, Illinois, and four years later was admitted to the bar at Chicago. He practised in that city in 1886–89; was local attorney in 1889–94, assistant general and general attorney in 1894–1902, and general counsel in 1902–09 of the Chicago, Rock Island and Pacific Railroad. In 1909 he was elected chairman of the board of the Westinghouse Electric Company. Mr. Mather was interested, as officer or director, in several railroad and industrial companies.

MATHER, William Williams, American geologist: b. Brooklyn, Conn., 24 May 1804; d. Columbus, Ohio, 26 Feb. 1859. He was graduated from West Point in 1828 and was an assistant professor of chemistry and geology there, 1829–35. After a short period spent as professor of chemistry at the University of Louisiana (1836), he undertook the superintendence of a geological survey of the 1st district of New York State which included the Hudson River counties, a labor which lasted from 1836 to 1844. He was also State geologist of Ohio 1837–40, and of Kentucky 1838–39, and from 1842–45, and 1847–50, professor of natural science in the Ohio University at Athens. He made a collection of about 22,000 mineralogical specimens. He contributed frequently to scientific journals, edited the *Western Agriculturist* for a time and published 'Geology of the 1st Geological District' (in 'Natural History o New York,' 1843); and 'Elements of Geology.

MATHESON, măth'ĕ-sŏn, **Arthur James** Canadian statesman: b. Perth, Ontario, 1842 d. 1913. He received his education at Uppe Canada College and Trinity College, Toronto was called to the bar in 1870 and established practice in his native town of which he wa mayor in 1883–84. From 1894 to 1913 he was member of the Conservative party in the On tario legislature and served as provincial treas urer in 1905–13 under Premier Sir James I Whitney. In 1906 he was a member of th Ottawa Inter-provincial Conference and in th following year of the National Conference o Taxation. In 1910 he served as vice-presider of the International Commission. Mr. Mathe son was made K.C. in 1908. He served in th militia after 1866, saw service during th Fenian raids and in 1900 attained the rank o brigadier-general.

MATHESON, George, Scottish Pres byterian clergyman: b. Glasgow, 27 Marc 1842; d. 28 Aug. 1906. He was educated a Glasgow University and although he ha lost his sight in boyhood he entered the ministr of the Kirk of Scotland and was ordained i 1868. He was minister of Innellan on the Firt of Clyde 1868–86; and of Saint Bernard's Pa ish, Edinburgh (1886–97). He was the autho of the famous hymn, 'O Love that Will No Let Me Go,' which finds a place in near every modern hymnal. Among his many pul lished books are 'Aids to the Study of Germa Theology' (1874); 'Natural Elements of Re vealed Theology' (1881); 'The Psalmist an the Scientist' (1887); 'Sidelights from Patmos (1897); 'The Sceptre Without a Sword' (1901) 'Representative Men of the Bible' (thre series); and 'Representative Women of th Bible' (1907).

MATHESON, Samuel Pritchard, Can dian clergyman: b. Manitoba (then the Re River Settlement), 20 Sept. 1852. He receive his education at Saint Johns' College School an Saint John's College, Winnipeg. He receive deacon's orders in the Anglican Church in 187 and those of priest in 1876. He became ma ter at Saint John's College School; subsequent served as professor of exegetical theology Saint John's College, canon and dean of Sai John's Cathedral, deputy headmaster and head master of Saint John's College School. Subs quently he was warden and chancellor of Sai John's College. He became secretary of th Provincial Synod of Rupert's Land and pro locutor of same and in 1902 became prolocuto of the General Synod of Canada. In 1903 h became coadjutor bishop of Rupert's Land, i 1905 he became archbishop and from 1909–3 was Primate of all Canada. D. 19 May 1942.

MATHEW, Theobald, known as "FATHE MATHEW," Irish temperance reformer: Thomastown Castle, County Tipperary, Irelan 10 Oct. 1790; d. Queenstown, Ireland, 8 De 1856. He was educated at Maynooth Colleg and the Capuchin Convent, Cork, and was or dained to the Roman Catholic priesthood i 1814. In 1838 he inaugurated a temperanc crusade and his labors in Great Britain an Ireland induced hundreds of thousands to sig the total abstinence pledge. The most co clusive evidence of the benefit of his preachi

yas the reduction of nearly £600,000 on the luties of spirits imported in Ireland in five ears. He made a tour of the United States in 849–51 and was very successful. Though pen-ioned by the Queen he was never entirely re-ieved from the burden of debt with which his xtended tours had burdened him, and which aused his imprisonment for a time in 1847. Consult *Life* by J. F. Maguire (London 863; abridged ed., 1890); Matthew F., *Father Mathew: His Life and Times* (London 1890); Tynan, K., *Father Mathew* (ib. 1908).

MATHEWS, măth'ūz, **Abert,** «Paul Siegvolk,» American lawyer and author: b. New York, 8 Sept. 1820; d. there, October 1903. He vas graduated from Yale in 1842 and after tudying law was admitted to the New York ar in 1845. He soon acquired an extensive ractice and was especially skilled in chancery ractice. He found time for literary work de-pite the claims of his profession, and under he pseudonym «Paul Siegvolk» published *Valter Ashwood,* a once popular love story 1860); *A Bundle of Papers* (1879); *Thoughts n Codification of the Common Law* (1881); *Juminations: The Ideal American Lady and Other Essays* (1892); *A Few Verses* (1893), tc. In the early part of his career he was a lose friend of N. P. Willis, whom he aided n establishing *The Home Journal.*

MATHEWS, Charles, English actor: b. ondon, 28 June 1776; d. Plymouth, England, 8 June 1835. He made his debut as an actor n Richmond in 1793 and was subsequently en-aged for some years in Dublin and London. n 1818 he made a hit as a professional enter-iner in his *At Home.* He continued in this lass of work, making two successful trips to ne United States and, returning, presented in ngland with great success *A Trip to Amer-a.* In 1828 he became joint proprietor of the delphi Theatre, London. Consult Baker, *Our ld Actors* (London 1881); Mrs. Mathews, *Memoirs of Charles Mathews, Comedian* (Lon-on 1839).

MATHEWS, Charles James, English ctor: b. Liverpool, 26 Dec. 1803; d. Manches-er, England, 24 June 1878. He was the son of harles Mathews (q.v.) and was educated as n architect, but abandoned that calling for the tage. As a light comedian he was very suc-essful, but his attempts at managing Covent arden and the Lyceum Theatre in London were ailures. He made several trips to the United tates, Paris and Australia, presenting an en-rtainment similar to his father's famous *At Home.* Consult Dickens, Charles, *Life of Charles James Mathews* (London 1879).

MATHEWS, Edward Bennett, American eologist: b. Portland, Me., 16 Aug. 1869. In 891 he was graduated at Colby College and in 894 received the degree of D.Ph. at the Uni-ersity of Johns Hopkins. In 1891–94 he was eld assistant of the United States Geological urvey; in 1894–95 was instructor in mineral-gy and petrography, in 1895–99 associate, in 899–1904 associate professor and in 1904 pro-essor of geology at Johns Hopkins. After 917, he served as chairman of the geolog-al department. From 1898 to 1917 Dr. Math-ws was assistant state geologist of Maryland nd subsequently was state geologist. He pub-lished *Bibliography and Cartography of Maryland* (1897); *Maps and Map-Makers of Maryland* (1898); *Building Stones of Maryland* (1898); *Limestones of Maryland* (1910); *History of the Mason-Dixon Line; Physical Features of Maryland; Water Resources of Maryland,* and numerous geological papers. Died Baltimore, Md., 4 Feb. 1944.

MATHEWS, Ferdinand Schuyler, American artist and author: b. New Brighton, N.Y., 30 May 1854; d. 20 Aug. 1938. He contributed extensively to the magazines both as illustrator and writer and published *The Writing Table of the 20th Century* (1900); *The Field-Book of American Wild Flowers* (1902); *Field-Book of Wild Birds and Their Music* (1904); *Field-Book of American Trees and Shrubs* (1915); *Wild Flowers for Young People* (1923).

MATHEWS, Joseph Howard, American chemist: b. Auroraville, Wis., 15 Oct. 1881. He was graduated from the University of Wisconsin in 1903, and took his Ph.D. at Harvard in 1906. In 1906–07 he was an instructor in chemistry at the Case School of Applied Science, Cleveland, Ohio. In 1911 he joined the faculty of the University of Wisconsin as assistant professor of chemistry. He was made associate professor in 1917, and professor in 1919, also chairman of the department. He served in the Ordnance Department of the United States Army during the First World War.

MATHEWS, Shailer, American educator and editor: b. Portland, Me., 26 May 1863; d. Chicago, Ill., 23 Oct. 1941. After being graduated from Colby College in 1884 and from Newton Theological Institution in 1887, he studied at the University of Berlin, 1890–91. He taught rhetoric and thereafter history and political economy, at Colby College, 1889–94; and in the latter year joined the faculty of the Divinity School of the University of Chicago, where he was professor of history and comparative theology, 1906–33, junior dean, 1899–1908, and dean, 1908, until he retired as emeritus in 1933. Honorary degrees were conferred on him by Colby, Pennsylvania, and Oberlin colleges, and by Brown, and Miami universities, the University of Glasgow, Faculté Libre de Theologie Protestante de Paris, the Chicago Theological Seminary, and the University of Rochester. Dr. Mathews was president of the Federal Council of the Churches of Christ in America, 1912–16; of the Northern Baptist Convention, 1915; of the Chicago Church Federation, 1929–32; and of Kobe College Corporation after 1920. He was also a trustee of the Church Peace Union, founded by Andrew Carnegie, after 1914; and was active in numerous other organizations. He delivered the Haverford Library lectures in 1907; the Earle lecture at Berkeley, Calif., in 1913; the William Belden Noble lectures at Harvard in 1916; the McNair lectures at the University of North Carolina in 1918; the Slocum-Bennett lectures at Wesleyan University in 1921; the Cole lectures at Vanderbilt University in 1926 and 1934; and the Barrows lectures in India, University of Chicago, 1933–34. He edited *World To-day* from 1903–11, and *The Biblical World,* 1913–20. He was also the editor of New Testament handbooks, *The Bible for Home and School, Social Betterment,* handbooks of ethics and religion, Women Citizen's Library and associate editor of the *Dictionary*

of the Bible, American Journal of Theology, Constructive Quarterly.

MATICO, mȧ-tē′kō, a shrub (*Piper angustifolium*), of the tropical family Piperaceae, native of Peru; remarkable for the styptic property of its leaves and unripe fruit.

MATIN, măt′ĭn, a large houndlike French dog, resembling the great Dane, but having a rough coat. The head is elongated, the forehead flat, the ears pendulous toward the tips; color, yellowish-fawn or whitish.

MATINS, the daily office of morning prayer in the Anglican communion. It is composed in part of the pre-Reformation offices of Matins and Lauds. In the Roman Catholic Church, it is the first part of the Divine Office, with which Lauds are usually associated. On Sundays and double feasts Matins have three nocturns; on simple feasts and weekdays, one nocturn. Easter and Pentecost have each only one nocturn, with three psalms. After private prayer versicles and responses are recited; the invitatory psalm follows.

MATISSE, mȧ-tēs′, **Henri,** French artist: b. Le Cateau (Nord), Dec. 31, 1869. The son of a grain merchant, after graduating from the lycée he studied law for a year at the University of Paris, then obtained a place in a law office at St. Quentin. While convalescing from an illness he enrolled in an art school for textile workers. On regaining health he determined, against parental wishes, to make art his career and in 1892 entered the Ecole des Beaux-Arts. After studying under the conservatives, Adolphe Bouguereau and Gabriel Ferrier, he studied in the class of Gustave Moreau. In 1893 he exhibited at the exposition of the Société Nationale des Beaux-Arts and one of his paintings was bought by the French government. For four years he was Moreau's pupil. In 1897 he married Noëllie Parayre of Toulouse who bore him two sons and a daughter. A fine draftsman, for a decade after arriving in Paris he supported himself mainly by copying old masters at the Louvre for provincial museums and private buyers. Revolting against academism, the classical tradition in which he was adept as a copyist, he strove for an individual manner of expression. His *La Desserte* (1897) reveals impressionist leanings. Strongly influenced both by Oriental art and modernism, his work was shown in all the exhibitions at the Salon des Indépendants. He was the leader of the group of modernists stigmatized in 1905 as "Les Fauves" (Wild Beasts) because of their "willful eccentricity." From 1906 he began to obtain wider recognition, and for a brief period he was regarded as foremost among the modernists, until Picasso supplanted him. His paintings appeared in the first Post-Impressionist Exhibition at London (1910–1911), also in the second (1912). In 1913 his work began to show Cubist influences but in the last years of World War I he reverted to his earlier manner of bold flat patterning. In 1920 he designed the scenery and costumes for Diaghilev's production of *Le Chant du Rossignol.* The Luxembourg bought one of his famous *Odalisque* series in 1920 and in 1927 he was awarded first prize at the Carnegie International Exhibition for his *Fruit and Flowers.* His subjects are generally young women, clothed nude or semi-nude, and occasional landscapes and still lifes. Regarded by many connoisseurs as the foremost painter of the day, he is also noted for his sculptures and graphic art work in etching, drypoint, lithography, and drawing.

MATO GROSSO, mȧ′tōō grō′sōō (formerly Matto Grosso), state, Brazil, bordering on the countries of Bolivia and Paraguay. It is the second largest state of Brazil, exceeded only by Amazonas. Its capital city is Cuiabá. Other major cities are Campo Grande and Corumbá.

Mineral resources in the state are large and unexploited. The chief occupation is stock raising, but some of the larger cities raise rice, beans, tobacco, sugar, and maté.

Navigable rivers are the São Lourenço, Cuiabá, Paraná, and Paraguay. The São Paulo-Corumbá Railroad crosses Mato Grosso from east to west.

Mato Grosso, city in the northwestern part of the state of the same name, is located on the Guaporé River, 250 miles northwest of Cuiabá. In the 18th century it was an important city with a population of about 20,000. Pop. (1950) 470.

MATRIARCHATE mā′trĭ-är-kāt, or **MATRIARCHY,** a family, group, or state in certain primitive societies ruled by a woman. In matriarchies descent is traced in the female line.

MATRIMONY VINE. See Lycium.

MATRONALIA, măt-rō-nā′lĭ-ȧ, the 1st of March, the New Year's day of the Roman religious calendar, sacred to Juno, the deity of matrons. On this festival day wives expected presents from their husbands, and themselves gave an entertainment to the household slaves.

MATSUDAIRA, mä-tsŏŏ-dī-rä, the generic name of 52 families of territorial nobles in feudal Japan, mostly, although not all, descended from an ancestor Minamoto Chikauji of the 14th century, 11th in generation from Yoshiie who, in the village of Matsudaira, in Mikawa, espoused the daughter of Matsudaira Nobushige and took his wife's name. When, in Yedo in 1603, the Tokugawa line of shoguns was established, permission was given to the heads of allied or loyal clans to bear his name. Among the hundreds of feudal barons and others thus favored were many of the most illustrious in the period 1603–1867. After the latter date the name, with the privilege of bearing the ancestral coat of arms, was restricted to 27 families. Their heraldic crest consists of three mallow leaves within a circle. With the exception of Fujisan, this is the most characteristic decoration seen on the older Japanese art products. It is said to have been selected by Ieyasu when three cakes, laid over as many mallow leaves, on a plate, were presented for the conqueror's refreshment by a loyal vassal.

MATSUDAIRA SHUNGAKU, mä-tsŏŏ-dī-rä shŏŏn-gä-kŭ, champion, during Japan's hermit days, of Western civilization and of friendship with the United States: b. Yedo, Oct. 11, 1828; d. Tokyo, 1880. Adopted at 10 years of age by Matsudaira, baron of Echizen, at 21 he began sweeping and con-

tructive reforms, introducing modern military, conomic and hygienic methods, abolishing rchery in favor of fire arms, establishing can- on and rifle factories, sending young men as tudents to the Dutch at Nagasaki, establish- ng lectures on the Oyoméi (q.v.) philosophy nd writing manifestoes. He combatted popu- ar prejudices, showed the superiority of Western civilization and the reasonableness of Christianity, compelled the use by doctors of he Western methods of medical practice, pened a dispensary and organized a foreign terature department in the excellent clan chool in Fukui. Opposed to opening the coun- ry prematurely, on unequal terms, as was done y Ii Naosuké, he suffered domiciliary confine- nent but was later called to be virtual premier f the empire. With the assistance of Yokoi Héishiro he abolished the century-old custom f compelling the feudal barons to live half the ear in Yedo, leaving their families as hostages hen away. This made Kioto the centre of ffairs. He later brought the first of the yatio n his domain, and here the first public schools eyond the treaty ports were organized, and ne of the very first of the new regiments of ie peasant national army was raised. Out of is region, chiefly, was raised the famous Ninth ivision that took Port Arthur. High posthum- us honors were awarded this pioneer of Western civilization. His biography and writ- gs have been compiled by his son the marquis. onsult Griffis, 'The Mikado: Institution and erson' (1915), and 'The Mikado's Empire' 1912).

MATSUKATA, Masayoshi, Prince, Jap- ese statesman: b. Satsuma 1835; d. Tokio, July 1924. He was son of a Samurai, it fell in with the Radical party; was made ead of the prefecture (or *ken*) of Hida ter the revolution; was prominent in the tax form of 1875; represented Japan in several dustrial exhibitions; was a member of the abinet, in 1880 as Minister of Commerce, in 81 as Minister of Finance, and, with the same rtfolio, as Prime Minister from 1891 to 1893. is great work was in 1896–97, when he formed new cabinet, carried through the gold stand- d, set Japanese credit on its feet, but he as forced to retire because of the ill-success his scheme of taxation. He was Minister Finance a second time in 1898–1900, became ivy Councillor in 1903, and received the title marquis in 1906. He was also president of Japanese section of the Red Cross.

MATSUMOTO, Japan, town, in the dis- t of Nagano, in the island of Hondo, 100 les north by west of Tokio. The town manu- tures baskets, preserved fruits and silks and s an old daimyo castle. Pop. 63,427.

MATSUMURA, Jinzo, Japanese botanist: Ibaraki-Ken, 1856. In 1886–88 he studied the universities of Würzburg and Heidelberg, anwhile holding the assistant professorship of any in the University of Tokio to which he d been appointed in 1883. He became full fessor in 1890 and seven years later was ointed director of the Botanical Gardens. collaborated in Brinkley's 'Japanese-English tionary' (1896) and published 'Nomenclature Japanese Plants in Latin, Japanese and nese' (1884); 'Names of Plants and their oducts in English, Japanese and Chinese' (1892); 'Conspectus of Leguminosæ' (1902); 'Index Plantarum Japonicarum: Cryptogamæ' (1904); 'Phanerogamæ' (1905); 'Tentamen Floræ Lutchuensis,' with Ito (1899); 'Revisio Alni Specierum Japonicarum' (1902); 'Enumeratio Plantarum in Insula Formosa Sponte Crescentium' (1906); 'Chinese Names of Plants' (1915); 'Classified Etymological Vocabulary of the Japanese Language Ancient and Modern' (1915); 'Vocabulary of Yamato' (1921).

MATSUSHIMA, Japan, village on the northeast coast of the island of Hondo, situated on the Bay of Sendai. In a lagoon opposite the village are 808 islets ranging in elevation from 30 to 300 feet and covered with pines. This beautiful natural garden is one of the wonders of Japan.

MATSUYAMA, Japan, town and capital of the district of Ehime, on the island of Shikoku, five miles from Mitsu. It contains a great feudal castle, one of the few perfect specimens of its period in modern Japan. Pop. (1925) 58,292.

MATSUYE, or MATSUE, Japan, town and capital of the district of Shimane, on the island of Hondo, 140 miles north by west of Kioto. It has large paper manufactories and agate-polishing establishments and has numerous temples. It is well built and is one of the cleanest towns in Japan. Pop. 36,209.

MATSYS, mät-sīs′, **or MASSYS, Quentin,** Flemish painter: b. Antwerp or Louvain, about 1460; d. there, between 13 July and 16 Sept. 1530. A blacksmith until he was 20, legend says that he turned artist to win the love of a painter's daughter. He was acquainted with many of the notables of the day, including Dürer, Erasmus and Sir Thomas More. Much of his present fame is due to genre pictures, especially of misers and money-changers, which are not his work, but that of his school, among them his son Jan, whose 'Misers' is at Windsor Castle. Matsys' own work is styled a connecting link between Van Eyck and the later Dutch realists; apart from such excellent portraits as those of Maximilian of Austria and Petrus Aegidius, it is mostly religious in theme. The 'Burial of Christ,' an altarpiece for the Antwerp Cathedral, now in the Antwerp Museum, and the 'Story of Saint Anne,' now in the Brussels Gallery, are the best examples of his work. The Metropolitan Museum, New York, contains his 'Adoration of the Kings.' Consult Cohen, Walter, 'Studien zur Quentin Metsys' (Bonn 1904) and de Bosschère, Jean, 'Quentin Metsys' (Brussels 1907).

MATTAWA, or MATTAWAN, Canada, town in the Nipissing district of Ontario province, situated at the confluence of the Mattawa and Ottawa rivers at the east end of Lake Timiskaming, on the Canadian Pacific Railroad, 38 miles east of North Bay on the Trans-Canada Highway. The town has extensive lumber interests, and hardwood blocks for the manufacture of airplane propellers are produced here. It is also famous as the starting point of hunters and anglers in the vicinity. Pop. (1931) 1,631.

MATTAWA, a river of Ontario, the source of which is Trout Lake, east of Lake Nipissing. It flows east a distance of about 45 miles and enters the Ottawa River at Mattawa, 308 miles from Montreal. This river forms part of an almost continuous water-way from the Ottawa

River to Lake Huron, and before the Canadian Pacific Railroad was built this water route was much used for transportation and travel.

MATTEAWAN, măt-tẹ-ą-wŏn', N. Y. See BEACON, N. Y.

MATTEI, măt-tā'ē, **Tito,** Italian musician and composer: b. Naples, 1841; d. 30 March 1914. He was educated in Naples. He received the degree of professor in Saint Cecelia's Academy at Rome when he was 11 and was also elected a member of the Philharmonic Society in Florence and other cities. He gave his first concert when 15 and afterward made tours of Europe, but in 1863 settled in London, where he lived for 50 years, confining his concert tours to Great Britain, and in 1870 he conducted an Italian opera at the Lyceum Theatre. He was the composer of hundreds of songs and pianoforte pieces, many of which have become widely popular, and the operas 'Maria di Gand,' 'La Prima Donna,' etc.

MATTER, *in physics, mechanics and chemistry,* the tangible substance of which the world external to our minds is composed and which is characterized by the resistance which it opposes to muscular efforts exerted upon it. Since we can know it only through the mediation of our senses, its actual objective reality has often been questioned by philosophers and metaphysicians; and in order to avoid doubtful points of this sort it is frequently defined merely as a "physical concept," without making any hypothesis as to its objective existence. (Consult Pearson, 'The Grammar of Science'). In physics and chemistry we think and speak of it as having a real existence, however, just as we do in common life. For scientific purposes it is highly important to be able to accurately compare the quantities of matter in two bodies; but the phrase "quantity of matter" is not commonly used in science, the word "mass" (or inertia) being substituted for it. The term "mass" is synonymous with "quantity of matter" so long as the bodies compared are identical in composition and in physical state; but by its use we avoid the uncertainty in the meaning of the longer phrase, when it is applied to bodies of dissimilar composition. Two bodies are said to have "equal masses" under the following conditions: Let the two bodies be conceived to be initially at rest, and free from the action of any external forces whatsoever. Let them then be exposed to the action of equal forces for an equal length of time. If, under these circumstances, the velocities that are produced in the two bodies are equal, the masses of the bodies are also equal, *by definition.* But if the velocities that are produced are unequal, then the masses are also unequal, and are (by definition) proportional to these velocities; the body which is moving the faster being the one whose mass is the less. It would be impossible to carry out an elaborate experiment of this kind every time we wished to compare the masses of a pair of bodies, and it fortunately happens that masses can be compared with great accuracy by merely weighing the bodies against each other in a balance. For equality of weight means that the earth's attractive force is the same upon both; and if (as we know to be the case, by experiment,) the two bodies would fall with the same speed in a vacuum, it follows that equal forces acting upo the two bodies for equal times communicate them equal velocities; and hence, by the defin tion of "mass," the mass of the two bodies a equal. It will be noted that mass and weig are two essentially different things, althoug they are very commonly confused, because th are strictly proportional to each other, accor ing to the most accurate experiments that ha yet been made. Yet it is not at all impossib to imagine a state of things in which mass a weight would not be strictly proportional. It only by experiment, for example, that we kno that the earth attracts a body with precisely t same force, whether the body is hot or col The attraction between two permanent magne varies with the temperature, and it may yet found that gravitative attraction varies in t same way, though to a much smaller exte Numerous experimenters have in fact fanci that they could detect an effect of this kin though its reality is not yet admitted. But can hardly admit that the mass of a body is function of the temperature; and so we see th the apparently strict proportionality betwe mass and weight is not at all a necessity thought, but merely an experimental fact, whi may any day be shown to be nothing but a clo approximation to the actual truth.

So far as we know, matter can neither be d stroyed nor created by any experimental mea at our command, nor by any process now ope ative in nature. This great fact is often call the "law of the conservation of matter," and appears to be rigorously true. As has be pointed out above, future experiment may sho that the weight of a body depends to a slig extent upon its temperature, and it may also found that the weight of a chemical compou is not always precisely equal to the sum of t weights of its constituents; but it is believ that any irregularities of this sort that may discovered will hold true to the weight onl and will not affect the mass; and that t weight will also return to its original val when the substance that is weighed is broug back to the same chemical and physical cond tion again. The gravitative action of matt is one of its most singular attributes, and o which we are still far from understandin It is apparently true that every particle matter attracts every other particle with a for which is directly proportional to the product the masses of the two particles and inverse proportional to the square of the distance b tween them, and independent of every oth circumstance. It is not certain that this la holds true, nor that the attraction exists at a at distances comparable with the distance fro the earth to the fixed stars, but it appears hold rigorously at distances commensurate wi the dimensions of the solar system. Electr and magnetic forces may be either attracti or repulsive; but gravitative action is probab always attractive, the only phenomena whic would countenance the opposite view being th apparent repulsion that the sun exerts upon th tails of comets and upon the coronal streame that are seen at the time of a total solar eclips

Matter exists in three (or perhaps four physical states. All ordinary bodies, for exam ple, may be classified, roughly, either as solid or fluids; fluids being further subdivided int liquids and gases. This classification is not a

ät could be desired, since there are certain dies (such as wax) which have certain characteristics of the solids and certain others of e liquids. A more complete and systematic ıssification is hardly practicable, however, in e present article. A solid body may be deed as a body capable of resisting a considerle shearing stress. (See ELASTICITY). Solid dies usually have a considerable tensile strength so. A solid does not yield continuously to small deforming force; it resists deformation, d its resistance increases as the deformation creases. A fluid, on the other hand, is a subance having almost no shearing strength, and fering very little resistance to forces that tend change its shape. A fluid yields continuously a deforming force, and a force that will form it at all will deform it indefinitely, so ng as it is allowed to act. Considering the bdivision of fluids into gases and liquids, we ay say that a gas is a fluid that presses conuously and in every direction upon the walls the vessel containing it and which follows em indefinitely if they retreat. A gas, if left itself, tends to expand infinitely in all direcns. A liquid is a fluid which does not follow e walls of the containing vessel if they retreat d which has no tendency to expand indefiely if left to itself. (For the prevalent ories regarding the constitution of matter, e GASES, KINETIC THEORY OF; MOLECULAR HEORY).

When a gas is rarefied very highly by a merry vacuum pump, it exhibits properties which different in many respects from those manited by gases in the ordinary state of density. e pressure in such a rarefied gas, for exam, may be different in different directions; so at in this respect, at least, the rarefied medium mbles a solid rather than a gas or liquid. chanical and electrical properties are also obved at high exhaustions which cannot be reoduced at ordinary pressures; and for these l other reasons Sir William Crookes considd that a gas, when under only (say) the llionth or ten millionth of an atmosphere of ssure, may be fairly said to constitute a urth state of matter," which he considered to as different from the gaseous state as the seous state is from the liquid state. At first ought this appears to be an extreme and dly a justifiable view; but it must be remmed that Thomas Andrews showed that the tinction between a liquid and the gas or vapor ained from it by evaporation ceases to exist temperatures higher than a certain critical ue peculiar to each substance. (See CRITICAL INT). This temperature is about 88°F. for bon dioxide, and at temperatures progresely higher than this the isothermals of carn dioxide approximate with increasing closeis to the hyperbolas of a perfect gas. It ght be thought that a critical state exists with erence to the solid and liquid states; but is is still somewhat doubtful. It appears probe that no such state exists between a solid l its liquid, unless the solid is crystalline; l its existence has not been established even this case.

See MOLECULAR THEORY; LIQUEFIED AND MPRESSED GASES; ELECTRON THEORY; SOLUNS; ETHER; VACUUM.

MATTERHORN, mät'ĕr-hôrn, or **MONT CERVIN,** môn sĕr-văn', Alpine mountain on the Italian frontier of Switzerland, 6 miles southwest of Zermatt, 14,780 feet in height; it is known in Italian as MONTE SILVIO.

MATTESON, măt'ĕ-sŏn, **Tompkins Harrison,** American artist: b. Poughkeepsie, N. Y., May 9, 1813; d. Sherbourne, N. Y., Feb. 2, 1884. His early lessons in art were from an Indian; otherwise he was mostly self-taught until after the success of his *Spirit of '76,* when he settled in New York and studied in the National Academy. From 1851 until his death his home was Sherbourne. For a time he was a member of the New York legislature. His themes were historical or from American country life, and his best-known pictures are *The First Sabbath of the Pilgrims, Examination of a Witch, Eliot Preaching to the Indians, Rip Van Winkle's Return from the Mountains, At the Stile,* and *Foddering Cattle.*

MATTHEW. Matthew, the apostle of Jesus Christ, is with sufficient certainty identified with Levi, the son of Alphaeus, whose call by Jesus to discipleship is described in Mark and Luke in terms practically identical with a story of the call of Matthew in Matthew. It was not uncommon among the Jews for a man to have two names, and sometimes both names were of Hebrew, or Aramaic origin. The derivation and consequently the meaning of the name Matthew is uncertain, though it is commonly interpreted to mean "Gift of God." The mere mention of his father's name does not identify his family to us. He is first spoken of as being in his office as a "publican," or collector of taxes, presumably near Capernaum on the great highway between Damascus and the Mediterranean. While as such officer he would be in the service of the Tetrarch Herod, and not directly in Roman employ, yet he must have shared the obloquy which attached to this office among strict Jews, and it has accordingly been reckoned a mark of his humility that we find him designated as "the publican" in the Gospel which bears his name. After his call to discipleship he made a great feast of farewell, gathering his former friends and business associates to meet his new-found Master and the disciples attending him. The name of Matthew stands in all the lists of apostles, always the seventh or eighth in order, but of his activities as an apostle we have no record. No other name than his has ever been associated with the authorship of the first Gospel, and while this view has been discredited by many critics, because of the difficulty of considering the Gospel in its present form the work of an apostolic eyewitness, it is possible to conserve the historical value of this strongly confirmed tradition by holding that he was the author of the Discourse Document which constitutes such an important and characteristic element in Matthew. (See article MATTHEW, GOSPEL ACCORDING TO). There are many variant traditions as to the missionary labors of Matthew, Macedonia, Egypt, Ethiopia, and Parthia having been named as places where he worked. There is no sufficient reason for accepting any of these traditions, though perhaps the last is the most probable. Some traditions assert that he died as martyr and this has been accepted in the Western Church, but according to other

traditions perhaps no less reliable he died a natural death.

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MATTHEW, George Frederick, Canadian geologist: b. Saint John, New Brunswick, 1837. He received his education at the University of New Brunswick; secured a civil service post in 1853 and in 1879 was appointed chief clerk of customs. He was made surveyor of customs in 1893. He collaborated with Bailey, in 1872, in preparing a report on the geology of southern New Brunswick and in the following year prepared a report on the carboniferous system of that province. Subsequently he made several geological tours of exploration in the Maritime Provinces. He was a Fellow of the Royal Society of Canada and member of the New Brunswick Natural History Society. He published geological papers in various technical and scientific periodicals. D. 14 April 1923.

MATTHEW, Gospel According to. The Gospel with which the name of Matthew has uniformly been associated has with almost equal uniformity stood first in the gospel canon. It received this place both because it is the longest of the Gospels and because of the apostolic authority which the name of Matthew gave to it, but the place is fitting also because it relates itself more closely to the Old Testament than does any other gospel.

Contents.—As respects the events recorded, they are much the same as those given in Mark and Luke, and are arranged in substantially the same order. The book may be briefly analyzed somewhat as follows: Introductory, genealogy, birth and infancy of Jesus, ministry of John the Baptist, baptism and temptation of Jesus, i, 1–iv, 11. I. Early Galilean ministry (iv. 12–xii, 50). II. Later ministry in Galilee and neighborhood, and the Perean journey (xiii, 1–xx, 34). III. Entry of Jesus into Jerusalem and his teaching there, mainly controversial (xxi, 1–xxiii, 39). IV. Eschatological discourse (xxiv, 1–xxv, 46). V. Closing scenes, anointing at Bethany, last supper, agony in Gethsemane, trial, crucifixion, death and resurrection (xxvi, 1-xxviii, 20). In addition to the story of events and many brief reports of sayings of Jesus, this Gospel is marked by a cycle of five long discourses, each followed by a uniform formula, "It came to pass when Jesus finished." These discourses are "The Sermon on the Mount" (v, 1–vii, 27); the "Address to the Apostles" (x, 5–42); the collection of "Kingdom Parables" (xiii, 1–52); the "Discourse on Humility and Forgiveness" (xviii, 1–35); and the "Apocalyptic Discourse" (xxiv, 4–xxv, 46). While it need not be doubted that Jesus spoke at length on each of the occasions with which these discourses are connected, it is commonly held, especially in view of the somewhat parallel reports in Luke, that the author has gathered sayings spoken at various times and grouped them into what may be called "bouquets" of discourse, uniting them, not on the ground that all were spoken on the same occasion, but rather according to a logical association of ideas. This Gospel is also characterized by an arrangement of material in groups of threes, fives or sevens, presumably to aid the memory. Some 40 triplets have been named, e.g., the genealogy is arranged in three groups of 14 generations each, in chapters viii and ix there are three miracles of power, followed by three of restoration, there are given three prayers in Gethsemane, etc. Groupings by five and seven are not so common but occur often enough to deserve note as a striking characteristic of this book.

Purpose.— The purpose of the author plainly was to confirm Jewish Christians in their belief that Jesus of Nazareth was the Messiah long foretold by the prophets and expected by his nation. This is strikingly shown by the many references to the Old Testament which is cited no less than 40 times, often with the formal statement "that it might be fulfilled." The frequent use of the title "Son of David," as well as the genealogy which is traced back to Abraham through the royal line of David, the declaration in the Sermon on the Mount of his right to legislate parallel to the original gift of the Divine law through Moses, the assertion that the kingdom would be taken from the Jews and given to others and the grief over Jerusalem, the picture of himself as the judge at the Final Judgment, these claims in addition to the claims of Messiahship found in the other Gospels and culminating in the declaration of the Risen Christ that all authority in heaven and earth alike is his, all this abundantly proves that the object of the author was to show that Jesus of Nazareth was the promised Messiah and that all the Divine promises were to be fulfilled, not for the nation at large which had rejected him, but for his followers, because they had accepted him.

Sources.— Careful comparison of the first Gospel with the second shows that the order of events is substantially the same in both and that almost every paragraph of Mark is reproduced in Matthew, the exceptions being only seven brief paragraphs of at most less than 35 verses. As the theory that Mark is an abbreviation of Matthew has proved untenable, it follows that Matthew must be in some way dependent on the material of Mark: the resemblance is too close to permit the supposition that both drew from some independent document. But while the source of Matthew must have corresponded in general very closely to the present form of our Mark, yet this contains so much of picturesque detail which is not reproduced in Matthew that it cannot reasonably be held that Mark as we now have it was the source in question. How to account for this difference is still a problem of criticism. It is generally held that there may also be traced in Matthew a second main source, sometimes called the "Logia" document, sometimes "Q." (See article GOSPELS). In addition there is some material which cannot reasonably be traced to either of the two main sources, as the genealogy and the infancy narratives, but it is impossible now to trace the origin and extent of these special sources. This fact need not, however, impair our sense of their trustworthiness. It may also be noted that it is not reasonable to hold that the author of this book was a mere copyist who kept slavishly to the exact form of any written sources which lay before him.

Authorship.— The author of this Gospel for Jewish readers must of course have been himself of Jewish descent. Nor is his use of the

eek language inconsistent with this, since the e of Greek was so widespread that in the 1st ntury Palestine must have been largely bi-gual. That he was a Palestinian Jew is mani-t from the whole tone of his work. It also kes it doubtful whether the author of the book it now stands was himself an associate of sus in his ministry. While much of the ma-ial must go back to eyewitnesses, the author nself seems more remote. Accordingly, the dif-ulty in the way of accepting the early and iform tradition that the Apostle Matthew was e responsible author is increasingly felt. It is nerally recognized that the book does not have e unavoidable marks of being a translation, but ows that it must have been originally com-sed in Greek, while the early tradition was at Matthew composed his work in the "Hebrew nguage," by which was meant Aramaic, which d long before replaced Hebrew in common use. will retain the substantial value of the tradi-n if it is held that Matthew was the author of

When the Marcian source was reworked to clude the collection of discourses and other ma-ial which was due to Matthew, it would not surprising to find his name attached to the ole work. Accordingly, while the direct au-rship by Matthew of the book in its pres-form is still very commonly held, there is perhaps increasing tendency among critics to nnect only the Logia document with the apostle atthew himself, and in this way his name became ached to the First Gospel.

Date and Place of Composition.—There is le dissent at present from the view that this spel was composed late in the seventh decade the 1st century, presumably 65–68 A.D. As to place of composition there is less agree-nt. The material is Palestinian, but many l a certain sense of detachment as if the hor was not of Palestine when he wrote amid scenes which he describes. Of course this ght be true if written in some place in Pales-e remote from both Capernaum and Jeru-em; some Syrian city has been suggested, and n Alexandria has been thought not too remote, ecially in view of its large Jewish and Jewish-ristian population.

Authenticity and Value.—If the common w of Matthew's direct authorship is still to accepted, then this Gospel as the work of apostolic associate of Jesus must be trust-rthy and valuable in the highest degree. If, the other hand, the book is referred to an named author who worked mainly on the is of the Marcan and Logia documents, its stworthiness and value will be impaired less n might at first be supposed. We must as-ne the honesty of the compiler and editor, ich indeed is everywhere manifest, and ac-ding to the theory he was working on uments which embodied the common Chris-n tradition approved by the many dis-les who had seen Jesus face to face or which n had full apostolic authority. Such were sumably the Marcan source and most prob-y the Matthaean Logia, while the genealogy ld have been drawn from public sources, and tone of the infancy narratives is such as clusively to guarantee their very early date. en all these facts are taken into account, will appear that the latest criticism really con-ns the often quoted saying of Renan: "The spel of Matthew, all things considered, is the most important book of Christianity—the most important book that has ever been written."

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MATTHEW TOWN. See INAGUA, GREAT.

MATTHEWS, James Brander, American author: b. New Orleans, La., Feb. 21, 1852; d. March 31, 1929. He was graduated from Columbia in 1871, from Columbia Law School in 1873, admitted to the New York bar (1873), began to contribute to the magazines in 1873, later turned wholly to literature and in 1892 was appointed professor of literature at Columbia. In 1900–1924 he was professor of dramatic literature. He was a founder of The Players and Authors clubs, of the Dunlap Society, and the American Copyright League, and of the Columbia University Press. In 1889–1891 he was president of the 19th Century Club. He was decorated with the French Legion of Honor in 1907; elected to the American Academy of Arts in 1908. He was made president of the Modern Language Association in 1910 and of the National Institute of Arts and Letters in 1913–1914. His published volumes include, from an extensive list, the following: *French Dramatists of the Nineteenth Century* (1881); *Pen and Ink* (1888); *American Literature* (1896); *The Development of the Drama* (1902); *Molière: His Life and His Works* (1910); *Shakspere as a Playwright* (1913); *On Acting* (1914); *The Oxford Book of American Essays* (1914); *Essays on English* (1921); *Playwrights and Playmaking* (1923). He wrote several plays and novels but was best known for his critical papers.

MATTHEWS, Francis Patrick, American public official: b. Albion, Nebr., Mar. 15, 1887. He received the degree of bachelor of laws from Creighton University, Omaha, in 1913. He became a prominent lawyer in Omaha, and he was counsel for the Reconstruction Finance Corporation, 1933–1949. He is much concerned with charities, including the Omaha Community Chest, the National War Fund, and the National Conference of Catholic Charities. He is an active member of the Knights of Columbus; he was made knight commander of the Order of St. Gregory in 1938 and received the Grand Cross of that order in 1942; in 1944 he was named papal chamberlain by Pope Pius XII. As special representative of the Catholic Administrative Board of Bishops, he visited Europe and the Near East in 1943–1944, to study the problems of relief for displaced persons and of welfare services for the armed forces. He was a member of the President's Committee on Civil Rights in 1946–1947, and a delegate to the Democratic National Convention in 1948. On May 13, 1949, he was appointed secretary of the navy, succeeding John L. Sullivan.

MATTHEWS, Franklin, American journalist: b. Saint Joseph, Mich., May 14. 1858; d.

26 Nov. 1917. Graduated from Cornell University 1883, he was reporter and editor on the Philadelphia *Press,* 1886–90, reporter, editor, correspondent of the New York *Sun,* 1890–1912. He was assistant Sunday editor and night city editor of the New York *Times,* 1912–15. He was associate professor of journalism, Columbia University, 1914. He was a trustee of Cornell University, 1913–18, and also president of the Cornellian Council, 1915. He published 'Our Navy in Time of War' (1899); 'The Newborn Cuba' (1899); 'With the Battle Fleet' (1909); 'Back to Hampton Roads' (1909).

MATTHEWS, John Hobson, English archivist: b. Croydon, near London, 1858; d. Ealing, 23 Jan. 1914. He was educated at the Proprietary School of Blackheath and at The Leys, Cambridge. In 1877 he entered the Roman Catholic Church and two years later was made a solicitor. From 1894 to 1903 he was employed as archivist to the corporation of Cardiff, Wales, and was also archivist to the county and urban councils of Monmouthshire. His various avocations included those of expert archivist, record searcher, genealogist, journalist and legal antiquary. In 1895 he discovered the text of the grant of Cardiff lands to Sir William Herbert, in 1550, the document being almost illegible. In the following year he brought to light the text of a charter to the borough of Newport. In 1903 and 1911 he was called as expert before the Royal Historical Manuscripts Commission. He published 'History of St. Ives, Cornwall'; 'History of the Hundred of Wormelow'; 'The Vaughans of Courtfield'; 'The Old Faith and the New'; 'Life and Memorials of St. Teilo'; 'The Mass and its Folklore'; 'Continuity Reconsidered.' He continued Duncumb's 'Herefordshire,' edited 'Cardiff Records' (1898–1905) and contributed to 'The Catholic Encyclopedia,' the *Tablet, Athenæum,* etc.

MATTHEWS, Marmaduke Matthews, Canadian artist: b. Warwickshire, England, 1839; d. 1913. He received his education in Oxford and London; removed to Toronto in 1860 and resided in New York from 1864 to 1869. In the latter year he returned to Toronto, was one of the founders of the Ontario Society of Artists, of which he was president in 1894. He excelled in woodland studies. His best-known works are 'The Canadian Wonderland' and 'The Conquered Portal.'

MATTHEWS, Paul, American Protestant clergyman: b. Glendale, Ohio, 25 Dec. 1866. In 1887 he was graduated at Princeton University and three years later at the General Theological Seminary, New York. In 1891 he was ordained to the ministry of the Protestant Episcopal Church; served as assistant at the church of the Advent, Walnut Hills, Cincinnati, 1890–91; entered the Associate Mission, Omaha, and had charge of Saint Paul's and Saint John's churches in 1891–95. From 1896 to 1904 Dr. Matthews was rector of Saint Luke's, Cincinnati, and from 1904 to 1913 was dean of Saint Paul's Cathedral of the same city. In 1913–15 he was dean of the cathedral at Faribault, Minn., and professor at Seabury Divinity School. On 25 Jan. 1915 he was consecrated bishop of New Jersey.

MATTHEWS, Stanley, American jurist: b. Cincinnati, Ohio, 21 July 1824; d. Washington, D. C., 22 March 1889. He was graduated from Kenyon College in 1840, studied law and was admitted to the bar in 1842, when he established a practice in Maury County, Tenn., but returned to Cincinnati in 1844 and engaged in practice there. He was editor of the Cincinnati *Herald,* an anti-slavery journal, in 1846–49, and held various political offices, and in 1855–56 was a State senator. In 1858 he was appointed United States district attorney for the southern district of Ohio, but at the outbreak of the Civil War in 1861 entered the volunteer service and was commissioned lieutenant-colonel and was a colonel when in 1863 he resigned to accept the seat of judge of the Superior Court of Cincinnati. He was elected United States senator in 1877 after having acted as counsel before the Electoral Commission, and in 1881 he was appointed a justice of the Supreme Court of the United States.

MATTHEWS, Washington, American physician and ethnologist: b. Killiney, Dublin County, Ireland, 1843; d. 1905. In 1864 he was graduated at the medical school of the University of Iowa. He was commissioned assistant surgeon in the United States army, from which he retired as surgeon in 1895. He made several anthropological studies of the Indians of North America. His published works include 'Dictionary of the Language of the Hidatsa' (1873); 'Navaho Silversmiths' (1883); 'Navaho Weavers' (1884); 'The Mountain Chant, a Navaho Ceremony' (1887); 'Navaho Legends' (1897); 'The Mystic Chant, a Navaho Ceremony' (1902); 'Navaho Myths, Prayers and Songs' (1907).

MATTHIAS, mą-thī'ąs, a disciple of Jesus, probably one of the 70, who was chosen by lot to take Judas Iscariot's place among the 12. Little is known of him. Even early legend confused him with Matthew, and an apocryphal gospel was attributed to him. In the Roman Catholic Church 24 February, in the Greek 9 August, is sacred to him. The 'Acts of Andrew and Matthias' make him a missionary in Africa. Consult Eusebiús, 'Ecclesiastical History' (Vol. I, 12; II, 1).

MATTHIAS (Ger. mät-tē'äs), emperor of Germany: b. Vienna, 24 Feb. 1557; d. 20 March 1619. He was a younger son of Maximilian II. He was made governor of Austria in 1593 and two years later became heir to the imperial throne. He fought in the war against the Turks and in 1606 was made head of the House of Hapsburg. He became king of Bohemia in 1611 and had annexed Hungary and Moravia before the death of Rudolf II. In 1612–19 he was emperor of the Holy Roman Empire, having been elected on the death of his brother, Rudolf II (q.v.). His reign was an unsuccessful one owing to the religious dissensions among the constituent parts of his empire. He attempted in vain to suppress by decree the Catholic League and Protestant Union. Consult Gindely, A., 'Rudolf II und seine Zeit' (Prague 1868) and Heling, J., 'Die Wahl des römischen Königs Matthias' (Belgrade 1892).

MATTHIAS I, Hunyadi («Corvinus»), kŏr-vē'noos, THE GREAT, king of Hungary: b. Klausenburg, Transylvania, 23 Feb. 1440; d.

énna, 4 April 1490. The second son of John
nyady, he was imprisoned in Bohemia by his
her's enemies, who strongly but unsuccess-
ly opposed his candidacy for the crown of
ngary in 1458. Another party of opposi-
n attempted to make the Emperor Frederick
king of Hungary; but Matthias brought
m to terms and in 1463 made peace with
ederick. By the Peace of Olmütz, 22 July
79, he gained Silesia, Moravia and Lausitz,
d the succession to the crown of Bohemia.
his wars with the Turks he was equally
ccessful and a part of Bosnia was ceded to
n by the Porte. War broke out again with
Austrian emperor; Matthias invaded his
ritory and captured and held Vienna. His
rt was a centre of scholarly men and his
rary, called the Corvina, a famous collection.
e internal administration of Hungary was
atly improved under Matthias. Consult
aknói, Vilmós, 'King Matthias Hunyadi'
udapest 1890; German trans., Freiburg
91) and Galeotti, Marzio, 'De egregie sapien-
et jocose dictis ac factis Matthiæ regis'
ienna 1746).

MATTING. While this term is usually
ployed to designate floor coverings made
m reeds and fibrous grasses, it is a generic
m which includes not only the commercial
ttings for house floors, which are made in
stern countries, but a much wider range of
icles useful in the domestic economy and in
ier employments, such as screens and tatties,
eping mats (used in India and the East), the
tting employed by nurserymen for protect-
g hotbeds and cold frames, and even some
ms of thatch. For the most part mattings
hand-woven, in the finer varieties the warp
ng cotton or other yarns and the filling the
ms of various sedges, reeds and grasses, an
ample being the familiar Japanese mattings
the house-furnishing stores. In the Russian
st mattings for nurserymen's use, bast of
linden tree is employed for both warp and
ing, very coarsely woven or plaited. The
ots of the Khus-Khus (*Andropogon squarro-*
s), a perennial grass of India, are woven into
agrant screens for open windows and also
de into awnings. The Taika rush mats of
rmosa are famous as sleeping mats, and the
st grades are said to be as fine and soft as
th, resembling the best Panama hat weaving.
nsul Davidson states that a mat of the high-
grade, measuring 5 x 6 feet, requires the
or of a girl weaver 120 days, and such mats
ve sold for 60 to 70 yen (or about $40). The
sh is an unidentified species, but sleeping
ts are made from several species of *Cyperus*
d *Scirpus* found in Asia, Africa and other
untries.

The commercial mattings used for house
corations are for the most part of Chinese
d Japanese manufacture. In Japan two spe-
s are employed, *Juncus effusus*, the Bingo-i
t rush, which is always manufactured into
e costly mats used by the higher classes (and
own as Tatamiomote) and *Cyperus unitans*,
ich is employed for the cheaper grades. The
gest importer of these mats is the United
ates, England, Austria and Germany, follow-
g in the order named. The qualities of the
ngo-i are named as follows: Kinkwanyen,
nufactured at Okayama; first quality Aya-
mushiro, second quality Aya-mushiro, Damask
Aya-mushiro, common Aya-mushiro, manufac-
tured at Bittiro. First quality Somewake-
mushiro, common Somewake-mushiro, Damask
Hana-mushiro, common Hana-mushiro, manu-
factured at Bingo; ordinary Hana-mushiro
(best quality), manufactured at Chikugo. *Cy-
perus unitans* produces the Shichito-i mats
which are chiefly manufactured in the Oita pre-
fecture. The plant is cultivated both upon up-
land and irrigated lands. The varieties of
mats from this species are known by names as
follows: Kikaiori Hana-mushiro, Damask
Hana-mushiro, common Hana-mushiro (two
forms). Seidaka Hana-mushiro, manufactured
at Bungo. Mattings made from the two species
above have been exported in a single year to
the value of 650,000 yen, or over $400,000.

The Chinese and Korean mat rush is *Cype-
rus tegetiformis,* this species also being used
for the manufacture of cuffs and sandals. The
India commercial mattings are made chiefly
from *Cyperus corymbosus* and *tegetum;* the
latter being known as the Calcutta mat rush,
while the former is used for the Tinnerelly
mats which are the finest made in India. They
are also made at Palghat, but these are not so
fine. In the manufacture of the India mat-
tings the culms are split into two or three
parts and then woven into mats upon a warp
of threads previously stretched across the floor
of a room. The operator passes the culms
with the hand alternately over and under the
successive threads of the warp and presses
them home.

It would be difficult to enumerate all of the
mattings made in different countries, though
mention should be made of the fine and highly
prized Niihau mats of Hawaii, produced from
Cyperus levigatus. Matting is made in Spain
and Morocco from *Juncus maritimus,* and in
Italy from *Juncus acutus.* Two species of sword
rush, *Lepidosperma gladiatum* and *L. flexuo-
sum,* are used by the natives of Australia not
only for mats, but for baskets and other articles,
and *Lepironica mucronata,* found in Asia,
Africa and Polynesia, supplies the fibre for
the mats with which Chinese boatmen cover
their cargoes.

In the United States, a handsome and utili-
tarian form of floor matting is largely manu-
factured from Slough grass, *Carex filiformis.*
In normal years the imports of mattings to the
United States reach a total of $3,250,000.

The University of California conducted
many experiments with several species of mat-
ting rushes, chiefly *Juncus effusus,* and *J. Ro-
bustus,* from which a fine sample of matting
had been manufactured at a factory in Maine.
There are now about a dozen factories in the
United States manufacturing mats and matting
from grass and coir.

For matting fibres consult 'Dictionary Eco-
nomic Products of India,' 'Descriptive Cata-
logue of Useful Fiber Plants of the World,'
and 'The Island of Formosa,' by Jas. W.
Davidson. Consult also 'History and Manu-
facture of Floor Coverings' (New York 1898).
The leaves of many species of palm, in different
parts of the world, are used for native mats
and mattings, though few of these ever reach
commercial importance. See PALMS.

CHARLES RICHARDS DODGE.

MATTING FIBERS. See FIBER.

MATTIOLI, mät-tê-ô'lê, CONTE **Ercole Antonio,** Italian statesman and diplomat: b. 1640; d. Paris, Nov. 19, 1703. Nothing is known of his early life but as a young man he settled at Mantua and became the confidential secretary to Charles III and Charles IV, dukes of Mantua. His name has been passed down to posterity only because it is generally believed that he was the famed secret prisoner of Louis XIV, first referred to by Voltaire as "The Man in the Iron Mask."

From the private papers of Louis XIV it became evident that it was this man who was seized by the king for revealing to others the secret negotiations of France with Mantua for the sale of the Mantuan fortress of Casale. Mattioli was first confined at Pignerol, then at the island of St. Marguerite, and in 1698 he entered the Bastille, where he died five years later.

Much speculation was caused at the time (and later) as to the identity of the unknown prisoner. Some regarded him as the natural son of Louis XIV and others as the twin brother of the French king. Dumas père established him as the latter in his book *Vicomte de Bragelonne* (1848) in a section often published separately as *The Man in the Iron Mask.*

MATTIPI (South American name) or **FROG SNAKE,** a serpent (*Xenodon severus*) of northeastern South America. While a poisonous variety, it is slow to bite. Its posterior teeth serve as fangs, but it has no venom sacs. The bite causes temporary swelling and soreness, but is seldom fatal.

MATTOON, mă-tōōn', city, Illinois, in Coles County, at an altitude of 725 feet, 40 miles southeast of Decatur, and served by the Illinois Central and the Cleveland, Cincinnati, Chicago and St. Louis railroads and state and federal highways. Situated in an agricultural region, Mattoon is an industrial city, making furniture, shoes, utility equipment, roofing, Diesel engines, and brooms. Broom corn and soybeans are the major crops in the surrounding district. The two railroads serving the city have machine shops and repair shops there. The city has a public library, and nearby are a fish hatchery and Paradise Lake, formed by a dam on the Little Wabash River.

Mattoon was settled and incorporated in 1855, in connection with construction of the Illinois Central through this region, and was named for William Mattoon of that railroad, who played an important part in organization of the town. It was here, in 1861, that Ulysses S. Grant mustered the Twenty-first Illinois Volunteers into service, with himself as colonel, appointed by Gov. Richard Yates. The city has commission government, and the water supply is municipally owned. Pop. (1950) 17,547.

MATTSON, măt's'n, **Henry Elis,** American painter: b. Gothenburg, Sweden, Aug. 7, 1887. He came to the United States in 1906 and was naturalized as a citizen in 1913. He studied briefly (1912–1913) at the School of Worcester Art Museum, Worcester, Mass., although most of his training in art is self-taught. His marines and landscapes are represented in many of the nation's finest collections, among them the Metropolitan Museum of Art. the Whitney Museum of American Art, New York; the Carnegie Institute, Pittsburgh; the Corcoran Gallery of Art and the White House, Washington, D.C. He painted under the sponsorship of the Works Progress Administration and has murals at the post office in Portland, Me. His prizes include those of the Art Institute of Chicago (1931), Corcoran Gallery of Art (1935 and 1943), and Carnegie Institute (1935).

MATURIN, mătū'rĭn, **Charles Robert** Irish dramatist and novelist: b. Dublin, 1782 d. there, Oct. 30, 1824. He received his education at Trinity College, Dublin, entered the ministry of the Church of Ireland, and served successively as curate at Loughrea, County Galway and at St. Peter's, Dublin. He wrote the novels *The Fatal Revenge, or the Family of Montorio* (1807); *The Wild Irish Boy* (1808); and *The Milesian Chief* (1812), under the pseudonym of DENNIS JASPER MURPHY. The novels, written as Gothic romances, were ridiculed by the critics but attracted the favorable attention of Sir Walter Scott, who introduced Maturin to Lord Byron. These powerful friends secured the production of Maturin's tragedy *Bertram, or the Castle of St. Aldobrand* at Drury Lane in 1816 with Edmund Kean in the leading role. It ran for 22 nights, and a French version was produced soon afterward at the Théâtre Favart Paris. His other tragedies *Manuel* (1817) and *Fredolfo* (1819) failed totally. Among his other works were the novels *Women* (1818); *Melmoth the Wanderer* (1820); and *The Albigenses* (1824). *Melmoth* is his greatest work and was most successful in its day.

MATURIN, mä-tōō-rēn', town, Venezuela capital of the state of Monagas, formerly the capital of the state of Maturin. It is on the Guarapiche River, north of the Orinoco, 25 miles by rail above its port, Colorado, and 40 miles from the sea. A considerable trade with the West Indies, principally in cattle and hides, is carried on. In the neighborhood are extensive plantations of cacao, sugar cane, fruits, and cereals. Its industrial establishments turn out cigars, starch, hammocks, boots, shoes, and soaps. There are petroleum fields nearby. Maturin is the birthplace of two presidents of Venezuela, José Tadeo Monagas and José Gregorio Monagas. Pop. (1941) 10,705; (1950) 25,350.

MATZOON, măt-sōōn', a milk food used in Armenia; prepared by exposing milk in open vessels to a heat of 90°F., and when coagulation takes place the curd is broken up by a churning process and salt is added. See also KUMISS.

MATZOTH, mät'sōth, the Hebrew name for a kind of unleavened bread or biscuit eaten by the Jews during the feast of the Passover.

MAUBEUGE, mō-bûzh', fortress and manufacturing town, France, in the Department of Nord, occupying both banks of the Sambre, 49 miles southeast of Lille, within two miles of the Belgian frontier. The origin of Maubeuge was in a double monastery for monks and nuns founded in the 7th century. Destroyed successively by the Normans, by Louis XI, by Francis I, and by Henry II, it finally fell to France by the Treaty of Nimeguen in 1678, and was fortified by the marquis de Vauban. Pre-

ous to outbreak of World War I in 1914 it was efended by nine forts. The principal industry is ie manufacture of iron and steel products. The wn was occupied by the Germans in 1914 and gain in 1940. Pop. (1946) 20,859.

MAUCH CHUNK, môk chŭngk, Pa., borugh and Carbon County seat, situated on the ehigh River at an elevation of 916 feet, 29 miles orthwest of Allentown; it is served by the Cenal of New Jersey and the Lehigh railroads. The rst settlement here, on the edge of the Pennsylania anthracite coal region, was begun in 1815 y the Lehigh Coal and Navigation Company. oth the Lehigh Canal and the Lehigh Valley ailroad had their start here. A gravity railroad, onstructed in 1827 to haul coal from the mines, as discontinued in 1870, and thereafter was a opular scenic railway until the 1930's. Mauch hunk, the Indian name for Bear Mountain, was ie home of Asa Packer (q.v.), builder of the Leigh Valley Railroad and founder of Lehigh Uniersity. Borough incorporation was effected in 846. Pop. (1930) 3,206; (1940) 3,009.

MAUD, a poem by Alfred Tennyson (q.v.), ublished in 1855. Tennyson called it a "monorama," a drama told in a series of lyric soliloies. His explanation of its unique form is is: "The peculiarity of this poem is that difrent phases of passion in one person take the ace of different characters." To tell the story *Maud* is to follow these phases of passion. he beginning shows the hero cut off from life his heritage of hate and wrong, crying for ar to kill the greed and cruelty of peace. With e coming of Maud, the child of his enemies, beus his new life of love that embraces mankind. is joy is shattered at its climax; a hopeless ile, he seeks only escape from the phantoms of e past. From this death in life, he is saved by e outbreak of war "in defence of the right." ne ending, written to the sound of cannon boomg from British battleships before the Crimean ar, is a paean of battle. It was this militant ain in *Maud* that shocked Tennyson's admirers d still provokes criticism. Yet read, not as a fense of any one war, but as an indictment the materialistic peace that is war and that uses war, the poem shows something of that ger vision that is prophetic.

As a monodrama, *Maud* fails to achieve draatic unity. Many of the separate lyrics are nuine bits of inner action, of soul drama, set rth with keen psychological analysis, with skill-l variation of meter to express fluctuation of eling. But sequence of action, the law of ama, is sacrificed to singleness of mood, the sence of the lyric. In *Maud,* as in *The Princess,* nnyson's attempt to fuse the lyric and the amatic moods fails. To think of *Maud* is to nk first of those songs that have become part the vocabulary of passion and of longing. nsult Tennyson, H., *Alfred, Lord Tennyson: Memoir,* 2 vols., (London, 1897); Grierson, H., *mbridge History of English Literature,* vol. 8, ap. 2 (Cambridge 1916–31).

FRANCES W. CUTLER.

MAUD MULLER, a poem by John Greenf Whittier, first published in the *National Era,* ecember 1854. It is a ballad reciting a romantic ssage in the lives of a susceptible judge and a untry girl.

MAUDE, SIR **Frederick Stanley,** British army officer: b. Gibraltar, June 24, 1864; d. Baghdad, Iraq, Nov. 18, 1917. Entering the army at the age of 20, he saw his first active service in the Egyptian campaign of 1885; during 1900–1901, in the South African War, he fought in several battles as a staff officer of the Guards Brigade. After three years as military secretary to the governor general of Canada he served at the War Office in connection with organization of the newly-formed territorial force. With outbreak of World War I in 1914 he went to France on the staff of the 5th Division, and shortly was given command of the 14th Brigade. He returned wounded to England, and in 1915 he was sent to the Dardanelles to assume command of the 13th Division; in Gallipoli he shared in the withdrawal from both Suvla and Helles. From Egypt, whither he had gone with his division, he was transferred to Mesopotamia, and there, after failure of the attempt to relieve Kut al Imara in August 1916, he became British commander in chief. Reorganizing his forces, he began an advance in December which drove the Turks from Kut and carried him on to Baghdad, where he concluded his successful campaign in March 1917. After a pause for preparation came another forward move, marked by the last victory of his lifetime at Tekrit. Again in Baghdad, Maude was struck down suddenly by cholera, which proved fatal.

MAUDSLEY, môdz'lĭ, **Henry,** English alienist: b. near Settle, Yorkshire, Feb. 5, 1835; d. Bushey Heath, Jan. 23 or 24, 1918. He graduated in medicine at the University of London in 1857, and thereafter specialized in mental diseases. From 1869 to 1879 he was professor of medical jurisprudence at University College, London. In 1913 he provided £30,000 for the erection in London of the Maudsley Hospital for the Insane. He edited *The Journal of Mental Science* from 1862 till 1878, and his numerous works included *Body and Mind* (1870); *Responsibility in Mental Disease* (1872); *The Physiology of Mind* (1876); *The Pathology of Mind* (1879); *Life in Mind and Conduct* (1902); and *Organic to Human* (1916).

MAUGHAM, môm, **William Somerset,** British author: b. Paris, France, Jan. 25, 1874. He was the son of Richard Ormond Maugham, the solicitor to the British Embassy in France, and was the youngest of six children. Orphaned at the age of 10, he went to England to live with an uncle who was vicar of Whitstable. He attended King's School at Canterbury for three years, and studied for a short time at Hyères, in south France. He spent the year 1891 in Heidelberg, Germany, where he frequently attended lectures at the university. In 1892 he entered the medical school of St. Thomas's Hospital in London, and after completing his studies, he became a physician. He discontinued the practice of medicine after one year in order to devote full time to writing. In 1915 he married Syrie Barnardo, an interior decorator; they had one daughter and were divorced in 1927.

His first book, *Liza of Lambeth* (1897), was a story which resulted from his experiences as a doctor in Lambeth, one of the poorer districts of London. *A Man of Honour,* his first play, was produced in 1903, although *Lady Frederick* in 1907, brought his earliest success; by 1908, four

of his plays were running simultaneously: *Lady Frederick, Jack Straw, Mrs. Dot,* and *The Explorer.* After the publication of *Of Human Bondage* (q.v.) in 1915, which is usually considered his outstanding achievement, he wrote a steady stream of plays, short stories, and novels. His plays, most of them drawing room comedies, were performed in Europe and the United States. Among them, *The Circle* (1921), *Our Betters* (1923), and *The Constant Wife* (1927) were outstanding. His last play, *Sheppey,* written and produced in London in 1933, was not especially successful.

Several of his novels and shorter pieces are reprinted almost annually. *The Moon and Sixpence* (1919), the story of an artist, was based on the life of Paul Gauguin. *Miss Thompson,* included in a collection of short stories, *The Trembling of a Leaf* (1921), was made into a play by John Colton and Clemence Randolph under the title *Rain* in 1922. *Ashenden, or The British Agent* (1928) was drawn from the author's experiences as an intelligence agent in Switzerland during World War I. *Cakes and Ale, or The Skeleton in the Cupboard* (1930) is a satirical story of two men of letters, who are often said to be Thomas Hardy and Hugh Walpole. In 1938 Maugham published an account of his literary experiences, *The Summing Up,* which has become a useful guidebook for persons interested in writing. *The Razor's Edge* (1944), the story of a young American's spiritual quest, brought his most immediate success, and was made into a motion picture in 1946. Among his more recent books are *The Mixture as Before* (1940), *Up at the Villa* (1941), *Then and Now* (1946), *Creatures of Circumstance* (1947), and *Catalina* (1948).

MAUI, mä'ōō-ē, one of the Hawaiian Islands, situated 26 miles northwest of Hawaii; it comprises two mountainous passes joined by an isthmus. The east peninsula contains Haleakala crater, 10,025 feet high, last active about 1750. There are large sugarcane and pineapple plantations. Wailuku, near the northwest coast, is the largest town and the seat of Maui County; it has supplanted Lahaina, on the southwest coast, where white men first established themselves in the island. The county of Maui comprises Maui, Lanai, and Kahoolawe. Pop. (1940) county 55,534.

MAULE, mou'lä, Chile, a maritime province bounded north by the province of Talcá, and south by the province of Nuble. The area is 2,172 square miles. Most of the surface is occupied by the forested coast range, averaging nearly 3,000 feet in height. Agriculture, stockraising, and lumbering are the principal industries. The province takes its name from the river Maule (q.v.). Linares (q.v.) the provincial capital, is on the main line of the state railroad; branch lines connect it with Cauquenes (pop. 11,198), the former capital, and with Constitución (pop. 7,049), the chief port. Pop. (1940) 70,497.

MAULE, a river of Chile, rising in the Andes and after a westerly course of 150 miles (52 miles navigable for small vessels) entering the Pacific Ocean immediately north of Constitución; it gives its name to the province of Maule (q.v.). The Maule River is believed to have been the southern boundary of the empire of the Incas.

MAUMEE, Ohio, village in Lucas County; altitude 648 feet; on the Maumee River; 8 miles southwest of Toledo; on Nickel Plate and Wabash railroads. It makes desks, cabinets, and butter coloring. Pop. (1930) 4,588; (1940) 4,683; (1950) 5,548.

MAUMEE, mô-mē', a river formed by the junction of Saint Marys and Saint Joseph rivers at Fort Wayne, Ind. It flows northeast across the northwest corner of the state of Ohio, and enters Lake Erie through Maumee Bay. Its affluents are the Auglaize and the Tiffin. Its basin is 6,700 square miles in extent. The river is 150 miles long and navigable 12 miles from its mouth to the Maumee Rapids.

MAUNA KEA, mou'nä kā'ä, Hawaii, a semi-active volcano, highest peak in the Hawaiian Islands, 13,784 feet in altitude. Snow covers its upper slopes for the greater part of the year; and its sides are wooded. Coffee is cultivated on the lower slopes.

MAUNA LOA, lō'ä, Hawaii, active volcano in the central southern portion of the island, 13,680 feet in altitude; the crater is nearly five miles in circumference, and on the inner side vertical precipices tower 500-600 feet. On the eastern slope of Mauna Loa is the still larger crater of Kilauea (q.v.), about nine miles in circumference but apparently having no communication with the former since their periods of activity are independent of each other. Mauna Loa's greatest activity was in 1881; it erupted on April 26, 1942, and again on Jan. 6, 1949. A sharp earthquake, accompanying its last eruption, rocked nearby Hawaii National Park Volcano House, but no damage was reported.

MAUNDY THURSDAY, môn'dĭ, the Thursday in Holy Week, the annual memorial of the Last Supper at which Christ washed the feet of his disciples. The ceremony of washing the feet of the poor on that day was originally kept by noblemen and prelates, as well as by the pope and Roman Catholic sovereigns. In Britain the ceremony was performed by the sovereign until the reign of William III, when it was transferred to the lord high almoner; it was discontinued in 1754. The maundy usage is now confined in Britain to gifts of money at Westminster Abbey to as many old men and women as there are years in the sovereign's age, one penny for each year, together with money in lieu of the clothes formerly given; the maundy pennies, first coined under Charles II, are silver and unmilled, and are legal tender. The yeomen of the guard carry the doles, which are distributed by the lord high almoner. Maundy Thursday is sometimes called Sheer or Chare Thursday.

MAUNOURY, mō-nōō-rē', **Michel Joseph,** French military officer: b. Maintenon, Eure-et-Loire, Dec. 11, 1847; d. en route from Paris to Orleans, March 28, 1923. He became an artillery officer in 1869, and in the Franco-Prussian War of 1870–1871 he was wounded at Champigny. In 1905 he attained the rank of general of division and had charge of the artillery of the Paris forts. General Maunoury was commandant of the École Supérieure de Guerre in 1907; the following year of the 15th Army Corps with headquarters at Marseilles, and in 1909 of the 20th corps at Nancy.

He was made military governor of Paris in 1910 and a member of the Superior Council of War. In the War of 1914–18 Maunoury was placed in charge of the army of manœuver and was rushed north in an effort to turn the flank of Von Kluck's army then driving toward Paris. When the latter discovered Maunoury on his right the drive was stopped and in the battle of the Marne the invader was driven back. Subsequently after the beginning of trench warfare Maunoury held a command at Soissons. He was severely wounded in March 1915 and in the same year received at the hands of the President of the Republic the *médaille militaire,* the highest military honor in the gift of France. He was also an officer of the Legion of Honor. In November 1915 Maunoury succeeded Gallieni as military governor of Paris. Consult Blanchon, G., 'Le général Maunoury' (Paris 1916). See WAR, EUROPEAN.

MAUPASSANT, Henri René Albert Guy de, ŏn-rē rē-nā äl-bār gē dē mō-pä-sän, French novelist: b. Chateau Miromesnil, Seine-Inferieure, France, 5 Aug. 1850; d. Paris, 6 July 1893. He began his career as a clerk in the Navy Department in Paris and also served for a time in the French army during the Franco-Prussian War. The novelist Flaubert, a friend of his mother's, was his godfather, and the youth took him as his model in the art of composition. After years of practice, during which he wrote and destroyed a great number of manuscripts, he allowed a short story, 'Boule de Suif,' to appear in 1880, a work which displayed the greatest finish and at the same time allied him to the naturalistic school of fiction. In the same year he published a book of verse, 'Des Vers,' and a drama, 'Histoire du vieux Temps.' After this he continued to cultivate the short story and was very soon recognized as one of the greatest writers of short stories the 19th century had seen. In spite of the perfection of art displayed in their construction neither his brief tales nor his novels form pleasant reading. They compel admiration, but they are dominated by pessimism and in his later work the traces of an unbalanced mind may be plainly seen. In 1890 De Maupassant's mental malady occasioned the cessation of literary occupation, two years later he became wholly insane and he died the next year in an asylum. His collections of short stories include 'La Maison Tellier' (1881); 'Mlle. Fifi' (1883); 'Les Sœurs Rondoli' (1884); 'Yvette' (1884); 'Contes du Jour et de la Nuit' (1885); 'Contes et Nouvelles' (1885); 'La Horla' (1887); 'La petite Roque' (1888); 'La Main gauche' (1889); 'Le Père Milon'; 'L'inutile Beauté' (1890), etc. The finest of his six novels is 'Pierre et Jean' (1888); the others are 'Une Vie' (1883; 'Bel Ami' (1885); 'Mont Oriol' (1887); 'Fort comme la Mort' (1889); 'Notre Cœur' (1890). He also published several collections of travel sketches, such as 'Au Soleil' (1884); 'Sur l'Eau' (1888); 'La Vie errante' (1890). A collection of 13 of his short stories published in English with the title, 'The Odd Number,' presents him at his best, both in point of art and as regards the stories themselves. The absence of a moral sense is less apparent here than elsewhere and there is less of gloom and pessimalism perceptible. Consult 'Œuvres complètes de Guy de Maupassant' (29 vols., Paris 1908–10); 'Works of Guy de Maupassant' (9 vols., New York 1910); Brunetière, Ferdinand, 'Le roman naturaliste' (Paris 1883); Doumic, René, 'Ecrivains d'aujourd'hui' (ib. 1894); Bashkirtseff, Marie, 'Further Memoirs' (London 1901); Symons, Arthur, 'Studies in Prose and Verse' (New York 1904); Mahn, P., 'Guy de Maupassant, sein Leben und seine Werke' (Berlin 1908); Matthews, Brander, 'Inquiries and Opinions' (New York 1907).

MAUPERTUIS, Pierre Louis Moreau de pē-ār loo-ē mō-rō dē mō-pĕr-tü-ē, French mathematician and philosopher: b. Saint Malo, France, 28 Sept. 1698; d. Basel, Switzerland, 27 July 1759. He was educated at the College of La Marche, Paris; entered the army in 1718 and after five years' service resigned in order to become instructor in mathematics in the Academy of Sciences. He went to England in 1728, where he was made a member of the Royal Society and became a pupil of Newton. In 1736 he conducted a scientific expedition to Lapland for the purpose of measuring an arc of the meridian, the result of which was confirmation of Newton's theory of the flattening of the globe at the poles. In 1743 he was elected to the French Academy, in 1744 was summoned to Prussia by Frederick the Great and in 1746 was declared president of the Academy of Sciences at Berlin. A dispute with the philosopher, König, regarding the discovery of the infinitesimal calculus shortened his days. Among his works are 'Sur la figure de la terre' (1738); 'Discours sur la figure des astres' (1742); 'Lettre sur la comète de 1742' (1742); 'Astronomie nautique' (1745; 1756); 'Essai de cosmologie' (1750); Maupertiana ou divers ecrits' (1753). Consult De la Baumelle, 'Vie de Maupertuis' (Paris 1856); Damiron, J. P., 'Memoires sur Maupertius' (ib. 1858); id., 'Mémoires pour servir à l'histoire de la philosophie du XVIIIe siècle' (Vol. III, ib. 1864).

MAUREL, mō-rĕl, Victor, French singer: b. Marseilles, 1848; d. New York City, 22 Oct. 1923. He was educated at the Paris Conservatoire and made his début in Paris in 1869. His first appearance in Royal Italian Grand Opera was in 1873 and he achieved a signal success. He created Iago in Verdi's 'Otello,' Falstaff in the opera of that name, and appeared in many operatic rôles in Europe and United States, being generally recognized as the leading acting baritone actor on the Italian stage. He published 'L'Art du chant'; 'Le chant renové par la science'; 'Dix ans de carrière,' etc.

MAUREPAS, Jean Frédéric, zhŏn frā-dā-rĕk mō-rē-pä, **Phélypeaux,** COMTE DE, French statesman: b. Versailles, 9 July 1701; d. there, 21 Nov. 1781. At 14 he succeeded to the office of Minister of State held by his father. In 1725 he became administrator of the navy, in which post he used the best knowledge then available to bring the navy to a high standard of perfection. He became Minister of State under Louis XV in 1738, but in 1749 was banished the court for an attack on Mme. Pompadour. In 1774 he was made Prime Minister by Louis XVI and became his principal adviser. The chief events of his administration were the restoration of the Parliament of Paris (12 Nov. 1774), and the alliance with and assistance of the American colonies in their struggle against Great Britain. He gathered

to the service of the state such men as Chrétien Guillaume de Lamaignon de Malesherbes, Le Comte de Vergennes, and Anne Robert Jacques Turgot. He intrigued against the latter, and replaced him as minister of finance by Jacques Necker in 1776. Five years later Necker experienced the same fate.

MAURER, mou'rĕr, **Georg Ludwig von,** German statesman and law historian: b. Erpolzheim, Nov. 2, 1790; d. Munich, May 9, 1872. He entered Bavarian government service in 1814, and in 1826 became professor of law at the University of Munich. During 1832–1835 he was a member of the regency council while King Otto was a minor; and for a short period in 1847 he served as Bavarian minister of foreign affairs and justice. Besides a number of volumes on early German systems of government, he wrote *Das Griechische Volk Vor und Nach dem Freiheitskampf,* 3 vols. (1835–1836).

MAURER, Louis, American artist: b. Biebrich, Germany, 1832; d. New York City, July 19, 1932. Migrating to the United States about 1851, he joined the staff of Currier and Ives, the well known New York City firm of lithographers. He lithographed and colored by hand many of their prints, notably, in 1855, *The Celebrated Horse Lexington,* depicting a famous trotting horse.

MAURETANIA, mô-rĕ-tā'nĭ-à, or **MAURITANIA,** ancient name for northwestern Africa, west of Numidia, varying in size at different periods but roughly corresponding to modern Morocco and western Algeria. The Romans became acquainted with the country during the war with Jugurtha, 106 B.C., and in 42 A.D. it was formed into a province by Claudius. In the 5th century the Vandals overran the country. See also MAURITANIA.

MAURIAC, mô-ryàk', **François,** French writer: b. Bordeaux, Oct. 11, 1885. Moving to Paris in 1906, he wrote poetry and poetry criticism for the *Revue de Temps Présent* and *Revue de la Jeunesse,* and published two volumes of his own verse: *Les Mains Jointes* (1909) and *L'Adieu à l'Adolescence* (1911). Turning to fiction after World War I, he won renown with *Le Baiser au Lépreux* (1922), *Genitrix* (1924), *Le Désert de l'Amour* (1925), and other books. Novels available in English translation include *Thérèse* (1928); *The Desert of Love* (1929); *Destinies* (1929); *The Family* (comprising *The Kiss of the Leper* and *Genitrix,* 1930); *Suspicion* (1932); *The Viper's Tangle* (1933). Among translations of his essays and works of criticism are *Maundy Thursday* (1932); *God and Mammon* (1936); *Life of Jesus* (1937); *Communism and Christians* (1938). In 1933 he was elected to the French Academy.

MAURICE, mô'rĭs, duke and elector of Saxony: b. Freiberg, March 21, 1521; d. near Sievershausen, July 11, 1553. In 1541 he succeeded his father, Henry the Pious, as duke, and, although a Protestant, refused to join the Schmalkaldic League. He fought for Charles V, and with the latter's aid became elector in the Albertine line in 1547. Subsequently opposed to Charles, in 1552 he forced the emperor to accept the Treaty of Passau. He was mortally wounded in a battle with Albert Alcibiades.

MAURICE (commonly known as MAURICE OF NASSAU), stadholder of the Dutch Republic: b. Dillenburg, Nov. 13, 1567; d. The Hague, April 23, 1625. The son of William the Silent, he was elected stadholder by the northern provinces following his father's assassination in 1584. Leading the Dutch in their war against the Spaniards, he gained victory after victory until 1609, when he made a 12-year truce with Spain. In 1618, following the death of his brother, Philip William, he became prince of Orange. He fell into a quarrel with his former supporter and friend, Jan van Olden Barneveldt, whose execution he secured in 1619. In 1621 he renewed the struggle against Spain, but his campaigns met with small success.

MAURICE, SIR **Frederick Barton,** British army officer: b. Feb. 1, 1871. He saw active service in northwest India (1897–1898) and the South African War (1899–1900), and with outbreak of World War I in 1914 went to France with the 3d Division. In 1915 he was made director of military operations at the War Office; he was placed on retired pay in May 1918 after he had questioned in the press some statements about the strength of the army in the field made by Prime Minister David Lloyd George, an action which led to a critical debate in Parliament. From 1922 to 1933 he was principal of the Working Men's College, St. Pancras, London, which had been founded by his grandfather, (John) Frederick Denison Maurice (q.v.). He wrote *Forty Days in 1914* (1920); *Lord Wolseley* (1924); *Robert E. Lee, the Soldier* (1925); *Governments and War* (1926); *British Strategy* (1929); *Life of Lord Haldane,* 2 vols. (1937–1938).

MAURICE, (John) Frederick Denison, English theologian: b. Normanston, Suffolk, Aug. 29, 1805; d. Cambridge, April 1, 1872. The son of a Unitarian clergyman, he studied at Trinity Hall, Cambridge University, prior to 1827, when he went to London and engaged in literary work. In 1834, after attending Exeter College, Oxford, he was ordained in the Church of England. He was appointed professor of English literature and history at King's College, London, in 1840, and professor of theology there in 1846. The controversy aroused by his *Theological Essays* (1853) led to his resignation, and for the next few years he devoted himself to literary work and to the principalship of the Working Men's College, St. Pancras, London, which he helped to found in 1854. He had been one of the founders, in 1848, of Queen's College for Women. In 1860 he became incumbent of St. Peter's, Vere Street, London, and in 1866 he was appointed professor of moral philosophy at Cambridge; from 1870 he was incumbent of St. Edward's, Cambridge. He was a colleague of Charles Kingsley in the Christian Socialist movement, an enthusiast for national education, and a friend of all movements for the betterment of the poor. Strenuously denouncing party spirit in religion, he stood apart from all parties in the Anglican Church, but was bitterly attacked for his alleged heretical teaching on the Atonement and eternal life. His works included *The Doctrine of Sacrifice* (1854); *Social Morality* (1869); *Moral and Metaphysical Philosophy* (1871–1872).

MAURICIUS, mô-rĭsh'ĭ-ŭs (in full FLAVIUS

Tiberius Mauricius; also known by English name Maurice), emperor of the Eastern Roman Empire: b. Arabissus, Cappadocia, 539?; d. Chalcedon, Nov. 27, 602. He fought against the Persians during 578–581, and in 582 he succeeded Emperor Tiberius II, whose daughter, Constantina, he married. In 591 he successfully concluded the Persian War by restoring Chosroes II to the throne. He defeated the Avars several times, but was forced to abdicate in 602 when faced by a mutiny of the army on the Danube. He was killed by Phocas, who succeeded him.

MAURISTS, mô'rĭsts, members of the Congregation of Saint Maur, an amalgamation of the Benedictine houses in France early in the 17th century. In 1720 the Maurists possessed in France six provinces, containing 180 abbeys and priories, of which the principal was that of Saint-Germain-des-Pres, Paris. Jansenism seems to have affected some of the convents, and it was alleged that a Masonic lodge was established at Glanfeuil in 1755, over which the prior of the monastery in that place presided. The Congregation was suppressed in 1792. The last superior general with 40 members of his order perished by the guillotine. In their literary work they produced a great number of works of permanent value. Their complete bibliography comprises over 700 works by 220 authors. The Revolution put an end to the work, for which hundreds of volumes and literary documents had been collected. The Bibliothèque Nationale de Paris contains most of this material.

MAURITANIA, mô-rĭ-tā'nĭ-ȧ, territory, French West Africa, north of the Senegal River. It is bounded on the northwest and north by the Rio de Oro (southern zone of Spanish Sahara), on the northeast by Algeria, on the east by the French Sudan, on the south by Senegal, and on the west by the Atlantic Ocean. The greater part of the area of 364,092 square miles consists of sandy desert. Low ranges of hills cross the territory from northeast to southwest; Adrar is a mountainous plateau region near the frontier of Rio de Oro. In the coastal area streams flow through ravines during the rainy season. The territory is administered from Saint-Louis, in Senegal. Most of the inhabitants are nomadic Arabs and Berbers, generally known as Moors; they are Moslems. The people possess large numbers of sheep and cattle. Other resources include gum and salt. Arguin, an island off the north coast some 50 miles below Cape Blanc was discovered by the Portuguese in the 15th century. In 1817 the territory was recognized as within the French sphere of influence, but it was not occupied until after 1900. It became a protectorate in 1903 and colony in 1920; and with adoption of the French constitution of 1946 it was constituted a territory. Pop. (1948 est.) 517,900. See also French West Africa; Mauretania.

MAURITIUS, mô-rĭsh'ĭ-ŭs (formerly Île de France), island in the Indian Ocean 934 miles southeast of the Seychelles and 155 miles northeast of Réunion. The island has a length of 39 miles and maximum breadth of 29 miles, the area being 720 square miles. The British colony of Mauritius consists of the island of that name and several dependencies: Rodriguez (40 square miles), 344 miles east of Mauritius; and scattered coral groups (aggregating 45 square miles) which include Diego Garcia (11 square miles) and Solomon Island (2 square miles).

Topography.—The island of Mauritius is chiefly of volcanic formation and is almost entirely surrounded by coral reefs. There are several small chains of mountains, but none of great height. The principal peaks are the Piton de la Rivière Noire (2,730 feet), in the southwestern part of the island; Pieter Both (2,690 feet); and the Pouce (2,661 feet). There are numerous rivers and streams; they flow generally through deep ravines and their course is broken by many small waterfalls and rapids. None of them are navigable beyond a short distance from the sea. The land rises gradually from the coasts, and the center of the island is composed chiefly of a fertile and picturesque plateau varying in altitude from 1,000 to 1,800 feet. Intense tropical conditions exist in the lowlands; while on the central high tableland and in the elevated eastern and southeastern districts, a milder and more equable climate prevails. A hot season occurs from December to April, and a cool or mild season from June to September. The hottest time is usually experienced during the second half of January, and the coldest during the second half of July or the first days of August. In the lowlands, there is an average maximum daily temperature of 86°F. from December to March, and in the central tableland the temperature is about 11°F. lower. The mean day and the mean night temperature differ by about 6°F. in summer and winter. The most unhealthy feature of the Mauritius climate is the high humidity. In the lowlands it averages between 70 per cent and 80 per cent; on the central plateau this value is still greater by 10 per cent in summer and 13 per cent in winter. Mauritius has an abundant rainfall, in the east and southeast districts the annual rainfall being 75 to 100 inches; on the eastern slope of the central tableland, 125 to 175 inches; in the west and northwest, less than 40 inches of rain each year. Cyclones, numbering about 8 annually, are usually encountered between December and April. Droughts occur almost periodically, and have been known to last from 6 months to 14 months.

Economy.—The indigenous Creoles, descendants of 18th-century French planters, are now outnumbered by the descendants of Indian immigrants; the latter were introduced between 1842 and 1910 to provide laborers for the plantations. Slaves had been emancipated in 1835. French law has been preserved, and both French and English are official languages. Port Louis, on the northwest coast, is the capital and principal port. The town of Curepipe, the next largest, is a health resort in the center of the island. Many of the forest trees are valuable, particularly the black ebony. The principal item of cultivation is sugarcane. There are also considerable acreages of aloe, corn, tea, and manioc; other products include rice, vanilla, coconuts, and spices. Manufactures include rum, soap, tobacco, and matches. The seven government railway lines aggregate 106 miles; there are 730 miles of highways.

History.—When discovered by the Portuguese, probably between 1507 and 1512, Mauritius had no inhabitants, and it showed no signs of ever having been peopled. The Portuguese named the island Ilha da Cirnos (Swan Island),

from the big birds resembling swans found on shore. The first settlers were Dutch, seamen under Admiral Wybrandt van Warwyk landing in 1598 and naming it for Maurice of Nassau, the stadholder; however, colonization did not commence until 1638. The colony did not prosper, and was finally abandoned by the Dutch in 1710. In 1715 the island was formally taken possession of by the French, but it was not actually occupied until 1721, when colonists were sent out on behalf of the French East India Company; it was then named Île de France. Mahé de La Bourdonnais, governor from 1735 to 1746, encouraged sugarcane cultivation and introduced other valuable plants. The French government took over direct control in 1767. Pierre Poivre, the first intendant, introduced cloves and nutmegs, and created a nursery at Pamplemousses which is now the famous Royal Botanical Gardens. British troops commanded by Gen. Sir Robert Abercromby captured the island in 1810, and possession of it by Great Britain was confirmed in 1814 by the Treaty of Paris. Much damage has been done periodically by cyclones. In literature, Mauritius is famous as the scene of Jacques Henri Bernardin de Saint-Pierre's *Paul et Virginie* (1871); and in ornithology, as the one-time home of the dodo. Pop. (1951 est.) 510,000.

Consult Barnwell, P. J., and Toussaint, A., *A Short History of Mauritius* (London 1949).

MAUROCORDATOS. See MAVROCORDATOS.

MAUROIS, mô-rwà′, **André** (pseudonym of ÉMILE SALOMON WILHELM HERZOG), French writer: b. Elbeuf, Seine-Inférieure, July 26, 1885. During World War I he served as liaison officer with the British forces. His first book, *Les Silences du Colonel Bramble* (1918) was a study of British military life. He is best known for his fictionalized biographies, including those of Shelley (1924), Disraeli (1927), Byron (1930), Lyautey (1931), Tourgeniev (1931), Voltaire (1932), Dickens (1934), and Chateaubriand (1938). Among his works of fiction in English translation are *The Conversation of Dr. O'Grady* (1921), *The Weigher of Souls* (1931), and *A Time for Silence* (1942). In 1938 he was elected member of the French Academy and created knight of the Order of the British Empire. During World War II, while France was occupied by the Germans, he resided in the United States, where he wrote *Tragedy in France* (1940) and *Why France Fell* (1941). In 1942 he published the autobiographical *I Remember, I Remember.* Another personal record appeared in *Journal, Etats-Unis* (1946). Also published that year were *La Terre Promise* and a volume of short stories, *Inattendu Toujours Arrive.* His *History of the United States* and *Woman Without Love* appeared in 1948; and in 1950, *Proust: Portrait of a Genius.* A prolific writer with an engaging style, many of his books achieved greater popularity in Great Britain and America than in France.

MAURRAS, mô-rà′, **Charles,** French writer: b. Martigues, Bouches-du-Rhône, April 20, 1868. A graduate of the Catholic college of Aix, he went to Paris where he became a contributor to various periodicals including *l'Evènement,* the *Revue bleue,* and the *Revue encyclopédique.* With Moréas and other writers he founded the *École romain* (1891) and drew up its program. A royalist by conviction, he engaged in bitter campaigns against democratic ideas in such periodicals as *le Soleil, la Gazette de France* and *le Figaro,* becoming the leading spokesman of the neomonarchist group. When *l'Action française* was converted from a semimonthly to a daily in 1908, he was associated with Léon Daudet in its editorial direction. A traditionalist, he was convinced that France could only achieve political stability by a return to the monarchy. His support of the church was not motivated by religious principles but by belief in its social values. He was twice imprisoned in 1936 for violent attacks against the Blum government, and his election to the Académie Française two years later caused considerable controversy. After the fall of France in 1940 he became a staunch supporter of the Vichy government. On Jan. 27, 1945 after a four-day trial at Lyon, having been charged with treason and intelligence with the enemy, he was sentenced to imprisonment for life. He was released on Feb. 9, 1952, to undergo hospital treatment.

Among his outstanding political works are *l'Idée de la décentralisation* (1898); *Trois idées politiques* (1899); *Kiel et Tanger* (1910); and the 4-volume *Conditions de la victoire* (1916–1918). His collected poems are in *la Musique intérieure* (1925). His *Les Amants de Venise* (1902) is a psychological study of George Sand and de Musset.

MAURY, mô′rĭ, **Dabney Herndon,** American army officer and diplomat: b. Fredericksburg, Va., May 21, 1822; d. Peoria, Ill., Jan. 11, 1900. He graduated at West Point in 1846, served in the Mexican War, and during 1847–1852 taught at the United States Military Academy. Joining the Confederate forces at outbreak of the American Civil War, he reached the rank of major general; he commanded a division at Corinth and later headed the Department of the Gulf. From 1886 to 1889 he was United States minister to Colombia. In 1894 he published the autobiographical *Recollections of a Virginian.*

MAURY, mô-rē′, **Jean Siffrein,** French Roman Catholic prelate: b. Valreas, Comtat-Venaissin, June 26, 1746; d. 1817. As a member of the Constituent Assembly during 1789–1891 he courageously upheld the old regime, but in 1792 was forced to seek refuge in Rome. In 1794 he was created cardinal. With the occupation of Rome by French troops in 1798 he fled to St. Petersburg, but the next year returned as ambassador of the exiled Louis XVIII. In 1806 he went back to France, and in 1810 was made archbishop of Paris. At the Restoration in 1814 he fled once more to Rome. There he was arrested and imprisoned for six months. Most notable of his writings was the *Essai sur l'Éloquence de la Chaire* (1777).

MAURY, mô′rĭ, **Matthew Fontaine,** American naval officer and hydrographer: b. Spotsylvania County, Va., Jan. 14, 1806; d. Lexington, Va., Feb. 1, 1873. He was appointed midshipman in the Navy in 1825, and during 1826–1830 he circumnavigated the globe in the *Vincennes.* A stagecoach accident in 1839 lamed him for life, and in 1842 he was appointed superintendent of the Depot of Charts and Instruments (later the

United States Naval Observatory and Hydrographic Office). He conducted researches on ocean winds and currents, and made wind and current charts of the Atlantic, Pacific, and Indian oceans; his *Physical Geography of the Sea* (1855) was the first textbook of modern oceanography. With outbreak of the American Civil War in 1861 he resigned his post to join the Confederate forces. From 1862 to 1865 he was agent of the Confederacy in Britain; and during 1865–1866 he sought to arrange with Emperor Maximilian for the settlement of Confederate veterans in Mexico. He then settled in Britain, but returned to the United States in 1868 to become professor of meteorology at the Virginia Military Institute. Maury Hall, at the United States Naval Academy, is named for him; his birthday is a school holiday in Virginia.

MAUSER, mou'zĕr, **Peter Paul,** German inventor: b. 1838; d. May 29, 1914. He was employed in the royal armory at Oberndorf, and there, with his brother, Wilhelm Mauser (1834–1882), invented a needle gun in 1863. Moving to Liége, Belgium, in 1867, the brothers invented a breech-loading gun which was adopted by the Prussian government in 1871. They purchased the arsenal at Oberndorf to manufacture their weapons, which included a pistol, a revolver, and a repeating rifle. The Mauser magazine rifle was invented by Peter Paul Mauser in the year 1897.

MAUSOLEUM (Greek, *mausoleion*), a tomb or burial place, the name of which is derived from Mausolus, a ruler of Caria, to whom a sumptuous sepulcher was raised by his wife, Artemisia, at Halicarnassus. Mausolus died 353 B.C.; and his wife was so disconsolate that she perpetuated his memory by the erection of his magnificent monument which became so famous as to be esteemed the seventh wonder of the world, and to give a generic name to all superb sepulchers. Its entire height was 140 feet, and the entire circuit 411 feet. It was overthrown, probably by an earthquake, between the 12th and 15th centuries; and when the Knights of Rhodes took possession of Halicarnassus in 1404 they availed themselves of the materials of the mausoleum to erect the fortress of San Pietro. Parts of the frieze were transported to the British Museum in 1846. Other famous mausoleums are that erected at Babylon by Alexander the Great in honor of Hephaestion, equally magnificent with that of Mausolus, though less refined; and the mausoleum of Augustus, built by him in the sixth consulate in the Campus Martius, between the Via Flaminia and the Tiber, the ruins of which are still seen near the church of Saint Roque. One of the obelisks which stood before this superb building was found in the reign of Pope Sixtus V. This mausoleum contained the ashes of Augustus, Marcellus, Agrippa, Germanicus, and of some later emperors. The mausoleum of Hadrian, at Rome, has been known since the addition of a medieval superstructure as the Castel Sant' Angelo. The most beautiful of all mausoleums is the Taj Mahal, at Agra, India, erected by Shah Jahan between 1632 and 1645 to the memory of his favorite wife, Mumtaz Mahall. Notable mausoleums of modern times include that of Napoleon under the dome of the Invalides, Paris; of President Lincoln, in Washington; of Gen. U. S. Grant, Riverside Drive, New York City; and of Nikolai Lenin, in Moscow.

MAUSOLUS, mô-sō'lŭs, ruler of Caria (ancient division of southwest Asia Minor): d. about 353 B.C. With other satraps, he revolted against Artaxerxes II (Mnemon) and made himself virtually independent, capturing much of Lycia, Ionia, and several of the islands of Greece. He removed the capital of Caria from Mylasa (now Milas, Turkey) to Halicarnassus (the modern Bodrum). The latter is the site of his celebrated tomb, erected by his wife, Artemisia. See also MAUSOLEUM.

MAUSTON, môs'tŭn, city, Wisconsin, seat of Juneau County, located in the valley of the Wisconsin River 35 miles west-northwest of Portage; it is served by the Chicago, Milwaukee, St. Paul and Pacific Railroad. The city handles the products of a fertile dairy and farming area, and engages in lumbering. Mauston's original name was Maughstown. Pop. (1940) 2,621; (1950) 3,171.

MAUTHNER, mout'nĕr, **Fritz,** German novelist and philologist: b. Horzitz, Bohemia, Nov. 29, 1849; d. Jan. 29, 1923. He came of a Jewish family. Moving to Prague at an early age, he studied law and in 1876 became a contributor to the *Berliner Tageblatt.* He continued writing for this newspaper in various departments, particularly as dramatic critic, until 1905. While he wrote novels and satiric romances, his greatest work was in the field of philosophical criticism of language as a means of expression. His style was smooth and brilliant.

MAUVAISES TERRES. See BAD LANDS.

MAUVE, mōv, an aniline purple coloring matter, first obtained by W. H. Perkin in 1856.

MAVERICK, măv'ĕr-ĭk, **Peter,** American engraver: b. New York City, Oct. 22, 1780; d. there, June 7, 1831. He learned the art of engraving under his father, and was engaged principally on designs for bank notes. Among his more famous engravings was that of Charles King's portrait of Henry Clay; of Samuel Lovett Waldo's portrait of Andrew Jackson; and of William Dunlap's portrait of Benjamin Moore. He was one of the founders of the American Academy of Design in 1826. His most celebrated pupil was Asher Brown Durand.

MAVERICK, an unbranded animal found straying, especially one appropriated by a chance finder. This term, in common use in the cattle country of the United States, is derived from the name of Samuel Augustus Maverick (1803–1870), a pioneer in Texas from 1835, who owned a cattle ranch of 385,000 acres. Having accepted in 1845 a herd of 400 cattle in payment of a debt, he left them in charge of one of his men. They were neglected and allowed to run wild, and when the calves were born they were of course appropriated by other ranchers and branded with their marks, and so passed to their undisputable ownership. As the ownership of the cattle was determined by the brand, the name mavericks came to be given to all calves caught when straying from the herd. From

this use of the word grew a wider application to anything dishonestly come by.

MAVIS, the Scottish name for the British songthrush or throstle (q.v.), one of the favorite song-birds of western Europe.

MAVOR, James, Canadian economist: b. Stranraer, Scotland, 8 Dec. 1854; d. 31 Oct. 1925. He was graduated from the University of Glasgow. He was for a time editor of the *Scottish Art Review;* in 1888 became professor of political economy at Saint Mungo's College, Glasgow, and in 1892 professor of political economy at the University of Toronto, Canada. He wrote 'Wages Theories and Statistics' (1888); 'Economic Theory and History Tables and Diagrams' (1890); 'Currency Reform' (1891); 'Economic Study and Public and Private Charity' (1892); 'English Railway Rate Question' (1894); 'Railway Transportation in America' (1909); 'Economic Survey of Canada' (1914); 'Applied Economics' (1914); 'A Short Economic History of Canada' (1915).

MAVROCORDATOS, mäv″-rō-kŏr-dä′-tŏs, or **MAUROCORDATOS, Alexander,** modern Greek soldier and statesman: b. Constantinople, Turkey, 15 Feb. 1791; d. Ægina, 18 Aug. 1865. He was a skilful linguist and early schooled in diplomacy. On the outbreak of the Greek war for independence (1821), he devoted his entire fortune to the equipment of a ship and the arming of volunteers. He organized the insurrection in Ætolia and Acarnania, was made president of the National Assembly at Epidaurus, drew up the provisional constitution and signed the proclamation of independence (January 1822). He also became president of the executive council, but resigned in what he believed to be the interests of harmony. In 1833–34, 1841–43, 1844 and 1854–56, he was at the head of the Cabinet and in 1850–54 was Ambassador at Paris. He promoted public education and was a Liberal in politics, being of the British party and opposed to the Russian policy of Giovanni and Augustin Capo d'Istria. He is generally considered the most important leader in the Greek Revolution. Consult Browning, Oscar, 'History of the Modern World' (Vol. I, New York 1912).

MAWSON, Sir Douglas, Australian geographer: b. Bradford, Yorkshire, 1882. He was educated at Sydney University, where he was graduated bachelor of mining engineer in 1901. In the following year he was demonstrator in chemistry there. In 1903 he made a geological exploration of the New Hebrides and lectured at Adelaide University in 1905. In 1908 he became a member of the scientific staff of Sir Ernest Shackleton's Antarctic Expedition and determined the position of the south magnetic pole on Victoria Land. In 1911–14 he was leader of the Australasian Antarctic Expedition to explore Antarctic lands and establish stations for scientific purposes. His discoveries were among the most important made so far in the 20th century. In 1915 he was awarded the founder's medal of the Royal Geographical Society and was knighted in 1914. He has published 'The Home of the Blizzard' (2 vols., Philadelphia 1915) and scientific papers in the transactions of learned societies. For a detailed account of the explorations directed by Mawson see Antarctic Regions.

MAX, mäks, **Gabriel von,** German painter: b. Prague, 23 Aug. 1840. The son of a sculptor, with whom he studied for a time, he soon devoted himself to painting, then went to the Prague Academy under Engerth's teaching, and, after several years at Vienna, became a pupil of Piloty in Munich, where he was professor in the Academy from 1879 to 1883. His work is largely fantastic; he aimed to interpret music, especially that of Beethoven, Mendelssohn and Liszt; and was fond of psychic themes, although occasionally, as in his famous pictures of monkeys, going to an extreme of realism, explained by his earnest belief in Darwin and Haeckel. But he is best known for his historical and figure paintings, which usually show a female figure of some beauty and ethereal charm, with dreamy, longing, sentimental eyes. In such pictures as these the flesh tones are particularly remarkable, being sometimes styled marble-like and due to his early training as a sculptor and again described as a twilight of sentiment, typifying the spiritual. To this class belong 'Spirit Greetings' (1879); 'The Last Token,' now in the Metropolitan Museum, New York (1874); 'Nydia' (1874); 'Veil of Saint Veronica' (1874); 'The Lion's Bride,' in the Museum of Manchester (1875), and many book illustrations, notably those for Schiller's and for Lenau's poems, for Goethe's 'Faust' (the 'Marguerite before the Mater Dolorosa' being especially well known), for Wieland's 'Oberon' and for Uhland's works. Max was ennobled in 1900. Consult Klemt, 'Gabriel Max und seine Werke' (Vienna 1887); Mann, N., 'Gabriel Max, Kunst und seine Werke' (Leipzig 1888); and Meissner (in 'Die Kunst unserer Zeit,' Munich 1899).

MAXENTIUS, mak-sen'shi-us, **Marcus Aurelius Valerius,** Roman emperor: d. 27 Oct. 312. He was the son of Maximianus, and in 306 A.D. was proclaimed Augustus by the prætorians and acknowledged by the people and Senate of Rome, to whom Galerius had become hateful. Severus, sent by Galerius against him and his father, was compelled by Maximianus to retreat to Ravenna and was put to death in 307. Galerius was likewise compelled to retreat and Maxentius, availing himself of an insurrection of the Africans under a certain Alexander, in 311 declared war against Constantine the Great. While Constantine pressed forward into Italy, Maxentius himself remained inactive at Rome and did not go out to meet Constantine till he had passed unopposed across the Apennines. At the great battle fought shortly after, at Saxa Rubra near Rome, Maxentius was defeated and perished in the Tiber as he tried to escape over the Mulvian Bridge. See Constantine; Rome — *History.*

MAXEY, Samuel Bell, American soldier: b. Tompkinsville, Ky., 30 March 1825; d. Texas, 16 Aug. 1895. When Maxey was a child his parents removed to Paris, Tex., where the son was educated until prepared to enter West Point, from which he was graduated in 1846, assigned to the infantry and at once sent to Mexico. He took part in the campaign from Vera Cruz to the City of Mexico and was brevetted for bravery at Contreras. As soon as the war was ended Maxey resigned to begin the practice of law. For 12 years he practised

n Kentucky and Texas. He entered the Confederate service as colonel of the 9th Texas nfantry and was engaged in the campaigns ast of the Mississippi River under A. S. Johnton, Bragg and Joseph E. Johnston. In 1862 ie was made brigadier-general. In 1863 he vas sent to command the Indian Territory. He aised and equipped numbers of troops, kept he Indians friendly to the Confederacy and n 1864 he drove back the Federal general, Steele, who was endeavoring to effect a junction with Banks in the Red River Valley. For his he was made major-general. After the war he was offered a Supreme Court judgeship n Texas but declined. From 1875 to 1887 he vas in the United States Senate. Maxey was in able senator, a member of the prominent committees and an efficient advocate of Western nterests.

MAXIM, Sir Hiram Stevens, Anglo-American inventor: b. Sangerville, Me., 5 Feb. 840; d. London, England, 24 Nov. 1916. As a boy he received his early education in the country schools of Maine. What little spare ime he had after attending to his work on the farm and in his father's workshop was spent n the pursuit of scientific knowledge. When ie was 14 years old he was sent as an apprenice to a carriage builder at East Corinth, Me. Later, while employed in a laboratory in Boson, he perfected his first invention, a method of carbureting air and gas for lighting purposes. His invention was used in many New York hotels. Others of his inventions included electrical devices, improvements on incandescent amps, self-registering current machines and ther similar contrivances. When he was 28 ears old he was employed as a draughtsman n a shipbuilding firm in New York City. While there he invented a locomotive headight, which was used generally. In 1884 Maxim perfected the automatic rifle, or machine un, in which the recoil due to the explosion of one cartridge was utilized to eject the empty hell and at the same time reload the weapon. The inventor was then in England. The government, interested at once in the possibilities presented by the rifle, adopted it. It was the Maxim gun that was an important factor in winning the Egyptian campaign for the English. It is now used by the armies throughout ie world. Closely following came the "disppearing gun," cordite and other smokeless powders, a gun for hurling aerial torpedoes and ie "delayed action" fuse. For many years ir Hiram experimented with aeronautics. In 894 he succeeded in building a heavier-than-air achine. At that time when aeroplanes were nly thought possible, Sir Hiram Maxim criticised the British nation for lack of interest in eronautics and predicted that a bombardment the island from airships was possible. Sir iram held membership in the American Soiety of Civil Engineers, the Royal Society of rts, the British Association for the Advancement of Science and many other bodies. He ecame a naturalized citizen of Great Britain ecause of alleged unfair treatment of his intentions by the American government. Sir iram Stevens Maxim will be remembered as ne of the foremost inventors of his day. In 881 President Grevy of France made him a hevalier of the Legion of Honor. This decotion was followed in 1901 by recognition by the British government, Queen Victoria elevating him to the knighthood.

MAXIM, Hudson, American inventor and engineer: b. Orneville, Me., 3 Feb. 1853; d. 6 May 1927. After an academic education with especial reference to the natural sciences and engineering, he took up the study of medicine; entered the printing and subscription book publishing business at Pittsfield, Mass., in 1883, but gave up the publishing business in 1888 to take up business of ordnance and explosives. He was the first to make smokeless gunpowder in the United States and was the first to submit samples to the government for trial. In 1890 he built a dynamite factory and smokeless powder mill at Maxim, N. J., named for him. It was there that the multi-perforated smokeless powder was developed and perfected under his inventions and patents, which was adopted by the United States government. These patents were purchased by the E. I. du Pont de Nemours Powder Company, of Wilmington, Del., in 1897. He invented the process of making calcium carbide by incandescence of molten carbide conductor, now in general use. In 1901 he sold United States government the secret of the high explosive Maximite invented by him (see Explosives); invented United States service detonating fuse for high explosive projectiles. He invented the system of driving torpedoes by steam and products of combustion of a self-combustive compound called motorite, the steam being generated by the motorite. This system was purchased by the United States navy. In 1898 he became consulting engineer for E. I. du Pont de Nemours Powder Company. He invented stabillite (q.v.), a smokeless powder made without volatile solvent, which consequently requires no drying. He received the degree of D.Sc. from Heidelberg University, Ohio, in 1913. He was a member of consulting board of United States navy; of Albany Burgesses Corps (rank, captain); of Military Service Institution; of Society of Chemical Industry; of Chemists Club; of Aeronautical Society; Fellow A. A. A. S., of Society of Applied Psychology. He published 'The Science of Poetry and the Philosophy of Language' (1910); 'Defenseless America' (1915); 'Dynamite Stories' (1916).

MAXIMA AND MINIMA. The maxima and minima of a function $f(x)$ are the points of the curve $y=f(x)$ where y is larger or smaller, respectively, than for any value of x differing from the value at that point by less than some finite number. According to this definition, a curve may have several maxima or minima, and a maximum or minimum need not be a point where y assumes the greatest or least value, respectively, throughout the entire curve. It is easy to see that a maximum is a point where the curve ceases to go up and begins to go down. At such a point, the slope of the curve, or the differential coefficient $\frac{dy}{dx}$, changes sign. If $\frac{dy}{dx}$ is continuous at a maximum, it can only be 0, and at any rate, on an algebraic curve, it can only be 0 or ∞. Thus the maxima — likewise the minima — are all to be found among the points where $\frac{dy}{dx}=0$ or ∞.

If $\frac{d^2y}{dx^2} > 0$, we have a minimum, of $\frac{d^2y}{dx^2} < 0$, a maximum. However $\frac{dy}{dx}$ may be 0 or ∞ without their being a maximum or minimum at the point. In this case $\frac{d^2y}{dx^2}$ will be 0. To determine whether we have a maximum, a minimum or neither when $\frac{d^2y}{dx^2}=0$, higher derivatives must be considered.

The definition of the maxima and minima of a function of two variables is obvious. It is clear that a necessary condition for a maximum or minimum of $f(x, y)$, at a point where its partial derivatives are continuous, is that $\frac{\partial f}{\partial x} = \frac{\partial f}{\partial y} = 0$. A sufficient condition for a maximum is $\left(\frac{\partial^2 f}{\partial x \partial y}\right)^2 < \left(\frac{\partial^2 f}{\partial x^2}\right)\left(\frac{\partial^2 f}{\partial y^2}\right)$ and $\frac{\partial^2 f}{\partial x^2} < 0$. A sufficient condition for a minimum is $\left(\frac{\partial^2 f}{\partial x \partial y}\right)^2 < \left(\frac{\partial^2 f}{\partial x^2}\right)\left(\frac{\partial^2 f}{\partial y^2}\right)$ and $\frac{\partial^2 f}{\partial x^2} > 0$.

Some important theorems in plane geometry having to do with maxima and minima are that of all polygons having a given perimeter and a given number of sides the regular one has the greatest area; that a circle has a greater area than any other figure with the same perimeter; that a right triangle is larger than any other with two sides equal to its legs, and that of all triangles with a given perimeter and a given base, the isosceles is the greatest. See CALCULUS, THE INFINITESIMAL; CALCULUS OF VARIATIONS.

MAXIMALISTS, or BOLSHEVIKI, the name applied to the adherents of the extreme Socialist party which, headed by Lenin and Trotzky, overthrew the provisional government and the Soviet leaders in Russia on 7 Nov. 1917. The words «Bolshevik» (sing.), «Bolsheviki» (plural) and «Bolshevism» are not explanatory terms and have nothing to do with the policy or aims of the party. Their origin dates from the second conference of the Russian Social-Democratic party in 1903, at which the methods to be adopted in regard to revolutionary activity were under discussion. A sharp line of cleavage made itself evident; and when voting on the resolutions took place there was naturally a majority (bolshinstvó) and a minority (menshinstvó). From that moment the groups were called Bolsheviki and Menshiviki (maximalists and minimalists). The majority represented the extremists, the «whole-hoggers» of Socialism (bólshĕ — more), or those who go for the biggest things; while the minority represented the «moderates» or «thin-end-of-wedge» theorists (ménshi — less, smaller), or those whose aims are of smaller intent. There appears to be no evidence that the terms existed or were current before 1903, though the Russian Social-Democratic party was founded by Plekhanov and others in Switzerland in 1884. The abortive revolutionary movement of 1905–06, which opened with the Putilov ironworks strike and the Father Gapon episode, served to widen the breach between the two factions to the extent that in 1907 the party was definitely split into two independent groups — Bolsheviki and Menshiviki. The former, following in part the teachings of Karl Marx, were led by Lenin. The Marxian revolution was essentially a class revolution, to the realization of which nationalism was regarded as an obstacle. The European War and the aftermath of the Revolution of March 1917 revealed the wide divergence existing between the aims and methods of the two groups. The Bolsheviki contracted the class distinction to narrower dimensions and looked upon the educated classes, the *bourgeoisie,* and even the peasants as enemies. Their aim was radical internationalism; they sought not the re-creation of Russia, but the triumph of one class throughout the world — the proletariat; in other words, mob-rule. For the most part they were bitter and arid doctrinaires, reeling off strings of long, high-sounding words and phrases which few understood, and clinging to a vague and abstract creed with fanatical devotion. Every problem was met by a reference to the letter of their law and interpreted accordingly. But whatever political, social or economic creed the Bolsheviki professed on paper, their activity — and by that alone can they be judged — consisted merely of a wild orgy of crime, plunder and treason. No trace of practical ability was revealed by any of their leaders, but they had the driving force which even the shallowest fanaticism can give. They were opposed to the war, which they declared to be «imperialistic» and «bourgeoise.» They were opposed (on principle) as much to a German peace as to a peace dictated by the Allies: «No indemnity, no reparation and no annexation» became their ideal. The Menshiviki were of a saner type; while claiming for the working classes the importance due to their numbers, they did not ignore other classes. Holding in view definite practical reforms, they were willing to utilize the existing machinery of the state for their purpose. They accepted the war and its vigorous prosecution as a part of their program and realized that nationalism must precede internationalism. They recognized that the cause of the Allies was also their cause, and in this belief they were undoubtedly supported by the more intelligent Russian Social-Democrats. To the Bolsheviki the fate of their country mattered nothing, provided only that their own crude ideas of social reconstruction survived the ordeal. They were eager for peace on any terms in order that they might proceed with their own program, that class war which recognized no political frontiers nor national consciousness. After the fall of Kerensky the Bolsheviki began their career as rulers by the wilful and systematic destruction of the Russian army and navy. Their leaders posed before the world as the elect champions of a new idealism which was to redeem mankind. They proposed to teach other democracies the true and saving doctrine of the real revolutionary creed. Of exercising government, as that term is understood among civilized peoples, they proved themselves utterly incapable; government, in fact, holds no place in their system, of which the sole principle is civil war or, as they term it, «class war.» Though it owes its genesis to Socialism (from which it is really far removed), Bolshevism may be described as a com-

ound of anarchism, syndicalism, hatred and ind fanaticism. Needless to say, ingredients f this type cannot fail to attract all the purely riminal elements which, in normal times, are eld in check by the forces of law and order. Vith the removal or breakdown of that salutary neck and the absence of an efficient substitute, free rein is given to unbridled passions by hich a political movement is converted into mere carnival of terrorism. This was what appened in Russia in 1917. The Bolsheviki ad nothing whatever to do with bringing about ie revolution which swept away the autocracy March of that year. That revolution was either engineered nor organized; it sprang ot from the burning inspiration of a new ith, but succeeded almost automatically from neer weariness: tired in mind and body, Rusa had lost nerve and heart. The provisional overnment that was formed on 16 March conisted of honest, patriotic and intelligent men—rince Lvov, Guchkov, Milyukov, Terestchenko, ekrasov, Shingarev and Kerensky, who was ie only Socialist in the group. Of all these, erensky proved to be the only «man of desny» with sufficient magnetism to compel a llowing. Their first energies were devoted maintaining discipline in the army and carving the war to a successful conclusion. But ready in September 1915 Lenin had issued ie Zimmerwald manifesto, signed by himself id the Swiss Socialist, Robert Grimm, callg for «peace without annexations or indemties.» German agents had sedulously spread is doctrine among the Russian rank and file, ith the result that the idea of a peace so sily to be gained soon won a large number converts. It was easy for German propandists to convert the working classes to this ew. The people were told what they wanted hear — that it was folly to fight longer and at their Western Allies were the true foes of ussia, since they sought to force her to reain in the war. Not only did demoralization the army set in, but there also grew up spirit of hostility against the Allies, especially Great Britain. Thus, while the provional government and later Kerensky alone ruggled to maintain order and national unity, olsheviki and German agents were underming the structure with glowing promises and dition. On 16 July 1917 the Bolsheviki in etrograd, led by Lenin and Trotzky, atmpted to seize the reins of government and iled. Lenin disappeared when warrants were ued for the arrest of the Bolshevist leaders. the last moment Kerensky weakened; rerding the Bolsheviki as «political opponents,» countermanded the order for their arrest. Up to this time the Russian armies were ll fighting in the field; their offensive in alicia was nearing its disastrous climax and olshevism—the foe of the revolution and enemy of the people—was growing in moentum. Confusion spread; Kerensky deunced the counter-revolutionists and those o unwittingly encouraged anarchy (Moscow, Aug. 1917), which caused a wider split ong his uneasy team. General Korniloff arred from the front and stated that the mili-y disasters were due not to the revolution t to the follies of the revolutionaries; that cipline must be maintained both at the front d in the rear. His gloomy picture of a degraded and defeated Russia had no terrors for the Bolsheviki. After three days of palaver the conference talked itself to a standstill with no result. Meanwhile, the German armies found no difficulties in overrunning northern Russia and seizing Riga. Kerensky again wavered. His fatal error in the Korniloff affair drove the few remaining moderates out of his Cabinet and gave the Bolsheviki their opportunity. The retreating Russian armies gave themselves up to pillaging their own people and the sailors of the Baltic fleet murdered their own officers. Lenin crept out of hiding and raised his voice afresh in Kronstadt—the worst nest of anarchy. Kerensky once more fulminated against the Bolsheviki and then informed the United States that Russia was worn out. The dark forces waiting in the shadows quickly observed the change and made their preparations. The apathy and despair of Russia made her an easy victim to a body of determined men. Trotzky, then president of the Petrograd Soviet, summoned the proletariat of all nations to do what had been done in Russia; he decided to make peace with a willing Germany and to raise his party to the supreme power. On 5 Nov. 1917 the Military Revolutionary Committee ordered the Petrograd garrison to place itself under their instructions. Kerensky suppressed the chief Bolshevist paper and called on the loyal troops to defend the government. On the 6th the military cadets occupied stations, bridges and telegraph offices and threw a cordon around Kerensky's residence, the Winter Palace. Lenin arrived the following day with his leading spirits and made the Smolny Institute (a girls' school) the Bolshevist headquarters. He issued a proclamation announcing the fall of the government. The majority of the troops went over to the Bolsheviki. Kerensky fled on the 7th, leaving a guard of cadets and some women at the Palace. The Bolshevist troops (Red Guards) captured the palace, committed many brutalities on the inmates and in a few hours the whole of Petrograd was in their hands. The «new government» was placed in the control of a «Council of People's Commissioners,» of which Lenin was appointed president, Trotzky foreign minister and Ensign Krylenko as commander-in-chief of what was left of the army.

The comparative ease with which the Bolsheviki overturned the provisional government was due mainly to the passive attitude of the troops. Had Kerensky had at his disposal a few brigades of reliable troops he might as easily have crushed Bolshevism on the same day. On 8 November Lenin telegraphed to all the belligerent governments a proposal for a three months' armistice. On the 10th a series of decrees began to emanate from the Smolny Institute, their principal features being the spoliation of one class and the transference of its property to another. Municipalities were empowered to sequestrate all houses, whether inhabited or not, and to install in them citizens possessing no abode or occupying crowded or insanitary dwellings. All factories were passed to the possession of the operatives (syndicalism), and a moratorium was proclaimed for the payment of rent for small houses and lodgings. The most important decree threatened civil war in the rural districts by declaring all private ownership in land to be annulled without com-

pensation to the owners. The land was to be nationalized and handed over to the cultivators, while for the present all lands belonging to the state, to the Church and to monasteries, etc., with all appurtenances — flocks, herds, machines, etc., were to be placed at the disposal of the 'local agrarian committees until the meeting of the Constituent Assembly. The local soviets were authorized to preserve order during the process of confiscation. All mines, forests and waterways were acquired by the state, and the smaller woods, rivers and lakes were to be the property of the village communes. The gloom of Bolshevism had settled over Russia. Missionaries of that cult were dispatched to all European countries and to the United States to spread the faith and incite proletariat uprisings, though with negligible success. During 1918–21 the dread of "Bolshevism" became a haunting spectre to not a few governments. Everywhere outside of Russia it was denounced by public men and its slightest symptoms rigorously suppressed. It is a remarkable fact that, while Jews formed a large percentage of the leading Bolsheviki, over 90 per cent of Russian Jews were hostile to them. Many of them had lived in America, Switzerland, Great Britain, France, Germany and the Scandinavian countries. They returned to Russia after the Revolution, where their ranks were swelled by large numbers of exiles from Siberia — not all political offenders, but also some of the most dangerous criminals. (The further adventures of the Bolsheviki régime are told under RUSSIA—HISTORY; see also RUSSIA—DURING THE WORLD WAR; WAR, EUROPEAN; KERENSKY; KORNILOFF; TROTZKY; LENIN). Consult Trotzky, L., 'The Bolsheviki and World Peace' (New York 1918); *The World's Work* (New York, October 1918); *Current History* (New York, November–December 1918).

MAXIMIANUS I, măk-sĭm-ĭ-ā'nŭs, **Marcus Aurelius Valerius,** Roman emperor: d. February 310 A. D. He so approved himself by his services in the army that Diocletian selected him for his colleague, creating him first Cæsar (285), then Augustus (286) and at the same time conferred on him the honorary appellation of Herculius. Maximianus had the care of the Western Empire, while Diocletian undertook that of the Eastern. In 287 he was consul with Diocletian, and in the same year conducted a campaign in Gaul. After conducting several wars, in 303–304 he was for the seventh time made consul, having for his colleague Diocletian for the fifth time, with whom he abdicated 1 May 305. In the following year he was again invested with the imperial title by his son Maxentius, to whom his services against Severus and Galerius were of the most important kind. His son shortly after expelled him from Rome, and repairing to Gaul, in 308 caused himself to be proclaimed Augustus at Marseilles, but Constantine easily deposed him. See CONSTANTINE; DIOCLETIAN.

MAXIMILIAN I, măk-sĭ-mĭl'ĭ-ăn (Ger. măks-ē-mē'lē-ăn), emperor of Germany: b. Neustadt, near Vienna, 22 March 1459; d. Wels, in Upper Austria, 12 Jan. 1519. He first became an independent prince by his marriage with Mary of Burgundy, the daughter of Charles the Bold, who died in 1477. This match involved him in a war with Louis XI, King of France, in which he was successful, though he was defeated at a later period by the Milanese. At Frankfort in 1486 he was chosen king of the Romans and two years later was imprisoned by the Flemings at Bruges. He secured the Tyrol in 1490 and in the same year made war against Charles VIII of France. In 1493 he became Holy Roman emperor on the death of his father. He was involved in war with Venice, France and Switzerland for the greater part of his reign. He was succeeded by his grandson, Charles V. Consult 'Cambridge Modern History' (Vol. I, 1903), and Heyck, 'Kaiser Maximilian I' (Bielefeld 1898).

MAXIMILIAN, emperor of Mexico, known in earlier life as Ferdinand Maximilian Joseph, Archduke of Austria: b. Vienna, 6 July 1832; d. Queretaro, Mexico, 19 June 1867. He was the younger brother of Francis Joseph I, emperor of Austria (q.v.). He entered the Austrian navy in 1846, and in 1854 obtained the rank of rear-admiral and was placed at the head of the Austrian marine. He was viceroy of the Lombardo-Venetian kingdom in 1857–59, and in 1857 married Princess Charlotte of Belgium, daughter of King Leopold I. On his return from a voyage made to Brazil for scientific purposes he fixed his residence at Miramar in the vicinity of Trieste, and there, 3 Oct. 1863, received a deputation from the Mexican Assembly of Notables, who offered him the crown of their country. He officially announced his acceptance 10 April 1864. He landed at Vera Cruz on 28 May and entered Mexico on 12 June. He set himself energetically to consolidate and develop his dominions, granted an amnesty to political offenders and exhibited great interest in religious worship and education. But he failed to conciliate the Republican party, and as he did not restore to the clergy their confiscated estates they pronounced him a traitor. Meanwhile there were incessant conflicts between the partisans of President Juarez and the allied French and imperial troops; and the decree of 2 Oct. 1865, by which the members of the Juarist bands and those who abetted them were to be regarded as bandits and shot, alienated the party of the Liberals. Juarez raised the standard of independence. Complications and misfortunes thickening around Maximilian rendered his position critical in the extreme. The empress in vain undertook a mission to Europe to enlist support for her husband, and grief and disappointment overthrew her reason. The French troops, largely by reason of the representations of the United States government, were withdrawn by Napoleon in March 1867; but Maximilian decided to remain in the hope of being able to maintain the empire. While bravely defending Queretaro against a Liberal force under Escobedo, he was betrayed by General Lopez on the night of 14 May 1867. Tried by court-martial, he was sentenced, with his principal officers, to be shot. The sentence was carried into effect on the morning of 19 June. Maximilian's body was after some delay surrendered to his relatives, and his funeral was celebrated with great pomp in the cathedral of Vienna on 18 Jan. 1868. Maximilian was a man of eminent abilities and high and varied culture. His collected writings are contained in a posthumous publication entitled

'Aus meinem Leben: Reiseskizzen, Aphorismen, Marinebilder' (1867), which gives ample testimony to the vigor of his intellect and the variety of his attainments. (See MEXICO, *History*). Consult Bancroft, H. H., 'History of Mexico' (6 vols., San Francisco 1883–88); 'Cambridge Modern History' (Vol. II, New York 1909); Kemper, J., 'Maximilian in Mexico' (Chicago 1911); Martin, P. F., 'Maximilian in Mexico' (London 1914).

MAXIMILIAN, Joseph, 1st king of Bavaria: b. Schwetzingen, Baden, 27 May 1756; d. Nymprenburg, near Munich, 13 Oct. 1825. He succeeded his uncle, Charles Theodore, as elector in 1799. He was a supporter of Napoleon, and gave his daughter in marriage to Eugene Beauharnais in 1806. In the same year his duchy was erected into a kingdom. In 1813, however, he was member of the league against the emperor, and thus retained his throne after the fall of Napoleon. His reign was distinguished by the introduction of many administrative reforms, especially the constitution of 1818.

MAXIMINUS, măk-sĭ-mī'nŭs, **Caius Julius Verus,** Roman emperor: d. Aquileia, 238 A.D. He was at first a shepherd in Thrace and when about 20 years of age became a soldier in the Roman armies, where he was distinguished by his gigantic stature. His capacity for fighting procured him rapid advancement, and under Alexander Severus he had the command of a legion on the Rhine. In 235 A.D. he took part in a conspiracy against Alexander, and after his murder of the latter by the soldiers was proclaimed emperor. The Gordiani having been proclaimed in Africa, Maximinus hastened to Italy and laid siege to Aquileia. He was there murdered by his soldiers.

MAXIMITE, a high explosive employed as a bursting charge for projectiles, invented by Hudson Maxim (q.v.) of New York City. The secret of the invention and the exclusive right to the use of the explosive was purchased by the United States government in 1901, after very exhaustive trials at Sandy Hook proving grounds. Maximite was the first high explosive to be successfully employed as a bursting charge for armor-piercing projectiles. This explosive, while it is claimed to be 50 per cent more powerful than ordinary dynamite, is so insensitive that it will not only safely withstand the shock of discharge from the gun, but will also stand the far greater shock of penetrating armor-plate as thick as the projectile containing it is capable of passing through, the projectile being then exploded immediately behind the plate with a delay action detonating fuse.

Ignited in the open, maximite simply burns like pitch. Projectiles are charged with it by the simple process of melting and pouring, the explosive solidifying on cooling, and adhering firmly to the walls of the shell. Maximite is known to be a picric acid compound. See EXPLOSIVES; PROJECTILES.

MAXIMS. The 'Maxims' of La Rochefoucauld furnish the most famous body of examples of that polished and studied condensation of expression to epigrammatic sparkle and brilliance in which the French so delight and so excel, and of which the 'Pensées' of Pascal, the 'Caractères' of La Bruyère and the 'Reflexions' of Vauvenargues are other specimens. They are precisely what their fuller official title proclaims them: Reflections, or Sentences and Moral Maxims ('Réflexions, ou Sentences et Maximes morales'). They are moral in the sense that they are concerned with the facts of human conduct and motive, but not at all in the sense of serving a didactic purpose or in proposing an incentive or a guide to virtuous living; and they are reflections rather than maxims in the ordinary meaning of the word, since what they give us is not practical precept and counsel, but an analysis of moral facts. In this analysis the sharp distinction and opposition between vice and virtue disappears. His moral philosophy is summed up in the maxim that stands as epigraph at the head of the collection: "Our virtues are most frequently but vices disguised." The idea is restated a little more specifically in the first reflection: "What we term virtue is often but a mass of various actions and divers interests which fortune, or our own industry, manage to arrange, and it is not always from valor or from chastity that men are brave, and women chaste." The root of all our actions, mask it as we will, is selfishness. This view of virtue and vice may owe something of its bitterness and pessimism to the personal temper of La Rochefoucauld, soured by disappointment after playing a restless and unsuccessful part in political and private intrigue. But it owed much also to his penetrating observation of the life of court and salon, and even those who wanted to think more generously of human nature admitted sadly the accuracy of his analysis, while all were captivated by the concision and elegance of his style. To this he gave unending care, polishing and refining his sentences, rejecting some and adding others in successive editions (1665, 1666, 1675, 1678). The standard edition is that prepared by M. Gilbert (Paris 1868). The Maxims have had many admirers among English writers, as Addison, Swift, Dr. Johnson and Lord Chesterfield. They have often tempted to translation. A late and complete English version is by J. W. Willis Bund and J. Hain Friswell (London 1871).

ARTHUR G. CANFIELD.

MAXIMS, Legal, epigrammatic statements of established principles in law, as "Ignorance of the law excuses no one" (*Ignorantia legis neminem excusat*). They are of historic and practical value, and are common in both law and equity. Usually they are given in Latin or in English, but occasionally they appear in French. The following are some of the most important which appear generally in English: "Equity treats that as done which ought to be done"; 'He who comes into equity must come with clean hands"; "Who seeks equity must do equity"; 'Acts indicate the intention"; "Where there is equal equity, the law must prevail." The following usually appear in Latin: *Qui facit per alium facit per se* ("He who acts through another acts himself"—important in the law of agency); *Affirmantis est probare* ("He who affirms must prove"); *Causa proxima non remota spectatur* ("The immediate and not the remote cause is to be considered"—important in the law of torts). While maxims are of importance in the law to-day, it is nevertheless true that some of them, through legal changes, are practically obsolete. Due

allowance also must be made for the fact that they do not contain exceptions and amplifications of the principles they state; otherwise they are very likely at times to be misleading.

MAXIMUM DUTIES. See DUTY.

MAXIMUS MAGNUS, Roman emperor: b. in Spain; d. 388. In 383, while commanding the Roman army in Britain, he proclaimed himself emperor. Gratian marched against him, but was defeated and assassinated, and Maximus, having made himself master of Gaul, Britain and Spain, fixed the seat of his empire at Treves. He then advanced into Italy and was besieged in Aquileia by the Emperor Theodosius, who caused him to be beheaded.

MAXWELL, SIR Herbert Eustace, 7th Baronet of Monreith, Scottish author: b. Edinburgh, 8 Jan. 1845. He was educated at Oxford, was Conservative member of Parliament for Wigtownshire, 1880–1906, and president of the Society of Antiquaries of Scotland, 1900–13. Among his many publications are 'Noontide Essays' (1892); 'Scottish Land Names' (1894); 'Rainy Days in a Library' (1896); 'Life of the Duke of Wellington' (1899); 'Memories of the Month's' five series (1900–09); 'The House of Douglas' (1901); 'Memoirs of George Romney' (1902); 'The Creevy Papers' (1903); 'A Century of Empire' (1909–11); 'The Making of Scotland' (1911); 'Flowers, A Garden Notebook' (1923); 'Inter Alia' (1925).

MAXWELL, James Clerk-, Scottish natural philosopher: b. Edinburgh, 13 Nov. 1831; d. Cambridge, England, 5 Nov. 1879. He was educated at Edinburgh and at Trinity College, Cambridge, and in 1856 was appointed professor of natural philosophy in the Marischal College, Aberdeen, and held that office till its amalgamation with King's College to form the University of Aberdeen in 1860, when he was appointed to a similar chair in King's College, London. In 1857 he obtained the Adams prize at Cambridge for an essay 'On the Stability of Motion of Saturn's Rings.' From 1855 to 1872 he published his investigations on 'Perception of Color, and Color Blindness,' which obtained for him the Rumford medal and his election as F.R.S. He resigned his chair in 1865 and in 1871 was elected unopposed to the newly-founded chair of experimental physics at Cambridge. He directed the formation of the Cavendish laboratory founded by the Duke of Devonshire and opened in 1874. In 1871 he published his 'Theory of Heat,' which has gone through several editions. In 1873 appeared his great work, 'Electricity and Magnetism.' Maxwell's fame will rest on his being the one who took the first grand step toward the discovery of the true nature of electrical phenomena. He rejected the theory of electrical "action at a distance," and sought to explain all electrical and magnetic phenomena as the results of local strains and motions in a medium whose contiguous parts only act on one another by pressure and tension. His scientific papers have been collected by W. D. Niven (1890). Consult Campbell and Garnett, 'James Clerk Maxwell' (London 1882); Glazebrook, R. T., 'James Clerk Maxwell and Modern Physics' (ib. 1896).

MAXWELL, William Henry, Irish-American educator: b. Stewartstown, Tyrone, Ireland, 5 March 1852; d. 3 May 1920. He was graduated at Galway Queen's College in 1872 and in 1874 received the degree of A.M. In 1874 he came to the United States. After eight years as teacher in Brooklyn he became assistant superintendent of schools in that city in 1882 and superintendent from 1887 to 1898. After 1898 Dr. Maxwell was superintendent of public schools of Greater New York. In this position he often came into conflict with members of the board of education. He advocated a college training for teachers and raised the requirements for teachers' examinations in New York. He was president of the National Education Association in 1905. Dr. Maxwell was always very deeply interested in the promotion of the study of English. He published 'Elementary English Grammar'; 'School Grammar' and other educational works.

MAY, Phil, English illustrator: b. Leeds, 22 April 1864; d. Saint John's Wood, London, 5 Aug. 1903. He was son of an engineer; had his schooling in Leeds; was apprenticed there to a lawyer, whom he soon left to join a company of players; for them he designed posters, married at the age of 19; and in 1884 and 1885 began drawing for *Society* and *Saint Stephen's Review.* He went out to Sydney, Australia, in 1885, where he gained some fame as artist of the *Bulletin,* and was forced by the exigencies of newspaper illustration to a very scanty use of line and a complete omission of anything else; went to Paris; returned to his work on *Saint Stephen's Review;* then began to draw for the *Daily Graphic;* in 1888 returned to England; thereafter traveling through America and shortly after Du Maurier's death was taken on the staff of *Punch.* He must rank with Leech, Tenniel and the other great British caricaturists. His art was remarkably simple and telling, his method, it is said, being to reduce an elaborate and detailed drawing to the fewest possible lines. He was particularly happy in his portrayals of London street-life, which are full of humor and sympathy; his Parliament sketches are less felicitous and a misapplication of his talent. His own hatchet face, "banged" hair and ever-present cigar figure in many of his sketches. From 1892 to his death he published 'Phil May's Annual.' His other collections of drawings are 'Parson and Painter' (1891); 'Phil May's Sketch Book' (1895) and 'Phil May's Gutter-Snipes' (1896); 'Phil May's Graphic Pictures' (1897).

MAY, Samuel Joseph, American reformer and abolitionist: b. Boston, Mass., 12 Sept. 1797; d. Syracuse, N. Y., 1 July 1871. He was graduated at Harvard in the class of 1817, and after studying theology under Dr. Ware at the Harvard Divinity School became a Unitarian clergyman and in 1822 accepted a call to a church at Brooklyn, Conn. He was interested in the anti-slavery cause and preached as well as wrote in favor of it, advocating immediate emancipation, for which he was mobbed and burned in effigy at Syracuse in 1830. He was a member of the first New England Anti-Slavery Society, formed in Boston in 1832, and eagerly championed Prudence Crandall, when she was persecuted and arrested for receiving colored girls into her school at Canterbury, Conn. Mr. May was also a member of the Philadelphia convention of 1833 which formed the American

Anti-Slavery Society, and was one of the signers of the "Declaration of Sentiments," the author of which was William Lloyd Garrison. For 18 years he was the general agent of the Massachusetts Anti-Slavery Society, and as such lectured and traveled extensively. He was five times mobbed while on a lecture tour in Vermont, in 1835, once while lecturing in the capitol at Montpelier. He had charge of the Unitarian church at South Scituate, Mass., from 1836 to 1842, becoming in the latter year, at the request of Horace Mann, the principal of the Girls' Normal School at Lexington, Mass. In 1845 he became pastor of the Unitarian Society at Syracuse, N. Y., which position he retained until 1868. Mr. May assisted in the rescue of Jerry, the slave, in 1851, and with several others was arrested for this offense against the Fugitive Slave Law. May and his associates issued a declaration in which they admitted the fact of their being implicated in the rescue, but claimed that the Fugitive Slave Law was unconstitutional and wicked. Realizing the changing sentiment in the North the authorities never brought the case to trial. May's life, like that of many another Abolitionist, was often in danger. He was among the most conservative anti-slavery leaders in his methods and was prominent also in many educational and charitable enterprises, and did a great deal toward improving the public-school system of Syracuse. By his associates May was termed the Saint John Apostle of the Gospel of Freedom, on account of his gentle voice and manner. He was both gentle and firm, courageous, unwearied and unselfish in the anti-slavery cause. He published 'Education of the Faculties' (1846); 'Revival of Education' (1855); 'Recollections of the Anti-Slavery Conflict' (1868). Consult Mulford, 'Memoir of Samuel Joseph May' (Boston 1873; new ed., 1882).

MAY, Thomas, English dramatist and historian: b. Mayfield, Sussex, 1594; d. London, 13 Nov. 1650. He was educated at Cambridge, became a member of Gray's Inn, but never practised, and figured brilliantly at court. He published 'Antigone,' 'Cleopatra,' 'Agrippina' and other dramas and translations of the 'Georgics' and Lucan's 'Pharsalia.' He was an intimate of Charles I and at the latter's behest wrote histories of Edward III and Henry II in verse. He espoused the cause of Parliament in the Civil War, was made secretary and historiographer to Parliament and wrote 'History of the Parliament of England, 1640–43' (1650; several times republished), and a 'Breviary' of the same history (1650). Until the Restoration his body reposed in Westminster Abbey, but as in the case of other Parliamentarians, it was then dishonored and thrown into a neighboring pit.

MAY, Thomas Erskine, Baron Farnborough, English historian: b. London, 8 Feb. 1815; d. Westminster, 17 May 1886. He was educated at Bedford Grammar School, became assistant librarian to the House of Commons in 1831 and was called to the bar in 1838. He was appointed examiner of petitions for private bills in 1846 and clerk to the House of Commons in 1871. He was knighted in 1866, and just prior to his retirement from office in 1886 was raised to the peerage. He is best known as an antiquarian and historian. His chief works are 'A Practical Treatise on the Law, Privileges, Proceedings, and Usages of Parliament' (1844; 10th ed., much enlarged, 1893), a model of its kind, which has been translated into most modern languages; 'Constitutional History of England since the Accession of George III, 1760–1860' (1861–63; republished with supplementary chapter, 1871); 'Democracy in Europe: a History' (1877). In 1854 he collected and reduced to writing the 'Rules, Orders, and Forms of Procedure of the House of Commons.'

MAY, the fifth month of the year, having 31 days. It was second in the old Alban calendar, third in that of Romulus and fifth in that of Numa Pompilius. The etymology of the word is doubtful. It was called Maius by Romulus, in respect to the senators and nobles of his city, who were called Majores, as the month following was called Junius, in honor of the youth of Rome who served him in war and were named Juniares. Some etymologists are of opinion that it was called Maia, from the goddess of that name, the mother of Mercury, to whom they offered sacrifices on the first day of the month. The sun enters Gemini during May and the plants of the earth generally begin to flower. See Calendar.

MAY APPLE. See Mandrake.

MAY BEETLE, or JUNE BUG, popular names for the clumsy brown beetles of the genus *Lachnosterna* (family *Scarabæidæ*) common throughout the United States. The adults fly by night during late spring and often are troublesome upon the young foliage of trees and shrubs. They are attracted by light and may be trapped in this way. The larvæ are large, brown-headed, white-bodied grubs which feed upon the roots of grass, etc., passing one or more years in the ground. For this reason strawberries and other crops which they attack should not be planted upon freshly-turned sod land. Late fall plowing is often practised to destroy them.

MAY-BIRD, a gunner's name for various shore birds which return from the South in the month of May, especially the knot (q.v.). In New England the black-bellied plover, and in the South a curlew, are called May-birds or May-cocks.

MAY CHERRY, a local name for the service-berry bush. See Amelanchier.

MAY DAY, popular name of the first day of the month of May, on which from a very early period general festivities took place. May has generally been regarded as a time for gladness. The outbreak into new life and beauty which marks nature instinctively excites. The first emotion is a desire to seize some part of that profusion of flower or blossom which spreads around, to set it up in decorative fashion and to let the pleasure which it excites find expression in dance and song; and among pagans the tendency has been to render to this vegetative trophy a sort of homage. Among the Romans, the feeling of the time found vent in their *Floralia*, or Floral Games, which began on 28 April and lasted to 3 May. Among the old Celtic peoples, a festival called *Beltein* (Baal's fire) also was held on this day, but it does not seem to have been connected with flowers, but rather with sun-worship. In Christian times in the Celtic countries the Church

Christianized this celebration by transferring it to June 24, the feast of St. John, which is still celebrated with bonfires.

In England, as we learn from Chaucer and other writers, it was customary during the Middle Ages for all, both high and low—even the court itself—to go out on the first May morning at an early hour "to fetch the flowers fresh." Hawthorn branches also were gathered and were brought home about sunrise, with accompaniments of horn and tabor. The people then proceeded to decorate the doors and windows of their houses with the spoils. By a natural transition of ideas, they gave the hawthorn bloom the name "the May"; they called the ceremony "the bringing home the May"; they spoke of the expedition to the woods as "going a-Maying." The fairest maid of the village was crowned with flowers as the "Queen of the May" and placed in a little bower or arbor, where she sat in state, receiving the homage and admiration of the youthful revellers, who danced and sang around her. This custom of having a May queen seems a relic of the old Roman celebration of the day when the goddess of blooming vegetation, Flora, was specially worshiped.

But perhaps the most conspicuous feature of these festive proceedings was the erection in every town and village of a fixed pole—the Maypole—as high as the mast of a vessel of 100 tons, on which, on May morning, they suspended wreaths of flowers, and round which the people danced in rings nearly the whole day. A severe blow was given to these merry and often wild revels, by the Puritans, who, in their campaign of taking the joy out of life, caused Maypoles to be uprooted and a stop put to all the festivities. They were, however, revived after the Restoration.

Since the 1890's May Day has been adopted in much of the Western World as the international labor day.

MAY FLY, SHAD FLY, or **DAYFLY,** members of the order Ephemerida. The species, of which about 300 have been described, nearly one third of which are North American, are fragile insects with large fore wings, small or lacking hind wings, short antennae, atrophied mouth parts and two or three thread-like abdominal filaments. Being greatly attracted to lights, the adults are often a source of annoyance in lakeside and riverside towns, and are sometimes troublesome in obscuring lights from lighthouses.

The eggs are laid in fresh water, either on the surface or the bottom. The larvae, which feed mainly on vegetable matter, are active creatures with strong legs, abdominal tracheal gills, and anal appendages. They live on the bottom, under stones, covered with mud, or in burrows. After molting about 10 times wing pads appear, and these increase with each molt until the last, which may be the twentieth. This occurs in the open air. The one previous to it occurs at the surface of the water, the insect escaping from its subimago skin rather suddenly. One striking difference the adults exhibit is the development of paired sexual organs, which do not appear in other orders of insects. The larvae may take three years to develop; the adults live only a few days, lay their eggs and die. Both adults and larvae are important food for fishes, and consequently they form a favorite bait with anglers, and are imitated in making artificial flies.

MAYA, mä'yà or mī'à, an American India people of Middle America. In the strict meanin of the word, the term Maya refers to the indig enous inhabitants of the Yucatán Peninsula an to their native language. The term takes on di ferent and wider connotations when used to refe to the ancient Maya civilization, to the Maya cu tural area, or to the Maya (or Maya-Quiché linguistic stock.

Modern Maya of Yucatán.—Ethnically, th Maya still form the largest part of the populatio of the peninsula. Physically, they are small i stature (average height: men, five feet one inch women, four feet eight inches), sturdily buil very round-headed, have warm copper-colore skin, and straight, coarse, black to dark brow hair. The epicanthic eye fold occurs frequentl

Culturally, the Indian way of life has bee modified profoundly; first by Spanish influenc the result of conquest and colonization, and late by the impact of Western industrial civilizatio These factors making for cultural change hav been much less effective in the eastern part the peninsula (Quintana Roo). The sparse In dian population of this area was in rebellio against the Spaniards throughout the coloni period, and stubbornly maintained its tradition In 1847, after Mexican independence, the Indian living in the part of Yucatán which had been co onized by the Spaniards for three centuries, ro against their white masters. This war is calle the War of the Castes. When the rebellion wa suppressed, by 1850, those among the vanquishe who did not want to submit again to white dom nation fled into the Quintana Roo jungles, whe they kept up armed resistance until 1901. Eve after this date, the Indian communities of interio Quintana Roo maintained their isolation an marked hostility against any interference by th federal government. Politically, they reverte to tribal patterns of organization. Only sinc 1935 have these Maya groups shown a tendenc to become part of the Mexican nation.

Maya Languages.—Maya proper is spoke by about 350,000 individuals, two fifths of who speak Maya only. The other three fifths spea Maya and Spanish. Roughly six sevenths of th Maya-speaking population inhabits the State Yucatán. The remainder occupy the norther part of Campeche; Quintana Roo; the Coroza Orange Walk, and El Cayo districts of Britis Honduras; and a small northeastern section the Department of Petén, Guatemala.

The Maya (or Maya-Quiché) linguistic stoc includes, besides Maya proper, a number of lan guages closely related among themselves and als closely related to Maya. Linguists differ on ho the Maya-Quiché languages should be classifie with relation to each other. Abraham Mey Halpern classified them, in 1942, as follows:

Guatemalan-Yucatecan Family. It com prises: (1) Maya (spoken in the areas liste above), and Lacandon (the language of a grou of perhaps 200 Indians in the Chiapas jungle (2) Quiché, Cakchiquel, Tzutuhil, Kekchí, Poko man, Pokomchí, Uspantec (all spoken in highlan Guatemala); (3) Mam (southeastern Chiap and southwestern Guatemala), Aguacatec, Jaca tec, Ixil (all three in highland Guatemala).

Chiapas-Honduras Family. It comprises: (1 Tzental, or Tzeltal, and Tzotzil (both in Ch apas); (5) Chontal (in Tabasco; former also southern Campeche), Chol, or Cholti, an Tojolabal, or Chañabal (both in Chiapas), Ch

(highland Guatemala), Chortí (eastern Guatemala and western Honduras).

Huaxtec (or Huastec) Family.—Composed of one group only: (6) Huaxtec (northern Veracruz, eastern San Luis Potosí). Most authors also include the Chicomuceltec language (Chiapas) in this group.

Other authors (Alfred L. Kroeber and John Alden Mason) on the one hand group together the subdivisions 1, 4, and 5 (Kroeber's Lowland Maya Speech Division), and, on the other, the subdivisions 2 and 3 (Highland Division) to form the two major divisions of the Maya linguistic stock. The separate position of Huaxtec is recognized by all authorities, but Kroeber has pointed out its relationships with groups 4 and 5, and places it as a separate branch of the lowland Maya languages.

In addition to the 350,000 people speaking Yucatecan Maya, more than 1,000,000 speak languages belonging to group 2 above; more than 300,000 speak languages of group 3; more than 100,000 speak languages of the Tzental-Tzotzil group; some 135,000 speak languages of group 5; and about 50,000 speak Huaxtec. About 2,000,000 thus speak languages belonging to the Maya-Quiché linguistic stock.

ANCIENT MAYA

Area.—The area of interest in dealing with the pre-Hispanic Maya civilization comprises the following regions: the whole territory of present-day Guatemala and British Honduras, western Honduras, El Salvador, and, in Mexico, the eastern parts of Chiapas and Tabasco, the states of Campeche and Yucatán, and the Territory of Quintana Roo. This geographical area coincides generally with the area of Maya speech at the time of discovery by Europeans.

Two exceptions are nevertheless of importance. Although the Huaxtec (Huastec) speak a language which belongs to the Maya linguistic stock, they remain outside the pre-Hispanic Maya area. Archaeologists have proved that the Huaxtec separated from their linguistic relatives at an early date (perhaps 1000 B.C., or even before), and that Huaxtec culture differs markedly from the other Maya cultures. In contrast, we must include in the Maya area the Pipil, who at the time of the conquest occupied the Pacific coast of Guatemala and El Salvador southeast to the Lempa River. The Pipil spoke Nahuat, a variety of the Nahuatl language of central Mexico. Nevertheless, archaeologists have proved that the history of the area inhabited by the Pipil is intimately related to the history of the Guatemalan highlands and western Honduras.

Both from a geographic and a historical point of view, the Maya area may be divided into three parts: (1) a northern Maya area, which comprises the Yucatán Peninsula roughly north of parallel 18° 30′ N.; (2) a central Maya area, including the lowlands and foothills south of this line and north of the Chiapas-Guatemalan highlands; (3) a southern Maya area, comprising the Chiapas-Guatemalan highlands, the Pacific coast of Guatemala, and El Salvador west of the Lempa River.

Culturally, the Maya area formed the southern part of the larger cultural area which ethnologists call Meso-America, comprising central and southern Mexico, British Honduras, Guatemala, western Honduras, and El Salvador. Despite regional differences, the civilizations which flourished in this area in pre-Hispanic times shared a basically common culture, with roots in a formative stage of sedentary cultivation, the origins of which date back to before 1000 B.C.

Origins.—Botanists consider the Chiapas-Guatemala highland region an important center of the domestication of cultivated plants. The so-called common, or kidney, bean (*Phaseolus vulgaris*) and secondary varieties of corn (maize) may have been developed in this area. It is believed that corn originated in South America, and that in highland Guatemala, through hybridization with a wild plant of the genus *Tripsacum*, it acquired traits which enabled it to be cultivated not only in temperate zones, but also in humid tropical lowlands. This would give the southern Maya area priority in the development of the proto-Maya culture. Archaeological finds made in the late 1940's also uncovered evidence of an early cultural flowering in this region, which seems to antedate similar developments in other parts of the Maya area.

The earliest period of sedentary cultures in the Maya zone for which we have archaeological evidence is called Formative, Archaic, or Pre-Classic. This period came to an end about 200 A.D. The available data do not permit us to date its beginnings. Nevertheless, by making comparisons with other parts of Meso-America, it is possible to say tentatively that the oldest cultural remains found go back to 1000 B.C., or before.

The oldest evidence of human occupation of the southern Maya area consists of pits filled with household debris found on the outskirts of Guatemala City. The culture which corresponds to these middens belonged to a sedentary people which cultivated corn and probably other plants as well. They ground the corn on grinding stones (*metates*), and baked it in bowl-shaped dishes, ancestors of the flat *comal* of later times. They lived in settled communities and had houses of pole and thatch, with mud-daubed walls. They used obsidian blades and scrapers, and greenstone celts, and made baskets, mats, and textiles. They produced excellent pottery, baked-clay fetishes in human or monkey form, and stamps and seals. This culture is comparable to the Archaic cultures of central Mexico.

The last centuries before Christ represent a period of cultural flowering in the southern Maya area, which lasted until the beginnings of our

era. The majority of the 200-odd mounds at Kaminaljuyú, a large archaeological site on the southwestern outskirts of Guatemala City, were constructed during this period. The largest of these mounds is a pyramidal platform over 65 feet high, containing two interior burial chambers. The body of the lord for whom the tomb was constructed lay on a wooden platform in the center of one of the chambers, surrounded by human bodies, apparently sacrificed to accompany him on his trip to the other world, and by rich funerary offerings, including ornaments of jade, bone, shell, and pyrite, and fine pottery in heaps. All this is evidence of the high social position of the individuals given such an elaborate burial. Great archaeological sites are also known on the Pacific Coast.

The oldest remains of occupation known in the central Maya area are pottery, stone and bone tools, and shell ornaments found in a midden covered by buildings of a later period in the ruins of Uaxactún, Department of Petén, Guatemala. The lack of grinding stones in this midden perhaps indicates that corn was not cultivated in the central Maya area at this time. If this be true, it is possible that the staple food plants cultivated by these proto-Maya were roots, as in many tropical lowland regions of America. The oldest building found at Uaxactún, or at any other site in the central Maya area, belongs to a later period than this midden. It is a base for a temple, in the shape of a stepped and truncated pyramid, with fronts decorated with grotesque stucco faces. It was probably built between the beginning of the Christian era and 250 A.D.

Surveys made in the northern Maya area after 1940 indicate that settlement by sedentary populations in this area is as old as in the other Maya areas. The beginnings of monumental architecture are similarly as old in Yucatán as in Petén Department. A high artificial mound at Yaxuná, Yucatán, appears to belong to the same period as the above-mentioned Uaxactún temple.

Classic Period.—From about 300 A.D. to about 900, a civilization flourished in the central area which was at one and the same time the most brilliant civilization of the Maya and one of the most outstanding of pre-Hispanic America. Sylvanus Griswold Morley called it the "Old Maya Empire." This flowering is characterized by the following traits: great architectural development, and stone buildings roofed with corbeled vaults; temples on top of high pyramids (the highest is Temple IV at Tikal, height 229 feet); artistic climax in sculpture, painting, and decorated pottery; hieroglyphic writing; advanced arithmetic, including the concept of completion or zero, and a positional notation of numbers; highly developed astronomy; complex calendrical calculations (Long Count); the stele cult; and deities not directly related to the powers of nature.

These traits form what J. Eric S. Thompson has called "the hierarchic culture." They are traits of an urban culture, superimposed on the elements of a peasant culture, that is, on the complex of farming and supplementary food-producing activities, home industries, and a simpler religion directly concerned with the elemental forces of nature (Thompson's "lay culture"). The complex calendrical calculations, the Long Count system of reckoning time, and the associated stele cult were some of the most original traits of the classic Maya civilization.

Calendar.—The Long Count was the indispensable basis for complicated astronomical counts It served as a fixed system of reference for th other two calendars, the civil year of 365 day and the magic cycle (*tzolkin*) of 260 days. I is a count of days (or multiples of days) wit an initial date going back to 3114 B.C., accord ing to the most accepted correlation betwee this count and our own calendar. This initia date is without a doubt much earlier than th invention of the system. We are dealing her with a retroactive count. Scholars set the rea beginning of the Long Count at between abou 350 B.C. and 140 A.D. The oldest known inscrip tion of the Long Count corresponds to 320 A.D The complexity of the astronomical calculation of the Maya is evident, if one considers tha some of these calculations covered millions o years.

Steles.—The steles are memorials erected t mark time intervals. Thompson maintains tha they were not erected to commemorate indi vidual deeds, but that they constitute impersona markers of calendrical or astronomical event related to religious ideas. There are archaeo logical indications that these monuments were th objects of a real cult, and traits of this cul survive among the present-day Maya.

Cultural Centers.—The main cultural center of the classic Maya civilization seem to hav been: Tikal (Department of Petén, Guatemala) Palenque (Chiapas, Mexico); and Copán (Hon duras). Other sites are: Bonampak, Yaxchilán and Piedras Negras, in the Usumacinta Rive drainage (Mexico-Guatemala); Uaxactún an Holmul (Petén Department, Guatemala); Calak mul (southern Campeche, Mexico); San Jos (British Honduras); and Quiriguá in the lowe Motagua Valley (Guatemala).

Some archaeologists deny that these center constituted real cities. They believe that thei function was primarily religious, and that they were enormous sanctuaries with a small residen population formed by priests and their servants For this reason they prefer to call them cere monial centers. If this were true, however, on would be led to ask where the main political an commercial centers of this civilization were lo cated. Moreover, these so-called sanctuaries were very large; the ceremonial nucleus of the Tika ruins covers an area of at least 220 acres. Along with other archaeologists, the author believes that insufficient attention has been paid to th possible role of these centers as political an commercial capitals, to their urban extension and to the size of their resident populations.

Southern Area.—During the Classic period close relations existed between the southern Maya area and central Mexico. Between 300 A.D. an 600, Kaminaljuyú served as a center of diffusio of central Mexican influences in the Guatemala highlands down to Copán. The finds made b Alfred Vincent Kidder and his collaborators i the late 1930's in the big tombs at Kaminaljuyú clarified the nature of these relations between th Maya zone and Teotihuacán, the great metropoli of the Valley of Mexico. Thompson found ar chaeological evidence along the Pacific Coas which seems to indicate that the Pipil may hav arrived in the area between 700 and 850 A.D.

Yucatán.—In the Yucatán Peninsula, the ruin of Oxkintok (Yucatán State) and Cobá (Quin tana Roo) belong to the classic period. A lint found at Oxkintok showed a Long Count dat corresponding to 475 A.D. Cobá, the center of

system of causeways radiating to outlying sites, flowered especially from about 600 A.D. to about 750. One of its causeways is 62 miles long. Many of the famous archaeological sites of Yucatán, Campeche, and Quintana Roo, such as Uxmal, Kabah, Sayil, Labná, Edzna, Santa Rosa, Xlabpak, Río Bec, Xpuhil, and the oldest buildings at Chichén Itzá are dated from 600 A.D. to 1000.

Collapse.—This civilization collapsed suddenly, apparently at the peak of its flowering, without going through a well-defined period of decadence. Between 800 A.D. and 900 or 950, one after another of the cities, or ceremonial centers, were abandoned. The cultural superstructure (Thompson's "hierarchical culture") disappeared, and only the peasant culture remained. It is probable that the population decreased markedly at this time, even in the rural areas.

The causes of this crisis are unknown. Many different hypotheses have been advanced to explain it. Some of these are wholly fantastic. Those which seem most valid attribute the phenomenon to impoverishment of the soil, or to a rebellion of the peasants against the exploitation of the ruling group. Moreover, there is archaeological evidence of warfare along the western and northern periphery of the central Maya area from 630 A.D. on. All these factors may have contributed, though it is important to note that whatever their nature, they were felt over a much wider territory than the central Maya area. Meso-America went through a general crisis during the 9th and 10th centuries.

Maya After 900 A.D.—*Yucatán.*—The centers of civilization which had flourished in Yucatán during the preceding period were similarly abandoned in the 10th century. This was nevertheless followed by a period of cultural resurgence under Toltec influence. Morley called this period in the history of Yucatán until the Spanish conquest the "New Empire." It begins with the invasion by the Itzá, who were probably Chontal from Tabasco and southern Campeche, strongly influenced by Toltec culture and perhaps led by Toltec chiefs. They established local dynasties in Yucatán, which associated in a kind of confederacy. Chichén Itzá, settled by the Itzá about 987, dominated the confederacy until about 1204. A rebellion of the lords of Mayapán and Izamal then put an end to the supremacy of Chichén Itzá. This was followed by a period in which the city of Mayapán was dominant, until a new rebellion brought this hegemony to an end about 1460. After the fall of Mayapán, Yucatán remained politically divided into some 18 independent warring lordships. Culturally, there is evidence of decadence from the fall of Chichén Itzá on.

In 1511, a dozen shipwrecked Spaniards reached the shores of Yucatán. Most of them were sacrificed by the Maya. In 1517, the expedition of Francisco Hernández de Córdoba first explored the Yucatecan coast. After Francisco de Montejo had made two unsuccessful attempts to conquer Yucatán in 1527–1528 and 1531–1535, his son Francisco de Montejo the Younger finally made Yucatán a part of the Spanish realm in 1540–1546.

Southern Area.—After the collapse of the Classic civilizations, Toltec invaders also reached the highlands of Guatemala in the southern Maya area. The invaders conquered the local population, and established dynasties which lasted until the Spanish conquest. The last centuries preceding the arrival of the Spaniards was characterized by continuous warfare. The Quiché and Cakchiquel were able to conquer a part of the rich cocoa-producing lands held by the Mam, the Tzutuhil, and the Pipil on the Pacific slopes of the highlands. Around 1500, the great Aztec conqueror Ahuitzotl waged a campaign in Chiapas, which resulted in the conquest of the Pacific coast and in the establishment of some garrisons in the highlands. However, the Aztecs did not push beyond the present-day boundary between Mexico and Guatemala. In 1524, the Spanish captain Pedro de Alvarado conquered the southern Maya area.

Central Area.—Little historical and archaeological information on this period is available for the central Maya area. From the accounts of the first Spanish expeditions it would seem that the region was sparsely populated and politically fragmented. Towns were elaborately fortified with palisades and moats. The Maya of Petén maintained their independence and their cultural traditions until 1697, when Martín de Ursúa completed the conquest of the last Maya redoubts of Lake Petén.

See also MEXICO—*Prehistory and Pre-Hispanic History; Architecture.*

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MAYAGUEZ, mä'yä-gwās', Puerto Rico, capital of district of same name, located on the west coast, 72 miles southwest of San Juan. It has a large harbor. It exports sugar, needlework, and fruit. A federal agricultural experiment station is located just outside of the city, as is the College of Agriculture and Mechanic Arts of the University of Puerto Rico. Founded in 1763, it has become an important manufacturing and industrial center, producing cheaper grades of cotton clothing for export. The city is connected by railroad with San Juan and Ponce, and by highway with all principal towns of the island. It has two radio broadcasting stations, and an active business community, which draws trade from nearby towns and rural areas. Pop. (1950) 58,944.

MAYAPAN, mī-yä-pän', archaeological site, Mexico, about 24 miles south-southeast of Mérida, Yucatán. It was a Maya capital after that people's revival in Yucatán under the influence of Toltec culture at about the beginning of the 10th century A.D. The city of Chichén Itzá dominated the confederacy, called the League of Mayapán, which had been formed by the principal cities, until the end of the 12th century, when it was captured during a rebellion of the Maya lords of the cities of Mayapán and Izamal. Mayapán then became dominant for a considerable period, but about 1460 was overthrown by a revolt under the leadership of the lords of Uxmal, and was sacked.

The present condition of the ruins seems to bear

out the traditional history that this old capital of the Mayas was completely destroyed, for little of its past magnificence now remains standing. But numerous mounds, terraces and pyramids, badly ruined edifices and huge quantities of stone, sculptured blocks and foundations of buildings scattered over a considerable extent of territory are evidence of the existence of a great centre of population and a place of some magnificence. One great mound or pyramid over 69 feet high has a stairway 20 feet wide on each of its sides leading from the ground to the truncated summit, a stone-paved platform considerably wider than the stairway. Sculptured stone blocks lie scattered over an area of three miles, attesting the great extent of this ancient Maya capital which tradition says was once surrounded by a thick and high stone wall, but that this wall was razed to the ground at the time of the final destruction of the city about 100 years before the conquest of Yucatán by the Spaniards. Along the line of this wall runs an old ditch, now filled up with débris, and on both sides of this are vast quantities of stone supposed to have once formed part of this ancient rampart. See UXMAL; CHICHEN ITZÁ; YUCATAN.

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JOHN HUBERT CORNYN.

MAYBRICK, Michael («STEPHEN ADAMS»), English composer: b. Liverpool, about 1845; d. 26 Aug. 1913. He studied music in Italy and Germany and was for many years a leading baritone vocalist in concerts and English opera. As a writer of songs over the signature «Stephen Adams,» he was widely popular in this country and England. Among the best known of his many songs are 'The Midshipmite'; 'Nancy Lee'; 'Alsatian Mountains'; 'The Holy City'; 'A Warrior Bold.'

MAYENCE, mä-yŏńs. See MAINZ.

MAYER, Alfred Goldsborough, American zoologist: b. Md., 16 April 1868; d. Fla., 24 June 1922. In 1889 he was graduated at the Stevens Institute of Technology and at Harvard in 1897. From 1892 to 1900 he was assistant to Dr. Alexander Agassiz and had charge of radiates in the Harvard Museum of Comparative Zoology from 1895 to 1900. In 1900–04 Dr. Mayer was curator of natural sciences and curator-in-chief of the Brooklyn Institute Museum; in 1904–05 he was director of the marine laboratory of the Carnegie Institution, Tortugas, Fla., and after 1905 was director of the department of marine biology at the Carnegie Institution, Washington. Dr. Mayer took part in several scientific expeditions in many parts of the world. In 1913 he became lecturer in biology at Princeton. His works include 'Medusæ of the World' (3 vols., 1910); and contributions to zoological publications, especially on the insects and medusæ and on chemical causes of animal movements; effects of ions upon rate of nerve conduction; studies of coral reefs of Samoa, etc.

MAYER, mā'ėr, **Alfred Marshall,** American physicist: b. Baltimore, 13 Nov. 1836; d. Maplewood, N. J., 13 July 1897. He studied at Saint Mary's College, Baltimore; spent two years in a machine-shop and draughting-room; specialized in chemistry and physics; became professor of these branches in the University of Maryland (1856) and in Westminster College, Fulton, Mo. (1859); after two years of study in Paris was appointed to a chair in Pennsylvania College, Gettysburg (1865); went thence to Lehigh University in 1867; and from 1871 to his death was professor of physics in Stevens Institute, Hoboken, N. J. There he made important researches in acoustics; invented the topophone, an apparatus to detect the phases of sound vibration; discovered five methods of analysis of compound sounds into their elementary tones; and stated the law of tuning-fork vibration. He became a member of the National Academy of Sciences in 1872. He wrote many papers for the *American Journal of Science,* notably a series entitled 'Researches in Acoustics' and was at one time a member of the editorial staff; several contributions to the *Scientific American Supplement;* 'Lecture Notes on Physics' (1868); 'The Earth a Great Magnet' (1872); 'Light' (1877); and 'Sound' (1878). Consult *Science* (issue of 20 Aug. 1897).

MAYER, Brantz, American author: b. Baltimore, 27 Sept. 1809; d. there, 21 March 1879. He was educated at Saint Mary's College, Baltimore, studied law by himself during an Oriental voyage in 1827–28 and then at the University of Maryland; was admitted to the bar in 1829; and after a year in Mexico as secretary of legation wrote 'Mexico as it Was, and as it Is' (1844). In the same year he founded the Maryland Historical Society. In the Civil War he sympathized with the Union was president of the Union State General Committee, and from 1863 to 1871 paymaster in the United States army. His best book was 'Captain Canot,' a story of the slave trade founded on fact. He wrote also 'Mexico, Aztec, Spanish, and Republican' (1851); 'Observations of Mexican History and Archæology' (1856); 'Mexican Antiquities' (1858); 'Memoir of Jared Sparks' (1867); and 'Baltimore as it Was, and as it Is' (1871).

MAYER, Constant, American artist: b. Besançon, France, 4 Oct. 1832; d. 1901. A student at the School of Fine Arts in Paris he left his studies in 1857 and settled in New York, where his sketches and portraits won immediate success. His portraits of Grant and Sherman and his life-sized genre paintings such as 'Maud Müller'; 'The Song of the Shirt'; 'Evangeline,' gained favor. From 1866 he was an associate of the National Academy of Design and exhibited frequently at the Salon.

MAYER, mī'ĕr, **Julius Robert von,** German physicist: b. Heilbronn, Germany, Nov. 25, 1814; d. there, March 20, 1878. He was educated at the gymnasium in Heilbronn, studied medicine at Tübingen and finished his university studies at Munich and Paris. In 1840 he went to Java as a ship's surgeon, and while there turned his attention to studies of the blood, extending his work to exhaustive investigations of animal heat, to which he applied the mechanical theory. Returning in 1841 to Heilbronn, where for some years he practiced his profession, he became deeply engrossed with his scientific labors, and in 1842 published in Liebig's *Annalen der Chemie und Pharmacie* a preliminary statement of his revolutionary theory of heat, together with his views on the conservation and correlation of energy. Three years later he restated his results in *Die organische Bewegung in ihrem Zusammenhang mit dem Stoffwechsel,* at the same time giving a forecast of his theory of the meteoric origin of the sun's heat. Contemporaneously with Mayer the mechanical theory of heat was worked out independently by James Prescott Joule (q.v.) in England, and a controversy arose regarding the priority of discovery.

MAYER, Louis Burt, American motion picture producer: b. Minsk, Russia, July 4, 1885. Of Jewish parentage, he was brought to Canada as a child and educated in the public schools of St. John, N. B. Until 1906 he engaged in salvaging ships and industrial plants. In 1907 he began his motion picture career as operator of a cinema theater at Haverhill, Mass., soon obtaining control of all the theaters in that town. In 1912 he became a naturalized American citizen, and two years later acquired the New England rights for D. W. Griffith's epochal *Birth of a Nation.* He expanded his activities by conducting a film booking agency covering New England, then helped to organize and was vice president of Metro Pictures Corporation which, in 1924, merged with the Goldwyn Company to become the Metro-Goldwyn-Mayer Corporation, with Mayer as first vice president in charge of production. Hollywood's Motion Picture Academy on March 29, 1951 presented him with a special "Oscar" award "for more than 35 years' outstanding contribution to the industry."

MAYFAIR, mā'fâr, a fashionable neighborhood, London, England, in the West End adjoining Belgravia, east of Hyde Park, and bounded by Park Lane and Bond Street. See also LONDON.

MAYFIELD, city, Kentucky, and Graves County seat; altitude 421 feet; 23 miles south of Paducah; on the Illinois Central Railroad. It is in an agricultural area producing tobacco, cotton and milk, and has manufactures of men's and boys' clothing, and condensed milk. Mayfield is an important national market for dark, fire-cured tobacco In February, each year, is held a mule market.

The town was founded about 1823 and incorporated in 1850.

MAYFIELD, borough, Pennsylvania, in Lackawanna County; altitude 952 feet; 11 miles northeast of Scranton; on the Delaware and Hudson Railroad. It is a coal mining center; the mines here, first developed prior to 1840. were sold to the Delaware and Hudson Canal Company in 1874. Pop. (1940) 3,172; (1950) 2,373.

MAYFLOWER, The, the name of the vessel in which the Pilgrim Fathers, or first colonists in New England, sailed to that country in 1620. The *Mayflower* was a vessel of 180 tons. She set sail from Southampton, England,

The Mayflower

on Aug. 4/15, 1620 (Old Style and New Style dates) in company with the smaller *Speedwell.* The latter's leaky condition forced them eight days later to put back into Dartmouth harbor. About August 22/ September 2, they again set sail, but the *Speedwell* proving quite unseaworthy they made port at Plymouth where she was abandoned. Here some passengers, disheartened, gave up the venture. On a third attempt the *Mayflower* alone sailed out of Plymouth on September 5/16, with a complement of 102 passengers and crew.

The Pilgrims aboard the *Mayflower* sighted Cape Cod on November 8/19 and their ship dropped anchor in what is now Provincetown Harbor at the Cape's point, November 10/21. They took on wood and water, mended their shallop and used it to explore the coast. On December 10/21 the future Plymouth harbor was explored and judged suitable for a settlement. Five days later the *Mayflower* dropped anchor there. She set sail on her return voyage March 25/ April 5, 1621, and arrived safely in London. Her history after 1624, when she was again in London, is unknown.

The male passengers aboard the *Mayflower* were as follows:

THE MAYFLOWER PASSENGERS

Alden, John
Allerton, Isaac
Allerton, John
Billington, John
Bradford, Wm.
Brewster, Wm.
Britterage, Richard
Brown, Peter
Carver, John
Chilton, James
Clarke, Richard
Cook, Francis
Crackston, John
Dotey, Edward
Eaton, Francis
English, Thos.
Fletcher, Moses
Fuller, Edward
Fuller, Samuel
Gardiner, Richard
Goodman, John
Hopkins, Stephen
Howland, John
Leister, Edward
Margeson, Edward
Martin, Christopher
Mullins, William
Priest, Degony
Rigdale, John
Rogers, Thomas
Soule, George
Standish, Miles
Tilly, Edward
Tilly, John
Tinker, Thomas
Turner, John
Warren, Richard
White, William
Williams, Thomas
Winslow, Edward
Winslow, Gilbert

With these 41 male passengers and heads of families came 15 male servants, whose names were as follows:

SERVANTS ON THE MAYFLOWER

Carter,	Langemore,	Sampson,
Coper,	Latham,	Story,
Ely,	Minter,	Thompson,
Holbeek,	Moore,	Trevore,
Hooke,	Prower,	Wilder.

These first Massachusetts settlers, before debarking at Cape Cod, signed a compact on Nov. 11, 1620, providing for a "civil body politic" to make all their laws. It remained Plymouth Colony's basic governmental charter until 1691, when that colony was absorbed by Massachusetts. The Mayflower Compact reads as follows:

In the name of God Amen! We whose names are underwritten, the loyal subjects of our dread sovereign Lord, King James, by the grace of God, of Great Britain, France and Ireland, King, Defender of the Faith, etc., have undertaken for the glory of God and the advancement of the Christian faith, and honor of our King and Country, a voyage to plant the first colony in the northern parts of Virginia; do by these presents, solemnly and mutually, in the presence of God and of one another covenant and combine ourselves together into a civil body politic for our better ordering and preservation, and furthermore of the ends aforesaid; and by virtue hereof to enact, constitute and frame just and equal laws, ordinances, acts, constitutions, and offices from time to time, as shall be thought most mete and convenient for the general good of the colony; unto which we promise all due submission and obedience. In witness whereof we have hereunto subscribed our names, at Cape Cod, the 11th of November, in the year of the reign of our sovereign Lord, King James of England, France and Ireland, the Eighteenth, and of Scotland the Fifty-fourth, Anno Domini, 1620.

Whittier, Lowell, Holmes and other poets have immortalized the *Mayflower* in well-known poems.

Consult Carpenter, E. J., *The Mayflower Pilgrims* (New York 1918).

MAYFLOWER. See Arbutus, Trailing.

MAYHEM, *in law,* the maiming of one person by another, the destroying or disabling of an arm, leg, hand or foot, putting out an eye, etc. Mayhem renders the perpetrator liable to a civil action for damages, and also to a criminal prosecution.

MAYHEW, mā'hū, **Experience,** American missionary: b. Martha's Vineyard, Mass., Jan. 27, 1673; d. there, Nov. 29, 1758. He took charge of a half-dozen congregations of Indians, and in 1709 executed for the Society for the Propagation of the Gospel in New England a translation of the Psalms and of the Gospel according to St. John into the Indian tongue. His principal writing is *Indian Converts* (1727), containing accounts of 30 Indian ministers and 80 other Indian Christians.

MAYHEW, Henry, English journalist and author: b. London, Nov. 25, 1812; d. July 25, 1887. In 1831 he started, with Gilbert à Beckett, a periodical called *Figaro in London;* in 1841 produced, with à Beckett, the farce of the *Wondering Minstrel;* and not long after formed a literary partnership with his brother Augustus, the Brothers Mayhew, as they came to be familiarly known, turning out a number of most successful works of amusing fiction.

Among these may be mentioned *The Greatest Plague of Life, or the Adventures of a Lady in Search of a Good Servant* (1847); *The Image of His Father, or One Boy is More Trouble than a Dozen Girls* (1850); *Living for Appearances* (1855). In 1851 appeared the first volume of his most important work, *London Labor and the London Poor.* He was one of the founders of *Punch* (1841) and its first editor. His brothers Horace, Thomas and Edward also assisted Henry and Augustus in their enterprises, besides publishing independently.

MAYHEW, Jonathan, American clergyman: b. Martha's Vineyard, Mass., Oct. 8, 1720; d. Boston, July 9, 1766. He was graduated from Harvard in 1744, and from 1747 until his death was minister of the West Church in Boston. In a day of theological controversy he was prominent for his tracts. His views were so liberal as to exclude him from the Boston Association of Congregational Ministers. He opposed the measures of the British Society for the Propagation of the Gospel in Foreign Parts, and got into dispute about it with Thomas Secker (1693–1768), archbishop of Canterbury. In both pulpit and press he was an earnest patriot, being of much assistance to Otis and other early leaders. By the Tories he was considered to have brought about the Stamp Act riots because of a sermon in which he pleaded for the repeal of the act. From him came the suggestion of uniting the colonies in opposition to England. Among his writings are *Seven Sermons* (1749); *Discourse Concerning Unlimited Submission and Non-resistance to the Higher Powers* (1750), and *Sermons* (1756).

MAYHEW, Thomas, American colonial governor: b. England, 1592; d. Martha's Vineyard, Mass., March 25, 1682. Prior to his emigration to New England in 1631 he had been a merchant in Southampton. He settled first at Watertown, Mass., and in 1641 secured from the agent of Lord Stirling a grant of the larger part of the island of Martha's Vineyard and the title of governor. With his son Thomas he labored to convert the Indians of the island so successfully that during King Philip's War the island Indians protected the white settlers. He founded Edgartown in 1647, and after the death of his son and grandson continued their ministry and organized an Indian church.

MAYNARD, mā'nērd, **Charles Johnson,** American ornithologist: b. West Newton, Mass., May 6, 1845; d. there, Oct. 15, 1929. He went to public school, worked on a farm and studied natural history as a boy. He was well known as an ornithologist, and the discovery of the vocal organs of the American bittern is attributed to him. In 1875 he was elected vice president of the Nuttall Ornithological Club, in connection with which he founded and edited *The Nuttall Bulletin.*

He was the author of a number of books growing out of his work, among them being *Naturalists' Guide; Birds of Eastern North America; Butterflies of New England; Field Directory of Birds of Eastern North America; Atlas to the Discovery of Birds of Eastern North America; Records of Walks and Talks with Nature,* 12 vols.

MAYNARD, Edward, American inventor: b. Madison, N. J., April 26, 1813; d. Washington, D.C., May 4, 1891. He entered West Point in 1831; resigned because of ill-health in 1832; studied dentistry and practiced in Washington

from 1836 to 1890. He invented new dental tools, discovered in 1846 the diversity of the maxillary antra, introduced the method of filling cavities with gold foil, taught dentistry in the Baltimore College of Dental Surgery and in the National University at Washington, and practiced successfully in Europe.

He is best known for his invention of small arms and new priming methods which superseded percussion caps. He patented a breech-loading rifle in 1851; a method of converting muzzle-loaders to breech-loaders in 1860; a plan to join two barrels so that contraction and expansion in either would be independent of the other, in 1868, and in 1886 a registering device showing the number of cartridges in a magazine rifle. His rifle was adopted by the United States, and brought him decorations from the governments of Belgium, Prussia, and Sweden.

MAYNARD, George Willoughby, American artist: b. Washington, D.C., March 5, 1843; d. April 5, 1923. He studied at the New York Academy of Design and at the Belgian Royal Academy, Antwerp. He had a studio in Paris in 1878, but later located in New York. He was a National Academician and librarian of the National Academy of Design, member of the Society of American Artists, the American Water Color Society and ex-president and honorary member of the Salmagundi Club. Maynard's decorative work may be seen in the Congressional Library, Washington, D.C., the ceiling of the Metropolitan Opera House, New York, the Essex County Courthouse, Newark, N. J., and the Appellate Court, New York. His principal canvases are *Vespers at Antwerp* (1776); *Venetian Court; Ancient Mariner* (1883); *Strange Gods* (1904); *Old and Rare;* and *Rocks at Ogunquit* (1912). He is represented in the Metropolitan Museum, New York, the Providence Museum, the Corcoran Gallery, Washington, and the Pennsylvania Academy.

MAYNARD, Horace, American politician: b. Westboro, Mass., Aug. 30, 1815; d. Knoxville, Tenn., May 3, 1882. He was graduated from Amherst College in 1838; and became instructor, and later professor, in East Tennessee College, Knoxville, Tenn. He studied law, was admitted to the bar in 1844 and built up a successful practice. In 1857 he was nominated for member of Congress by the Know-Nothing Party, and elected. On the outbreak of the American Civil War he declared his loyalty to the Union and took an active part in the unsuccessful attempt to keep Tennessee from seceding; on this account he suffered persecution and heavy loss of property during the war. When the Union forces occupied his state in 1864 he was made attorney general. In 1866–1875 he was again member of Congress, being representative at large for his state in the last two years. In 1875–1880 he was appointed minister to Turkey, and in 1880 postmaster general in President Hayes' Cabinet, holding the office until March 4, 1881.

MAYNARD, Theodore, historian and poet: b. Madras, India, Nov. 3, 1890, where his parents were Protestant missionaries. Educated in England and America he received the Ph.D. degree from the Catholic University of America.

Most of Dr. Maynard's life has been spent in America, where he became a citizen in 1941. After working as a minister, journalist, and teacher, he gave all his time to writing, chiefly in the field of biography.

Among his books are: *Laughs and Whiffs of Song* (1915); *Drums of Defeat* (1916); *Carven from the Laurel Tree* (1918); *A Tankard of Ale* (1919); *The Divine Adventure; The Last Knight* (both 1921); *Exile and Other Poems* (1933); *Man and Beast* and *The Odyssey of Francis Xavier* (both 1936); *Apostle of Charity,* a life of St. Vincent de Paul (1939); *Queen Elizabeth* (1940); *The Reed and the Rock* (a life of Bishop Simon Brute), and *Orestes Brownson, Yankee, Radical, Catholic* (both 1942); *Too Small a World,* a life of Mother Cabrini (1945), and anthologies of prose and verse. His best-known work is *The Story of American Catholicism* (1941). In 1938 he published his autobiography under the title of *The World I Know.* In 1912 he became a convert to the Roman Catholic Church.

MAYNARD, town, Massachusetts, in Middlesex County, altitude 176 feet, 21 miles west-northwest of Boston. It is served by the Boston and Maine Railroad. Its principal manufactures are woolens, chemicals, and beverages. Settled in 1638; incorporated in 1871. Pop. (1950) 6,978.

MAYNOOTH, town, Ireland, in County Kildare, 15 miles west-by-north of Dublin. Located here is famous St. Patrick's College. This college is the chief center for the training of Roman Catholic diocesan clergy in Ireland. It was established in 1795 on the site of a college founded by the earl of Kildare in the 16th century, which was suppressed by Henry VIII.

Maynooth is of historic interest as the seat of the powerful Geraldines, and has ruins of their castle, built 1176 and enlarged in 1426. Several battles with the English occurred here, notably in the rebellion of Silken Thomas in the reign of Henry VIII, and the War of the Confederates (1641–1650). Pop. (1946) 572.

MAYO, mā'ō, **Amory Dwight,** American Unitarian clergyman and educator: b. Warwick, Franklin County, Mass., Jan. 31, 1823; d. April 8, 1907. He was graduated from Amherst, and taught in the public schools in Massachusetts 1839–1844. In 1846 he became minister of the Universalist Church at Gloucester, Mass., and later held Universalist pastorates at Cleveland, Ohio (1854–1856), and at Albany, N. Y. (1856–1863). He then entered the Unitarian ministry, and was pastor at Cincinnati, Ohio (1863–1872), and at Springfield, Mass. (1872–1880). He was long prominent as an educator, was an efficient and active member of the boards of education, in Cincinnati and Springfield, and was connected with the Meadville (Pa.) Theological School as lecturer and professor from 1868–1898. After 1880 he devoted his attention chiefly to the advancement of education in the South, lecturing frequently in many different states. He was the chief editorial writer for the *New England and National Journal of Education,* and published *The Moral Argument for Universalism; Graces and Powers of the Christian Life* (1852); *Biography and Collected Writings of Mrs. S. C. E. Mayo; Symbols of the Capital or Civilization in New York* (1859); *Talks with Teachers* (1885); *Southern Women in the Recent Educational Move-*

ment in the South' (1892), and 'History of the American Common School.'

MAYO, Charles Horace, American surgeon: b. Rochester, Minn., 19 July 1865; d. Chicago, Ill., 26 May 1939. He was educated at the Rochester High School, Northwestern University, and in 1888 was graduated in medicine at the Chicago Medical College. In the same year he entered on the practice of medicine at Rochester, where he afterward resided. He received many honorary degrees, among them: A.M., Northwestern University, 1902; LL.D., University of Maryland, 1909; F.A.C.S., American College of Surgeons, 1913; LL.D., Kenyon College, 1916; D.Sc., University of Leeds, 1927. Dr. Mayo was surgeon to the Mayo Clinic of Saint Mary's Hospital, Rochester, Minn.; to the Mayo Foundation, University of Minnesota, where he was professor of surgery after 1915. In 1913 he was commissioned first lieutenant in the Medical Reserve Corps, United States Army; was appointed major in 1917, and colonel in the same corps in 1918. In the same year he was made associate chief consultant of the United States Army Medical Department for Surgical Services. He was also consulting surgeon of the Chicago and Northwestern Railway and of the Chicago Great Western Railway. Dr. Mayo was a member of the American Medical Association, of which he was president in 1916–17 and chairman of the section on surgery in 1910; of the American Surgical Association; of the Association of Military Surgeons of the United States; of the Clinical Congress of the American College of Surgeons (president in 1914–15); of the Minnesota State Medical Society, of which he was president in 1905; of the Society of Clinical Surgery; of the Southern Surgical and Gynecological Society, of the Western Surgical and Gynecological Society, of which he was president in 1904–05; of the Council of National Defense Medical Board; of the National Medical Museum; of the Minnesota Pathological Society; of the American Association of Railway Surgeons; of the American Association for the Advancement of Science; etc., etc. In 1908–09 he was president of the section on surgery of the International Congress on Tuberculosis. In 1915, with his brother, W. J. Mayo (q.v.), he donated $1,500,000 to establish the Mayo Foundation for Medical Education and Research at Rochester, in affiliation with the University of Minnesota.

MAYO, Frank, American actor: b. Boston, 19 April 1839; d. 8 June 1896. His first appearance on the stage was at the American Theatre in San Francisco, and he was for several years the leading actor on the Pacific coast. In August 1865 he appeared in Boston as Badger in 'The Streets of New York' with great success, and though he played Shakespearian and other rôles acceptably, notably Othello, Hamlet and Ferdinand, became best known in his character of Davy Crockett, first played by him in Rochester, N. Y., in 1872, and thereafter almost exclusively by him till 1884. In later years he played in his own drama of 'Nordeck' and in a stage version of 'Pudd'nhead Wilson.'

MAYO, Henry Thomas, American naval officer: b. Burlington, Vt., 8 Dec. 1856; d. 23 Feb. 1937. In 1876 he was graduated at the United States Naval Academy; advanced through various grades to rear-admiral 15 June 1913. In 1915 he was made vice-admiral and in 1917 was promoted admiral. He served on various vessels of the United States Navy, also on both naval and coast survey; was commandant of the Mare Island navy yard in 1911–13; served as aide for *personnel* at the Navy Department, Washington, in 1913, and on 18 December of that year was made commander of the fourth division of the Atlantic fleet. In 1915 he commanded the battleship squadrons of the Atlantic fleet and two years later became commander-in-chief of that fleet and hoisted his flag on the *Pennsylvania.* Admiral Mayo demanded an apology from the Mexican commander at Tampico and the firing of a national salute of 21 guns to the United States flag, to make amends for arrest of paymaster and crew of the dispatch boat *Dolphin* at a wharf while loading gasoline into whaleboat on 9 April 1914. The admiral's action was commended and approved by the government at Washington, and the occupation of Vera Cruz later in the same month was one result of the flag incident. Reverted to rank of rear-admiral 1919. Retired 1920.

MAYO, William James, American surgeon: b. Le Sueur, Minn., 29 June 1861; d. 28 July 1939. He was a brother of Charles Horace Mayo (q.v.), was educated at Rochester High School and Niles Academy and received his professional training at the University of Michigan, where he was graduated in 1883. Thereafter he practiced in Rochester, Minn., as surgeon to Saint Mary's Hospital. He became first lieutenant of the Medical Reserve Corps of the United States army in 1913. With his brother he established the Mayo Foundation for Medical Education and Research at Rochester in 1915. He was regent to the University of Minnesota, was president of the State Medical Society in 1895–96, of the American Medical Association in 1905–06, of the American Surgical Association in 1913–14, and of the Society of Clinical Surgery, 1911–12. He was also a member of the American College of Surgeons, of the Clinical Congress of Surgeons of North America, of the Academie de Medicine de Paris (corresponding secretary), of the Société de Chirurgie de Paris, of the Royal College of England and Scotland. He received honors from all the principal universities, among them: M.D., University of Michigan, 1883; A.M., University of Michigan, 1889; LL.D., University of Toronto (1906), University of Maryland (1907), University of Pennsylvania (1912); D.Sc., University of Michigan (1908) and Harvard University (1924). He was a Fellow of the Royal College of Surgeons of England from 1913, of Scotland from 1905 and of the American College of Surgeons from 1913. He was widely known for his numerous successful operations in cases of gallstones, cancer and diseases of the intestinal tract.

MAYO, William Starbuck, American novelist: b. Ogdensburg, N. Y., 20 April 1812; d. New York 22 Nov. 1895. His parents had removed to Ogdensburg in the year of his birth. He studied in his native place and in Potsdam Academy and in 1833 was graduated at the College of Physicians and Surgeons, New York. After practising his profession for several years in Ogdensburg he was forced to abandon it owing to ill health. He visited Spain, made a tour in the Barbary States and

then took up his residence in New York City, where he gave his entire attention to literature. He is the author of 'Flood and Field, or Tales of Battles on Sea and Land' (1844); 'Kaloolah, or Journeys to the Djebel Kumri,' purporting to be the autobiography of Jonathan Romer and describing his marvelous adventures in Africa (1849); 'The Berber, or the Mountaineer of the Atlas,' similar to the preceding (1850); 'Romance Dust from the Historic Places,' a collection of short tales, founded on historical incidents (1851); 'Never Again,' a novel (1872).

MAYO, mī'ō, a tribe of Mexican Indians of the Piman family, located on the banks of the Mayo River in southern Sonora. Their allies and northern neighbors are the Yaquis and their habits and language, the latter known as Cahita, are almost identical. They are a peaceful, agricultural people and are thoroughly Mexicanized. They number perhaps 6,000.

MAYO-SMITH, mā'ō-smith', **Richmond,** American political economist: b. Troy, Ohio, 9 Feb. 1854; d. New York City, 11 Nov. 1901. He was graduated from Amherst College in 1875 and studied in Germany for two years at the universities of Berlin and Heidelberg. From 1877 he was connected with Columbia University, first as assistant in history and political science, then as adjunct professor (1878–83) and professor of political economy and social science (1883–1901). He was also one of the faculty of the graduate School of Political Science, established in 1880, and his chief work as teacher was done in this school. His specialty was statistics, on which he was a recognized authority. He was an honorary Fellow of the Royal Statistical Society of Great Britain, a member of the International Statistical Institution and of the American Statistical Association, being vice-president of the latter; he was also a member of the National Academy of Science and of the American Economic Association, of which he was one of the founders. He was editor of the *Political Science Quarterly* from 1886, and published 'Emigration and Immigration' (1890); 'Statistics and Sociology' (1895); and 'Statistics and Economics' (1899).

MAYON, mä-yōn', a volcano of the Philippines situated in the northern part of the province of Albay, Luzon, height, 8,274 feet. It rises from a broad plain about six miles from Albay Gulf and forms a perfect cone; its summit is surrounded by vapor, which at night has a fiery glow. Its sides, almost at the top, are covered with grass or moss, and the ascent, though it has been made, is difficult. Near the summit there are fissures which emit sulphurous gases and steam, and there were several eruptions during the 19th century, the town of Cagsaua at the foot of the mountain being entirely destroyed in 1814. Great quantities of lava and ashes were belched forth in the last eruption (1897).

MAYONNAISE, mā-ŏn-āz', a thick cold dressing for salads, cold meat, poultry, fish, vegetables, etc., made of the yolks of eggs, salad oil and vinegar, with a little salt and pepper; it is sometimes colored red with powdered lobster shell or green with spinach or parsley.

MAYOR. See Cities, American, Government of; City Manager Plan of Government; Executive.

MAYOR OF ZALAMEA, The ('El Alcalde de Zalamea'). Two Spanish plays bear this title, the first by Lope de Vega (1562–1635), the second, an adaptation, by Calderón de la Barca (1600–81). The superiority of the adaptation over the original is admitted by all critics. A comparison of the two works is somewhat unfair to Lope de Vega, because his play is one of his least worthy productions. He reveals, indeed, his characteristic spontaneity, but fails to seize resolutely upon the dramatic possibilities of his story, preferring for some reason to narrate events in their chronological sequence. Calderón studies the dramatic situations more carefully and by discarding irrelevancies, reducing the number of personages and sharpening the features of those retained, produces a masterpiece. To his predecessor he owes his plot, the dramatic conflict, the principal personages and a few lines which he transfers to his play unaltered. The most striking difference between the two pieces is the character of Isabella, daughter of the mayor (or magistrate). In Lope's play there are two daughters, both flirtatious to the last degree. So little control has the father over them, that when he is appointed magistrate, he asks pathetically, "How can a father who fails to rule at home, govern a town?" The fate of the daughters at the hands of dissolute soldiers does not surprise the spectator, and the penalty of death imposed upon the seducers hardly seems justified. Calderón corrects this defect, and in Isabella, who replaces Leonora and Agnes, he presents a modest young woman, the unhappy victim of a crime which she strives in vain to prevent. Her soliloquy after she has been wronged is pathetic and poignant, and is one of the best passages in the play (Act II, scene i). Among other excellent scenes may be noted the magistrate's farewell to his son, in which shrewd advice and good feeling are happily blended (Act II, scene xxi), and the prolonged struggle between the magistrate and the gouty, blustering, irascible, old soldier, Lope de Figueroa (Act III, scene xv). King Philip II, who appears suddenly at the close of the play, sets his seal of approval upon the action of the father-magistrate in avenging the wrong done to his daughter and thus vindicates the triumph of justice and local autonomy (a precious privilege to Spaniards) over the lawlessness of undisciplined soldiery. The events narrated by the two dramatists are so circumstantial that it is assumed that they are based on a real incident in the march of Philip II into Portugal (1580), when the Tercio de Flandes, a famous regiment commanded by Lope de Figueroa, passed through Zalamea, a small town in Estremadura. Krenkel published both plays with valuable notes in 'Klassische Bühnendichtungen der Spanier' (Vol. III, Leipzig 1887). Consult also Menéndez y Pelayo's edition in 'Obras de Lope de Vega' (Vol. XII, 1902), and 'Select Plays of Calderón' (ed. Maccoll, London and New York 1888).

Milton A. Buchanan.

MAYORUNA, South American Indian tribe of Panoan stock. Their country lies south of the Marañon and between the Ucoyali and

Javarí rivers, in northeastern Peru. Seminomadic, they live mainly by hunting. They are hostile to their neighbors and have resisted acculturation. In 1940 they numbered about 3,000.

MAYOTTE, mä-yôt′, easternmost of the Comoro Islands (q.v.).

MAYOW or **MAYOUWE** or **MAYO,** mā′ō, **John,** English physiologist and chemist: b. London, May 24, 1640; d. there, October 1679. He entered Wadham College, Oxford University, in 1658 and was elected a fellow of All Souls in 1660. He received the degrees of bachelor (1665) and doctor (1670) of civil law, and studied medicine, which he practiced in Bath. In 1678 he was elected a fellow of the Royal Society. Mayow was the author of *Tractatus duo, de Respiratione et de Rachitide* (1668), the first part of which correctly described the mechanism of respiration and showed that the function of breathing is to give oxygen to the blood, and that the heart is a muscle for pumping blood through the body. In 1674 he published an expanded work, *Tractatus quinque Medico-Physici,* in which he described the chemistry of combustion and showed that combustion and respiration are analogous.

MAYSVILLE, city, Kentucky, seat of Mason County, situated at an altitude of 450 feet, on the Ohio River and the Chesapeake & Ohio and the Louisville & Nashville railroads, 64 miles southeast of Cincinnati. The city serves as a river port and is an important burley tobacco market. Its industrial products include automobile and bicycle accessories, shoes, pulleys and transmission equipment, condensed milk, cans, textiles, and distillery products.

Settled about 1782 and first called Limestone, Maysville was established in 1787 by the Virginia legislature and named for John May, on whose land it was originally laid out. It was incorporated in 1833. Government is of the commission type. Pop. (1950) 8,632.

MAYURBANJ, mä-yo͝orb′hŭnj, former princely state, India, with an area of 4,034 square miles. In 1949 it became a district of Orissa (q.v.).

MAYVILLE, city, Wisconsin, situated in Dodge County, on the Rock River and the Chicago, Milwaukee, St. Paul and Pacific Railroad, 52 miles northwest of Milwaukee. The city's industrial establishments produce sheet metal products, shoes, luggage, tools and dies, dairy products, and canned foods. Mayville has a community park and a public library. Settled in 1845, it was incorporated in 1885. It is governed by a mayor and council. Pop. (1950) 3,010.

MAYWOOD, city, California, situated in Los Angeles County, 6 miles southeast of downtown Los Angeles, of which it is a residential suburb. It is served by Pacific Electric Railway motor coaches. The city has plants producing automobile accessories, furniture, processed food, and steel. Founded in 1920, it was incorporated in 1924. Government is administered by a mayor and council. Pop. (1950) 13,292.

MAYWOOD, village, Illinois, situated in Cook County, on the Des Plaines River and the Chicago Great Western, the Chicago and North Western, the Chicago Aurora and Elgin, and the Indiana Harbor Belt railroads, 12 miles west of Chicago. The seat of Chicago Lutheran Theological Seminary, its industries include canning and tubing. Incorporated 1881; mayor-council government. Pop. (1950) 27,473.

MAYWOOD, borough, New Jersey, situated in Bergen County, just north-northwest of Hackensack and 12 miles west of New York City, on the New York, Susquehanna & Western Railroad. A residential community, Maywood also has plants producing chemicals and pharmaceuticals. It was incorporated in 1894. Government is by a mayor and council. Pop. (1950) 8,667.

MAZAGAN, măz-ä-găn′ (Arab. El Jedida), city, French Morocco, situated on the west coast, 55 miles south of Casablanca. A fishing port and resort, it enjoys a sizable trade in agricultural products. It was a Portuguese possession from 1502 to 1769. Pop. (1947) 40,318.

MAZAR-I-SHARIF, mä-zär′ê-shä-rēf′, city, Afghanistan, capital of the province of Mazar-i-Sharif, situated 190 miles northwest of Kabul. The leading city of Afghan Turkestan, it produces silk and cotton textiles, flour, and bricks. The older section of the city surrounds a 15th century mosque containing the alleged tomb of Caliph Ali, son-in-law of Mohammed. Pop. (1948 est.) 41,960.

MAZARIN, mä-zä-răN′ (Ital. Giulio Mazarini), French cardinal and statesman: b. Pescina, Italy, July 14, 1602; d. Vincennes, March 9, 1661. He studied with the Jesuits in Rome and from 1619 to 1622 at the University of Alcalá in Spain. In 1625 he entered the papal military service as an infantry captain. His talents, however, lay in diplomacy, to which he soon turned and in which he distinguished himself on missions for Pope Urban VIII. He was rewarded for his services by being appointed vice legate to Avignon (1634) and nuncio to France (1634–1636). In Paris he gained the favor of Cardinal Richelieu, who induced him to enter the service of France. He became a naturalized French citizen in 1639, and in the following year was sent on a mission to Savoy. In 1641 he was made a cardinal (although he was not a priest), and in 1642 was designated by Richelieu as his successor. On the death of Louis XIII in 1643, Anne of Austria became regent for her young son, Louis XIV. It was thought that Mazarin would be dismissed, but he won the queen regent's favor and was retained in the office of prime minister, which he continued to hold, with the exception of two brief periods of exile, until his death. Mazarin turned at first to the prosecution of the Thirty Years' War, which the success of French arms helped to bring to a conclusion in 1648. Meanwhile, his neglect of domestic affairs, his nepotism, and his accumulation of wealth had aroused much discontent. The Parliament of Paris denounced the increasing taxation, and the nobility dreaded Mazarin's rising power. As a result, the civil war known as the Fronde (q.v.) broke out. In January 1649 Mazarin left Paris with the court and took up residence in St.-Germain. In April he concluded peace with the Parliament, but further opposition developed from the aristocracy, and in

particular from Condé, who had hitherto remained faithful to the royal authority. With the support of the parliamentarians, Mazarin was enabled to put down the *Fronde des princes*, imprisoned Condé at Vincennes and crushed the revolt of the latter's friends at Rethel and Guyenne, in 1650. Mazarin's ingratitude to his late allies, the parliamentarians, caused all his adversaries to unite against him and in February 1651 he was obliged to go into exile near Cologne. His activity, however, was nowise at an end. He continued to direct the policy of Anne of Austria from his exile and, in September, rejoined the court at Poitiers, and soon afterward was about to enter Paris with it when he saw that his presence was an obstacle to the young king's entry to the capital. He again went into exile, in October 1652, but returned to Paris on 13 Feb. 1653, and through means of intrigue formed a powerful royal party in the state, gained General Turenne to his cause and returned to his position at court.

Untroubled now with troubles from within, Mazarin set about winding up the war with Spain. The outcome of this conflict remained in doubt until 1655, when French victory became assured through the alliance with Cromwell and the help of English soldiers. The Spaniards, beaten at the Dunes, at Dunkirk, threatened in the Netherlands and menaced at home by the capture of Barcelona, were obliged to sue for peace. By the Treaty of the Pyrénées (1658) the Spaniards lost to France, Roussillon, Artois and parts of the duchy of Luxembourg and of Hainaut. Not satisfied with this splendid result, Mazarin formed, in 1658, the League of the Rhine against Austria and diverted the succession to the throne of Spain by bringing about the marriage of Louis XIV with the Infanta Maria Theresa. With the completion of these projects his career ended. Mazarin was very avaricious, and through every kind of financial dealing amassed the huge fortune of over 50,000,000 livres. To the Royal Library he bequeathed his magnificent collection of books. He founded the Collège de Quatre-Nations, later known by his name as the Collège Mazarin. He has been blamed for the favors shown his family and the project, once entertained by him, of marrying his niece, Maria Mancini, to Louis XIV. These, however, are but the smaller side of a great character. They cannot make one forget the great political genius who extended the territory of France from the Pyrénées to the Rhine and which extricated her from a dangerous internal crisis. Consult Chéruel, 'Lettres du cardinal Mazarin pendant son ministère' (in 'Collection de documents inédits sur l'histoire de France,' Paris 1872–94); id., 'Histoire de France pendant la minorité de Louis XIV' (1879–80); id., 'Histoire de France sous le ministère de Mazarin' (1883); Chantelauze, 'Portraits historiques' (1886); Cousin, V., 'La jeunesse de Mazarin' (1865); Hassell, A., 'Mazarin' (1903); Perkins, J. B., 'France under Mazarin' (New York 1915).

MAZARRÓN, Spain, town, in the province of Murcia, 18 miles west of Cartagena and about three miles from the Mediterranean coast, with which it is connected by rail. It has flouring mills, soap works and metallurgic factories, and there are copper, iron and lead mines in the nearby mountains. A customhouse, barracks, lighthouse and lead works are situated on the coast. The town has a large trade in coal, lead and other ores. Pop. 18,000.

MAZATLAN, mä-sät-län', Mexico, a town and seaport of Sinaloa, about 183 miles southeast of the city of Sinaloa, at the entrance to the Gulf of California, on the Mexican Southern Pacific Railroad. It is built on a hilly crest and has a pleasing appearance. It has a municipal gas system and a street railway. Mazatlan is the chief Pacific port of Mexico and the outlet for the products of the mining district of Saint Sebastian; it has a considerable import and export trade. Silver, copper, lead, pearls and hides are exported. In 1914 the town was besieged by the Constitutionalists and taken after many months. A wireless station has been erected here. In normal times the exports amount annually to about $4,250,000 and the imports to $2,500,000.

MAZDAK, mäz'däk, Persian religious leader: b. Persepolis, about 470 A.D.; d. Nahrvan, between 530 and 540. He was a chief priest at Nishapur, and in 500 proclaimed himself a prophet. He preached the equality of man, the abolition of property rights and free love, abstinence from animal foods and the simple life generally. He converted King Kobad to his views, which forthwith became law, but a rising of the nobles ousted Kobad for three years, and on his return he abjured Mazdak and his doctrine. Khosru Nashirvan put him to death. Consult Browne, E. G., 'Literary History of Persia' (London 1909).

MAZE, Hippolyte, ē-pō-lēt maz, French historian: b. Arras, 5 Nov. 1839; d. Paris, 25 Oct. 1891. He studied at the Ecole Normale Supérieure; taught there and at the Lycée Fontanes; was elected prefect of Landes in 1870, deputy in 1879 and 1881 and senator in 1886. He wrote 'The Republic of the United States: Its Foundation' (1869); 'The End of the Revolution' (1872); 'Hoche in Vendée' (1882); 'The Struggle against Want' (1883); 'General Marceau' (1889), and 'The Generals of the Republic' (1889).

MAZEPPA, mä-zĕp'ä, **Ivan Stepanovitch, or John,** hetman of the Cossacks: b. Podolia, about 1645; d. Bender, Bessarabia, 1710. He was page to John Casimir, king of Poland, who was a patron of the arts and of literature, and he had therefore an opportunity of acquiring various useful accomplishments. A Polish nobleman having surprised Mazeppa with his wife bound him naked upon his own horse and committed him to his fate. The horse carried him to his own residence. Shame made him flee to the Ukraine and join the Cossacks, whose warlike roving life suited his disposition. He made himself conspicuous by his dexterity, bodily strength and courage. His knowledge and sagacity procured him the post of secretary to the hetman Samilovitch, and in 1689 he overthrew Samilovitch and himself became hetman. He gained the confidence of Peter the Great, who loaded him with honors and he was finally made Prince of the Ukraine. In 1706 he opened negotiations with Charles XII (q.v.) of Sweden for the purpose of freeing himself from Russian dominion, but his treachery was finally revealed to Peter, and he was obliged openly to declare for Charles. After the defeat of Pultowa in 1709 Mazeppa

fled to Bender. Peter tried to have the sultan extradite him, but failed despite an offer of 300,000 ducats for the favor. Lord Byron has made Mazeppa the hero of a poem (1818) and Liszt of a symphony.

MAZURKA, a lively Polish national dance, popular also in the United States. The movements are of a grotesque character. The term is also applied to the music which accompanies the dance, sometimes in three-eighths time, but for the most part in three-fourths. The mazurka is danced by four or eight couples. Augustus III brought the mazurka to Germany, whence it was learned by the French and finally about the middle of the 19th century it acquired considerable popularity in England. The music of the dance has taken its modern form from Chopin.

MAZZINI, Giuseppe, Italian patriot: b. Genoa, 22 June 1805; d. Pisa, 10 March 1872. He studied law at the University of Genoa and practised his profession for a time, but the strong Liberal opinions he had imbibed as a child and his conviction that the oppressed condition of his country under Austrian rule called for men of action and public spirit, and that a noble course lay open before anyone who would give himself up, heart and soul, to the work of reforming her, led him to devote himself to a political career. In his ardent aspirations for the national unity of Italy, it seemed to him that her deliverance from foreign tyranny was to be achieved only by a return to the republican glories of ancient times. His patriotic enthusiasm in this direction was fostered by his early studies, which developed in him a passionate idea of the glories of a republic, and by the success which he had achieved in literature while still little more than a youth. In 1827 appeared his maiden essay, 'Dell' Amor Patrio di Dante,' which was published in a Liberal journal, the *Subalpino.* This led him to contribute under the mask of literary critiques other historical, philosophical and critical papers to the *Antologia* of Florence and the *Indicatore Genovese.* But the authorities, perceiving that the periodical literature of Italy was becoming far too strongly tainted with advanced Liberal opinions, suppressed these journals, and hoped, no doubt, thereby to have silenced their writers also. About 1830 Mazzini became an active member of the Carbonari, and this affiliation was the introductory step to his subsequent political life; he was active, able, bold and impetuous, and he soon rose into a position which gave him great influence in the councils of that secret society. While on a mission for the society he was betrayed by a Piedmontese spy, arrested and detained for six months as a prisoner in the fortress of Savona. On his release he went to Marseilles, France, to escape the police surveillance imposed on him in Italy. Here he organized the society of La Giovine Italia (Young Italy), and established under that same title a journal to advocate his views; the purpose of the society was to liberate Italy and establish a national government, Mazzini desiring a republic. It was about this time, too, that he addressed to Charles Albert of Sardinia the celebrated letter which drew down on him a sentence of perpetual banishment from his native country. He took active part in the organization of an insurrection of which Genoa was to be th centre, but the plot was discovered and faile For his share in it Mazzini was sentenced death in the Sardinian courts. He then wer to Switzerland, where he organized anothe conspiracy for the invasion of Savoy (1834 which also failed. In 1837 he quitted Switze land and took up his abode in London, whe he kept in correspondence with the revolutio ary leaders on the Continent, was recognize as the head of the Young Italy party, and i stigated several insurrections, which were u successful. After the insurrection in Milan i 1848 he again went to Italy, was chosen a mem ber of the Tuscan provisional government i February 1849, and in the following mont when Rome was proclaimed a republic, he wa chosen first of the triumvirs. He was the mai spring of the defense of Rome against th French, and on the surrender of that city i June Mazzini escaped to Lausanne, Switze land. At this time he addressed to M. d Tocqueville and other French statesmen som most bitter and reproachful letters on the high handed policy pursued by France. Finding h continental residence too hot for him he re turned to London, not, however, with any ide of abandoning his long-cherished hopes fo Italian unity. Later he had a hand in the u successful uprisings at Mantua (1852), in Mila (1853) and in Piedmont (1857), being in Ital for a short time in 1857. He assisted also i organizing the expeditions led by Garibaldi i 1860, 1862 and 1867. An ardent Republica he refused to take his seat in the Italian Parli ment under the monarchy, though repeated elected from Messina, as a protest against th uncanceled sentence of death against him. I 1866 this sentence was formally rescinded; i 1868 he suffered from a serious illness, th effects of which left him in impaired healt In 1870 he was arrested at Gaeta under charg of conspiracy with Garibaldi and imprisone for two months, being released after the occu pation of Rome by the Italians. He was ac corded a public funeral by the Italian gover ment.

Mazzini was a copious writer. A perfe master not only of Italian, but of French an of English literature; he was an able com mentator of Dante, the author of works o philosophy and a constant contributor to som of the most delightful periodical literature i Paris and in London. He would turn fro the warfare of politics to write in his *Apo tolato Popolari* for the benefit of Italian wor men sermons 'On the Duties of Man.' H analyzed in masterly fashion the faults an shortcomings of the economic and socialis schools. Though his actions were som times politically indiscreet, he was a ma of attractive character and strong person magnetism, distinguished throughout his care for disinterested patriotism and the highe moral standards of conduct. He was interested the labor movement, organized a workingmen association in London in 1840 and was for time connected with the International Workin men's Association (q.v.), but withdrew fro that society when it declared for Socialis During his later life especially his efforts we directed toward separating republicanism fro both Socialism and atheism. No man won many admirers as Mazzini and yet secured

few friends. There was hardly a human being whom long familiarity had not estranged from Mazzini. With manners consummately affable and courteous he combined an overweening conceit and a narrowness and bigotry of view which hardly tolerated independent minds. He was a lonely genius, all apart from the common ways of other mortals, spurning the suggestions of the plainest common sense, professing to do all for his fellow-beings, yet nothing with them or by their aid. He gave up the idea of ever being a prophet in his own country in his own age; his only trust was in a coming generation, where the germ of his idea could alone attain full development. The best edition of his works is 'Scritti Editi ed Inediti' (18 vols., Milan 1861–91); a partial collection is published under the title 'Life and Writings of Joseph Mazzini' (1891). His letters have been published in English (6 vols., London 1890–91). Consult 'Memoir of Joseph Mazzini' (1877), containing his two essays 'Thoughts on Democracy in Europe,' and 'On the Duties of Man'; Linton, W. J., 'Recollections of Mazzini' (1892); Marriott, 'Makers of Modern Italy' (1889); MacCunn, J., 'Six Radical Thinkers' (London 1907); Holland, R. S., 'Builders of United Italy' (New York 1908); 'Cambridge Modern History' (Vol. XI, ib. 1909); King, Bolton, 'Life of Mazzini' (new ed., ib. 1912); King, H. E. B., 'Letters and Recollections of Mazzini' (London 1912); Thayer, 'The Dawn of Italian Independence' (1893); Martinengo-Cesaresco, 'Italian Characters.'

MAZZOLA, mat-so'la, or **MAZZUOLI,** mat-soo-ō'lä, **Francesco,** Italian painter, known from his birthplace as IL PARMIGIANO: b. Parma, 11 Jan. 1503; d. Casalmaggiore, 24 Aug. 1540. His father and two uncles were painters, and to them and to Correggio, who was in Parma in 1521, he owed his earlier training. Correggio's manner he caught so well that his 'Cupid Fashioning a Bow' was long and generally attributed to Correggio. When 20 he went to Rome and there imitated Raphael and Michelangelo. In 1527, upon the capture of Rome by Charles V, his losses were great and he had to escape from the city. He returned to Parma, lost his health, was imprisoned by the city authorities for failure to complete a commission which had been paid for in advance, and upon his release fled to Casalmaggiore, failing to live up to his promise to repay. His paintings are to be found in most of the galleries of Europe; mention should be made of the 'Madonna with St. Margaret,' in the Bologna Gallery; 'Madonna del Collo Lungo,' Pitti Palace, Florence; 'Annunciation,' Ambrosian Library, Milan; various portraits in the Naples Museum; several sacred subjects, notably 'Madonne' in the Dresden Gallery and in the Louvre; and the great frescoes in the church of Saint John, Parma. More important, though less well known, are Mazzola's etchings, since he introduced etching into Italy. His drawing is correct, and his work bold, fiery and graceful.

MAZZONI, Guido, gwē'dō mat-so'ne, Italian scholar and poet: b. Florence, 12 June 1859. He was educated at Florence, Leghorn and Bologna, in 1881 became instructor in Italian literature in secondary schools and in 1887 professor of Italian literature at Padua. After 1894 he was professor of the Italian language and literature at the Institute of Florence. His poetic work has been to some extent influenced by his familiarity with English literature and largely by his countryman Carducci. Besides contributions to reviews, he wrote 'Epigrammi di Meleagro da Cadora' (1880); 'In Biblioteca' (1882); 'Esperimenti metrici' (1882); 'Un Ritratto di Gesù' (1887); 'Rassegne litterarie' (1887); 'Fra Libri et Carte' (1887), and other works, including a scholarly history of Italian literature in the last century.

MEAD, Edwin Doak, American author and lecturer: b. Chesterfield, N. H., 29 Sept. 1849. His early life was spent on his father's farm, and in 1866 he entered the publishing house of Ticknor and Fields, Boston. He studied in English and German universities 1875–79, and afterward engaged in lecturing and writing. In 1889 he was associate editor of the *New England Magazine* with Edward Everett Hale, the chief editor, 1890–1901. He was connected with numerous historical and social clubs. For 25 years he was director of The Old South Historical Works; edited 200 Old South leaflets widely used in schools and colleges, and annually arranged courses of lectures. For several years he was president of the Massachusetts Good Citizenship Association and Free Religious Association, and for 10 years president of the Twentieth Century Club. He labored very earnestly in the cause of international peace. He was a trustee of the Church Peace Union, endowed by Mr. Carnegie, and was delegate to international peace congresses at Glasgow, Rouen, Lucerne, Munich and London. He published 'The Philosophy of Carlyle' (1881); 'Martin Luther: A Study of the Reformation' (1884); 'A More Beautiful Public Life'; 'Organize the World'; 'The Principles of the Founders'; 'The Influence of Emerson.' D. 17 Aug. 1937.

MEAD, Larkin Goldsmith, American sculptor: b. Chesterfield, N. H., 3 Jan. 1835; d. 15 Oct. 1910. He was educated in the public schools and studied art in Italy, where in Venice he was a member of the United States consulate. His first work was an ideal figure, 'The Recording Angel,' executed in 1855. He served for a time in the Civil War as illustrator for *Harper's Weekly,* and after the war his work as a sculptor gave him national prominence. The statue of Lincoln on the monument at Springfield, Ill., is his work, as are the bronze statues of Ethan Allen at the Capitol at Washington and in Montpelier, Vt. The latter city has also his heroic figure 'Vermont' on the State Capitol. He also executed the soldiers' monument at Saint Johnsbury, Vt.; the Stanford family group for Stanford University; 'The Mississippi River,' Minneapolis; portraits of W. D Howells, John Hay and Henry James. His work includes many ideal pieces: 'The Returned Soldier'; 'The Return of Proserpine from the Realm of Pluto' (exhibited at the World's Columbian Exposition), etc.

MEAD, William Rutherford, American architect: b. Brattleboro, Vt., 20 Aug. 1846. He was graduated from Amherst College in 1867, studied architecture in New York under Rus-

sell Sturgis and in Europe, and upon his return to the United States became a member of the prominent New York firm of McKim, Mead and White, which has had charge of many of the most important public and private buildings in the country. In 1902 he was made a Fellow of the American Institute of Architects, and was a member of the American Academy of Arts and Letters and president of the American Academy, Rome. In 1910 he was chosen member of the National Academy of Design and was awarded a gold medal of honor by the National Institute of Arts and Letters. He died in Paris, France, 20 June 1928.

MEAD, or **METH,** a vinous liquor, used in northern Europe and made of honey and water by means of digestion and fermentation. It also receives an addition of fruit, spices and simples to give it a richer flavor. When new, mead has always a strong taste of honey, but this diminishes as it becomes older. Mead is mixed with the must of apples or with wine, beer and even vinegar, and then takes the name of wine-mead, beer-mead, etc. It is one of the oldest of beverages, being known all over Europe within historic times.

MEADE, George Gordon, American soldier: b. Cadiz, Spain, 31 Dec. 1815; d. Philadelphia, 6 Nov. 1872. In 1835 he was graduated from the United States Military Academy and assigned to the 3d Artillery, in 1835–36 served in the Seminole War in Florida, on 26 Oct. 1836 resigned from the army, and in 1836–37 was assistant engineer in the construction of the Alabama, Florida and Georgia Railway. He was later employed in various works of engineering, including surveys of the mouths of the Mississippi and of the northeast boundary between the United States and British North America. On 19 May 1842 re-entered the army as second lieutenant of topographical engineers. He joined Scott's staff at Corpus Christi, Tex., 14 Sept. 1845, and during the Mexican War participated in the battles of Palo Alto, Monterey, Resaca de la Palma and the siege of Vera Cruz. After the war he was occupied in lighthouse construction and in the geodetic survey of the Great Lakes (1857–61). He became captain in the corps of engineers in 1856. On 31 Aug. 1861 he was commissioner brigadier-general of volunteers and assigned to the command of the 2d brigade of the Pennsylvania reserve corps of the Army of the Potomac, stationed on the right of the lines before Washington. He served in the Virginia peninsula campaign and took part in the actions at Mechanicsville (26 June), Gaines' Mill (27 June) and Frayser's Farm (30 June). On 18 June he was promoted major of engineers. At Manassas (second Bull Run) he commanded the 1st brigade of Reynold's division, and later he took a distinguished part at South Mountain (14 September) and Antietam (17 September). In the latter battle, when Hooker was wounded, he was placed in command of the First Corps. For his services he was promoted major-general of volunteers 29 Nov. 1862; and at Fredericksburg (13 December) commanded the 3d division of the First Corps, with which he broke through Lee's right and penetrated to the position occupied by the Confederate reserves, but for want of support was compelled to fall back. At Chancellorsville (2–4 May 1863) he commanded the Fift Corps. On 28 June 1863 he was appointe commander of the Army of the Potomac, t succeed Hooker. His command was then sca tered, and on the march through Pennsylvani in pursuit of the Confederate invaders. Mead had everything yet to learn of both his ow force and the enemy. At Gettysburg on 1–3 July he won the great and decisive battle wit which his name is generally associated. (Se Gettysburg, Battle of). He received th thanks of Congress and was made brigadie general, United States army, 3 July 1863. Du ing the remainder of the war he commande the Army of the Potomac with conspicuou ability, and on 18 Aug. 1864 became majo general in the regular army. From 1 July 186 until his death he was commander of the mil tary division of the Atlantic, with the excep tion of the period January 1868–March 186 when he was in command successively of th Third Military District and the Department o the South. He was a Fellow of the America Academy of Arts and Sciences. A residenc was purchased for him by the citizens of Phila delphia, and after his death $100,000 were co lected and given to his heirs. There is a equestrian statue of him by Calden in Fai mount Park, Philadelphia, and one by Bush Brown on the field of Gettysburg. Consu Bache, R. M., 'Life of General G. G. Meade' (Philadelphia 1897); Pennypacker, I. R., 'Ge eral Meade' (New York 1901).

MEADE, Richard Kidder, American so dier: b. Nansemond County, Va., 14 July 174 d. Frederic, now Clarke, County, after 180 He was educated in England at Harrow and i private schools. He had returned from En land some years before the outbreak of th Revolution, and in 1775 entered the service o the struggling colonies, and distinguished hin self in his first battle, that of Great Ridg Recognition came speedily with an appointme to the staff of General Washington, with who he remained until the close of the war. Th supervision of the execution of Major And fell to his lot, a duty which while recognizi the necessity for it, he performed with deep r gret. At the conclusion of the war he r turned to Virginia to engage in the quiet li of the plantation.

MEADE, Richard Worsam, American n val officer: b. New York, 9 Oct. 1837; d. Was ington, D. C., 4 May 1897. He was a nephe of Gen. G. G. Meade (q.v.). He entered th navy as midshipman 2 Oct. 1850. His promo tions were lieutenant, 23 Jan. 1858; lieutenan commander, 16 July 1862; commander, 20 Se 1868; captain, 13 March 1880; commodore, May 1892, and rear-admiral, 7 Sept. 1894. O 20 May 1895 he was retired from the servic In 1862–63 as commander of a division he c operated with the land forces of Sherman i subduing the Confederates on the Mississip In 1863 he was in command of the marines d ing the Draft Riots in New York. For a tir he was in charge of a department at the nav academy; in 1868 was sent to Alaska and t 1871–73 commanded the *Narragansett* on th Pacific station. In 1894 he was placed in com mand of the North Atlantic squadron. He w naval representative of the United States b the World's Columbian Exposition, Chicag

1893. He published 'A Treatise on Naval Architecture and Ship-building' (1869).

MEADE, William, American Protestant Episcopal bishop: b. near Millwood, Va., 11 Nov. 1789; d. Richmond, Va., 14 March 1862. He was a son of R. K. Meade (q.v.), and was graduated from Princeton College in 1808, studied theology and took orders in the Episcopal ministry in 1811. His first charge was his home parish, which he served gratuitously, and in 1829 he was elected assistant to Bishop Moore. He was in charge of Christ Church in Norfolk, Va., in 1834–36, and in 1841 succeeded Bishop Moore as head of the diocese of Virginia. He was one of the founders in 1847 of the 'Evangelical Knowledge Society.' He tried to keep Virginia in the Union in 1861, but later entered into the spirit and aims of the Confederacy. He was the author of several works, among which are 'Family Prayers' (1834); 'Reasons for Loving the Episcopal Church' (1852); 'Old Churches, Ministers and Families of Virginia' (1857); 'The Bible and the Classics' (1861). Consult the memoir by his coadjutor, John Johns (Baltimore 1867).

MEADOW, Making and Care of. Meadows may be divided into general groups which will depend upon location, duration and purpose, and their treatment will vary with each of these factors. Meadows located upon low ground, which may be inundated, or which is constantly moist, usually consist of grasses and other plants which do not thrive so well upon upland fields. Because of their dampness they cannot be treated like dry soils and they are therefore more frequently permanent than temporary. Further, they are generally better adapted for haying than for grazing, because the grasses that naturally grow upon them are ranker, taller growing species and generally have grown to a considerable height before the land becomes dry enough to turn stock upon it. Except as to season the preparation of lowland meadows is not necessarily different from that of upland.

For best results the land should be deeply plowed as early in the season as soil conditions will permit, and harrowed at intervals of 10 days and after each rain that forms a crust until late summer. The practice will not only destroy weeds and weed seeds, but ensure the quick germination of grass seed sown even in dry weather, the soil being moist close to the surface. The soil may be anything, but preferably not sand or clay. If mucky, as in a reclaimed swamp, rolling is frequently advisable, otherwise generally not. Prior to plowing liberal applications of good manure or commercial fertilizers should be made and light annual dressings should also be given, preferably in autumn or early spring. Temporary pastures which are intended to last only three or four years should constitute part of a general rotation scheme (see ROTATION OF CROPS) and should be followed by some crop such as corn or potatoes, which can best utilize their products of decomposition. Permanent meadows should be inspected each spring and the spots which appear to be failing given special attention, such as fertilizing, liming, seeding, etc., to maintain a general good average. When the annual yield of hay falls below two tons the meadow may be considered unprofitable and should be plowed up and given a change of crop for three or four years.

In general, timothy or "herd's-grass" is the most popular grass in America, because it is hardy, long-lived, large, easily cured and its seed inexpensive and likely to be free from weed seed. Orchard grass, tall meadow fescue, red-top, rye-grass and cat-grass are also often used, but are secondary. Blue-grass, which generally appears as a volunteer grass in permanent meadows, is rarely profitable as a hay grass, but is unequaled in the north as a pasture grass. These grasses may all be sown with a sparsely planted cereal which acts as a "nurse crop." But this practice is generally considered inexpedient. The admixture of clover, however, is generally highly desirable, since the clovers supply nitrogenous food to the grasses. Alsike clover is considered best for mixing with timothy since it is somewhat later in ripening than the other large clovers, which mature before the timothy can be profitably cut. Consult Wing, Joseph E., 'Meadows and Pastures' (Chicago 1911).

MEADOW-BEAUTY. See DEER-GRASS.

MEADOW FESCUE, a fescue-grass (*Festuca*). See GRASSES IN THE UNITED STATES.

MEADOW-GRASS. See BLUE-GRASS.

MEADOW-HEN, the American coot. See COOT.

MEADOW-LARK, or MEDLARK, a beautiful American starling (*Sturnella magna*), numerous in eastern United States as far west as the high central plains, where it is replaced by a variety (*S. neglecta*) remarkably different in song and some habits. It is about 11 inches long and tail five inches. The body is thick and stout, the legs large, the bill long and straight and the flight powerful. The upper parts are brown, marked with brownish-white, and the exposed portions of the wings and tail with transverse dark-brown bars; the under parts yellow, with a black crescent upon the breast, which is very distinctive as well as a handsome ornament. These birds receive their popular name "lark" from their terrestrial habits and way of singing in the air, uttering a loud sweet double call while circling upon fluttering wings above the meadow or grain-field where the nest is carefully concealed among the roots of the grasses. The eggs are white, profusely speckled with light red. The western variety has a longer, more vivacious and tuneful song than the eastern bird, and is justly accounted the finest songster of the open regions of the interior. These birds are migratory in the northern parts of their range, but most of them remain during the winter in the middle parts of the United States and southward, and in the autumn are often shot for market, although in most States such shooting is now prohibited by law. In the Southern States it is commonly called "old-field lark." The meadow-lark subsists both on insects and on seeds. In winter they often form groups, but in the fine seasons seldom more than two are seen together. Consult Coues, 'Birds of the Northwest' (Washington 1874).

MEADOW-MOUSE. See FIELD-MICE.

MEADOW PINK, or **MEADOW CAMPION,** the common cuckooflower (q.v.), or ragged robin (*Lychnis floscuculi*). See LYCHNIS.

MEADOW RUE, a plant of the crowfoot family and of the genus *Thalictrum.* These rues are erect perennial herbs, with much divided leaves and small flowers, usually in loose panicles. The genus contains about 75 species, scattered about the north temperate zone, of which the United States and Canada possess about 15 species. The early meadow rue (*T. dioicum*) is a slender, leafy species, of rocky woods, a foot or two in height, whose flowers, purplish and greenish with yellowish anthers, appear in April or May. The purple meadow rue (*T. dasycarpum*), common in New England woods, is distinguishable by its size (two to four feet tall), large bright-green, waxy leaves and purplish stem; the flowers form a greenish fleecy bloom. A third large species is the thick-leaved (*T. coriaceum*) of the Southern states, whose flowers are of different hues, the staminate flowers being white and showy, while the pistillate flowers, borne on separate plants, are purplish. The tall meadow rue (*T. polygamum*) towers to a height of 10 feet in favorable situations. All are fertilized mainly by the wind.

MEADOW SNIPE. See JACKSNIPE.

MEADOWSWEET, a well-known handsome European plant (*Filipendula ulmaria*) of the rose family. It grows by the sides of streams and in damp places, has pinnate leaves and stems two feet high bearing corymbs of white fragrant flowers. It is also called queen of the meadow.

MEADVILLE, mĕd′vĭl, city, Pennsylvania, seat of Crawford County, is located on French Creek, 33 miles south of Erie, on the Erie and the Bessemer and Lake Erie railroads. It has a radio station and two airports, one municipal and one private, and is the industrial center for a diversified farming and oil producing area. Its manufactured products include castings and bearings, industrial heating equipment, rayon yarns, slide fasteners, stereoscopes, lanterns and lantern slides. The Erie Railroad has repair shops here. Allegheny College is here. The Meadville Historical Society maintains a museum, and the community supports its own symphony orchestra. The old courthouse is said to have been the scene of the first direct primary election.

Meadville was first settled about 1788 as a fortified outpost by Major David Mead, a Revolutionary soldier, for whom it was named and whose home built in 1797 is a point of interest. It was incorporated as a borough in 1823, as a city in 1866, and has a modified form of commission government. Pop. (1950) 18,972.

MEAFORD, town, Canada, in Ontario Province, on Nottawasaga Bay, 20 miles west of Collingwood, on the Canadian National Railway, in a fine farming section of Grey County. It has a good harbor from which fishing is carried on, and there are beaches which attract summer residents. The town does a considerable trade as outfitter to Great Lakes shipping. Local industries include furniture factories, hardwood flooring mills, and several smaller industries. The town has churches, public and high schools, a public library, two weekly newspapers, two banks, and a board of trade. It takes its name from the birthplace in England of Admiral the Earl of St. Vincent (John Jervis), victor over Spain in the crucial naval battle of Cape St. Vincent (1797); several of its streets are also named after British naval officers. Pop. (1951) 3,178.

MEAGHER, mä′ĕr; -hĕr; -kĕr, **Thomas Francis,** Irish-American soldier: b. Waterford, Ireland, Aug. 23, 1823; d. near Fort Benton, Mont., July 1, 1867. He was educated at the Jesuit College, Clongowes Wood, Kildare, and at Stonyhurst College, near Preston, England. In 1845 he joined the Young Ireland party, which aimed at independence through armed revolution and became one of its most inflammatory speakers. He was sent on a mission by the Irish Confederation to the French provisional government in 1848, and soon after his return to Ireland was arrested on a charge of sedition. He was bailed, but on passage of the Treason Felony Act was rearrested and sentenced to death for treason. The sentence was commuted to life banishment, and he was sent to Tasmania in July 1849. In 1852 he escaped to the United States, where he became a naturalized citizen, studied law, was admitted to the bar, and practiced in New York City in 1856–1861. For some time also after 1856 he was editor of the *Irish News* of New York.

At the outbreak of the Civil War in 1861 Meagher organized a company of Zouaves which as part of the 69th New York Volunteers under command of Col. Michael Corcoran took part in the first battle of Bull Run. After three months' service he recruited the Irish Brigade in New York City and was made its commander. He fought bravely at Richmond, the second battle of Bull Run, Fredericksburg and Antietam, but after Chancellorsville found his command so reduced in numbers that he resigned. Early in 1864 he was reappointed brigadier general of volunteers and was assigned to the command of the military district of Etowah. The following January he joined the forces of Gen. William Tecumseh Sherman at Savannah, and was mustered out there at the close of the war. He was appointed secretary of Montana Territory in 1865, and for about a year acted as temporary governor. At Fort Benton, Mont., on July 1, 1867 he boarded a steamer for an inspection trip down the Missouri and thereafter was never seen. It is supposed that he fell overboard unperceived during the night. He published *Speeches on the Legislative Independence of Ireland* (1853); *The Last Days of the 69th in Virginia* (1861).

Consult Cavanagh, Michael, *Memoirs of Gen. Thomas Francis Meagher* (1892); Bowers, C. G., *The Irish Orators* (1916).

MEAGRE. A fish. See MAIGRE.

MEAKIN, mē′kĭn, **James Edward Budgett,** English author and social reformer: b. London, Aug. 8, 1866; d. there, June 26, 1906. He was educated at Reigate grammar school. He was editor 1884–1893 of the *Times of Morocco,* a newspaper established by his father, and is best known for his books on the Moors. He was also interested in social reform and slum removal in England and organized the Shaftesbury Lectures. Among his works are *The Moorish Empire* (1899); *The Land of the Moors* (1901); *The Moors* (1902).

MEAL-MOTH, or MEAL-WORM. See FLOUR AND MEAL INSECTS.

MEAL-TUB PLOT, *in English history,* an alleged conspiracy, concocted in 1679 by an informer, Dangerfield, with the view of cutting off those who were opposed to the succession of James II after he had embraced Roman Catholicism. The false charges to which Dangerfield was prepared to swear were found in the meal-tub belonging to a Mrs. Cellier, one of his friends. Ultimately he confessed his crime, was whipped and condemned to stand in the pillory.

MEALY-BUG, a scaleless scale insect of the genus *Dactylopius* and family *Coccidæ.* These insects are covered with a mealy or waxy substance which they secrete for protective purposes. Like their relatives, the true scale insects, they also secrete honey-dew and are attended and transported by ants; unlike these relatives they do not lose the power of locomotion. The species are most numerous in tropical and sub-tropical countries; one species (*D. citri*) being the best-known outdoor species in the United States, feeding upon citrus trees in Florida. In greenhouses another species (*D. destructor*) is often troublesome. Owing to the protective covering difficulty has been met in ridding plants of these creatures, but fumigation and caustic solutions have been tried with most satisfactory results, a kerosene and soap emulsion being particularly effective in destroying them. (See INSECTICIDE). Consult Comstock, J. H. and A. B., 'Manual for the Study of Insects' (8th ed., New York 1909); Comstock, J. H., 'Report of the United States Department of Agriculture' (Washington 1880).

MEALY WING, a minute bug of the family *Aleyrodidæ,* whose species (about 150 in number) have the wings covered with a white meal-like secretion. They are allied to the coccids, but differ in development and structural peculiarities; and throng upon the leaves of plants which they injure by sucking away the sap and also by attracting a growth of smut-fungus by their secretion of honey-dew. In this manner they blacken and harm orange and lemon trees in parts of Florida and Louisiana, where they are prevalent. Consult Howard, 'Insect Book' (1901).

MEAN VALUE. If n quantities are commensurable, the sum of their units divided by n, the number of the quantities, is the *arithmetical mean* and is the *mean value* of the n quantities when their number is finite. For example, if the number of units in three quantities are respectively 4, 8 and 15, the mean value is $\frac{4+8+15}{3}=9$; and in general, if the number of units in n quantities is denoted by $X_1, X_2, X_3, \ldots X_n$, the mean value is

$$M=\frac{1}{n}(X_1+X_2+X_3+\ldots+X_n).$$

But if a quantity vary continuously in accordance with some law, thereby assuming every possible value between two extremes, the number of different quantities is infinite, and the mean value in such a case requires a new definition. For example, assume that at every point in the diameter of a semi-circle a perpendicular to the diameter is drawn to meet the semi-circle. The lengths of these lines form a continuous series of values represented by every number from zero to r, where r is the length of the radius. In such a case if n values of the perpendiculars are obtained and their sum is divided by n, the ratio should approximate to the mean value. It is easy to see, however, that this ratio will approximate to $\frac{2}{\pi}$ of the radius of the circle if the n perpendiculars are evenly spaced on the circle, to $\frac{\pi}{4}$ of the radius if they are evenly spaced on the diameter. It follows that the mean value of a continuously varying quantity is not definite until the law is known by which the «weight» of each portion of the scope of variation is determined.

The several forms of the theorem that pass under the name of the mean value theorem involve the principles of the infinitesimal calculus. The *first theorem of the mean value* is the following: Let $f(x)$ denote any finite and continuous function of x in the interval between $x=x_0$ and $x=X$; let dx denote the increment and retain the same sign in this interval; and assume that m and M are respectively the least and the greatest values of $f(x)$ in this interval: then the definite integral $\int_{x_0}^{X} f(x)dx$ has a definite value that is greater than $m(X-x_0)$ and less than $M(X-x_0)$; that is,

$$m\int_{x_0}^{X}dx<\int_{x_0}^{X}f(x)dx<M\int_{x_0}^{X}dx.$$

Since $f(x)$ is continuous in the interval $X-x_0$, there must be a value $x=\xi$, where $x_0<\xi<X$ such that $\int_{x_0}^{X} f(x)dx=(X-x_0)f(\xi)$, $m<f(\xi)<M$. The value, $f(\xi)=\frac{1}{X_0-x}\int_{x_0}^{X} f(x)dx$, is called the *mean value* of $f(x)$ in the interval $X-x_0$. If we assume $F(x)$ to be the primitive or indefinite integral of $f(x)$, then $F(X)-F(x_0)=(X-x_0)f(\xi)=(X-x_0)F(\xi)$ which is the familiar form of the law of the mean in the differential calculus.

The theorem of mean value is of importance in establishing Taylor's series. It follows immediately from the theorem of mean value that if $F(X)=F(x_0)=0$, for some ξ between X and x_0. $F'(\xi)=0$, if F is continuous between X and x_0. Let ϕ be a function of X with derivatives of every order at every point between $x=a$ and $x=b$. Construct the function

$$\psi(z)=\phi(X)-\phi(z)-(X-z)\phi'(z)-\frac{(x-z)^2}{a!}\phi''(z)$$
$$-\ldots.-\frac{(x-z)^n}{n!}\phi(n)(z)-\frac{(x-z)^{n+1}}{n+1}p,$$

where X is of the form x_0+h, and X and x_0 lie between a and b. ψ' will be of the form $-\phi'(z)+\phi'(z)-(X-z)\phi''(z)+(X-z)\phi''(z)-\ldots-\frac{(X-z)^n}{n!}\phi(n+1)z+\frac{(X-z)^n}{n!}p$, or

$$\frac{(X-z)^n}{n!}[p-\phi^{(n+1)}(z)].$$

Furthermore, $\psi(X)$ is identically 0, and by properly choosing P, $\psi(x_0)$ can be made 0.

Therefore, by the theorem just stated $\psi'(z) = \frac{(X-z)^n}{n!}[p-\phi^{(n+1)}(z)]$ vanishes for some value of z between x_0 and x. As it can be shown that this value need not be X itself, we have $p-\phi^{(n+1)}(z)=0$ for some value of z between x_0 and X, and since $\psi(X)=0$, if we let $X=x_0+h$, we have $\phi(x_0+h)=\phi(x_0)+\phi'(x_0)h+\ldots+\frac{\phi^{(n)}(x_0)}{n!}h^n+\frac{\phi^{(n+1)}(x_0+\vartheta h)}{(n+1)!}h^{n+1}$, where $0<\vartheta<1$. Therefore, if $\frac{\phi^{(n+1)}(x_0+\vartheta h)}{(n+1)!}h^{n+1}$ can be made as small as you please by increasing n, we have $\phi(x_0+h)=\sum_0^\infty \frac{\phi^{(n)}(x_0)h^n}{n!}$, which is Taylor's theorem. See SERIES. Consult Osgood, 'Differential and Integral Calculus' (rev. ed., New York 1914).

MEANDER, mē-ăn'dẽr, *in art,* an ornamental design, in which the lines interlace; it is often used in decorating vases. The lines usually advance in one direction and pass one another at right angles. The design is so named from the river Meander, well known for its numerous windings.

MEANDERS, broad swinging curves made by a river on its flood plain. A river in its early history may have accidental curves, but it is only when it has cut its course as deeply as it can, and has begun to widen its valley notably, in other words when it has passed its maturity and is progressing toward old age, that it characteristically develops meanders. These frequently become almost perfect loops many miles around and but a few rods across the neck. When a meander cuts off and is occupied by stagnant water only, ox-bow lakes are formed. If a region in this stage is uplifted the river will again begin to deepen its valley, and the meander curves will cut down anew, forming deep valleys or gorges. They are then said to be entrenched or incised meanders. Sometimes the neck of an incised meander may be cut through at river level, by undermining the rock, leaving a natural bridge. See NATURAL BRIDGE, and the section on *Work of Running Water* in the article on GEOLOGY.

MEANING, the object of a symbolization, considered from the standpoint of the symbol. Thus the meaning of the figure 2 is the number two, the meaning of the formula $(x+y)^2=x^2+2xy+y^2$ is the law that formula represents, and so on indefinitely. The experiences which we undergo possess besides their presented content a represented content, and this represented content bears toward them the relation of meaning. One of the cardinal problems of modern psychology is the determination of the psychical concomitants of this meaning. In accordance with the general nominalistic and associationalistic trend of experimental psychology, those who approach the question of meaning from this angle have usually considered that the meaning of an image is conveyed in consciousness by a group of such accompanying substantive states as images, sensations and feelings. They held, that is, that the meaning of "bear" read into a noise in the woods is "carried by a verbal image and an organic shudder," and that every experience is surrounded by a fringe of vaguer meaningful states. They would consider that the vehicle of the law of universal gravitation is a visual or auditory verbal image, together with certain organic and kinæsthetic sensations.

All this psychology of meaning suffers from the lack of an antecedent logical analysis. The logical situation best adapted to this analysis is that of the relation of a set of mathematical symbols to the theory they represent. The theory is obviously the meaning of the symbols, but it is only to the very slightest extent carried by the individual symbols themselves. Only the elementary constituents of the system together with certain of the simpler general notions, are represented by special characters. The structural relations are signified, and must be signified, by the arrangement — that is, the structural relations of the symbolism on the paper. The essence of the conventional system of algebraic notation lies, not in the use of letters for numbers, not in the symbolizing of addition by + and of multiplication by ×, but in the agreement between the laws of the manipulation of the symbols and the laws of number. Symbolization is primarily the relation toward a system of entities of a similarly order system of arbitrary marks, and only in a derived sense the relation between a mark and the corresponding entity. The symbol is a symbol only within a symbolism. It is precisely as a symbolism that our verbal images, kinæsthetic sensations and other mental states convey a meaning. When the mathematician is developing a new theorem, his mental content may be inventories as a verbal image or two, his sensation of the paper and pencil in front of him, and a few organic sensations. Somehow or other he puts these into an entirely extraneous correlation with the entities which he is examining. This strain behind the eyeballs acquires a temporary association with the unknown function for which he is seeking; that fragmentary visual image of a formula represents a mathematical law; and so on. In his trained mind, the symbolism of his states shapes itself into the desired conclusion, which he symbolizes anew in the conventional algebraic notation on the paper lying before him. No enumeration of his substantive states can ever disclose how the meaning of the conclusion and the premises is carried in his mind, for it is not these states themselves, but their arrangements, that are the vehicles of meaning.

This structural nature of the vehicle of meaning is intimately connected with our power to communicate with others. My sensation of red is something that as far as I know may be peculiarly mine. If there were a man who from his birth had seen red where I see green and green where I see red, it would be a matter of the utmost difficulty for me to detect his anomaly. He would learn the name "red" from hearing it applied to the things which appear red to me but green to him, so that his speech would not disclose his peculiarity. It is only by observing that green objects excite in him the expression of the emotions which we consider appropriate to red, or by some similar peculiarity in the associations of his experience of red and green objects, that the interchange of red and green sensations could even be sus-

pected. If the interchange were his sole peculiarity, he would always consider himself, and be considered by others, in the light of a normal human being. Accordingly, we have no reason to believe that the sensory qualities or sense-data of normal human beings agree with our own sensory qualities and sense-data, and there is no way of conveying these qualities and data by language. On the other hand, language is the vehicle of meaning and of nothing else. This alone is enough to prove that the meanings do not reside in any special data or qualities in our minds. What language does is to order the mind of the hearer or reader in a manner similar to that of the speaker or writer. In reading a story we pass through a sequence of mental states which has been designed for us by the author, though our individual states are beyond his knowledge. When he uses the word "green," we interpret it in our own way, but we put it in the same sort of relational context—complementary color of red, intermediate between yellow and blue, etc.—as that which it occupies in his mind. It, therefore, follows that this relational context, which is all that language can convey, is identically the meaning conveyed by language.

The situation when we hear a noise in the bushes and interpret it as "bear" can now be analyzed. The meaning is not carried in the first instance by the verbal image and the shudder. It is true that there is a possible state of consciousness in which the rustle in the bushes, the verbal image, and the shudder are all that is present, but at this stage meaning has not yet appeared. Meaning first appears when we think, not "bear," but "That's a bear." In this case, the rustle in the bushes stands for "that," the shudder or verbal image for "bear" and the juxtaposition of the shudder or image with the sound impression for the relation expressed in the sentence. The meaning of "bear" is derived from the meaning of the sentence. In other words, the meaning of the sound in the bushes resides, not in its correlates, but in its correlation. (See THOUGHT). Consult James, W., *Principles of Psychology* (New York 1899); Stout, G. F., *Manual of Psychology* (London 1913); Titchener, E. B., *Experimental Psychology of the Thought Processes* (New York 1909).

NORBERT WIENER.

MEANS, David MacGregor, American lawyer: b. Groton, Mass., May 1, 1847; d. May 24 1931. He was graduated from Yale in 1868, studied theology at Andover and New Haven, was professor of economics in Middlebury (Vt.) College in 1877–1880, and in 1881 was admitted to the bar and entered the practice of law. He contributed to periodicals, and wrote *The Boss* (1894); *Industrial Freedom* (1897); *The Methods of Taxation* (1909).

MEANS GRASS. See GRASSES IN THE UNITED STATES.

MEANTONE, or MESOTONIC TEMPERAMENT, *in music,* the system or principle of tuning voices or instruments in vogue up to the middle of the 19th century, when it was superseded by the system of equal or even temperament. In the meantone temperament, tuning was based on the use of a standard whole step or mean tone, which is an interval between a greater and a less major second. See MODE; WELL-TEMPERED CLAVIER.

MEARES, mērz, **John,** English navigator: b. England, 1756; d. London, 1809. He entered upon a seafaring life at an early age and in 1771 he entered the navy and served in the war with the French until peace was declared in 1783, when he became a captain in the merchant service. In 1786 he explored the coast of Alaska and made in 1789 a second tour of exploration on the discoveries of which the British government based its claim to the possession of British Columbia and Oregon. Three ships sent by him to Nootka Sound in 1789 were captured by the Spaniards and this act caused England to fit out an expedition in the following year, upon which reparation was made by Spain. He was the author of *Voyages in the Years 1788–89, from China to the Northwest Coast of America* (1790).

MEARIM RIVER, Brazil, rises in the Sierra do Negro, and after a northerly course of about 360 miles in the state of Maranhão flows into the Bay of São Marcos near the city of Maranhão. It has numerous affluents and is navigable, but the sudden tidal bores are dangerous.

MEARS, Helen Farnsworth, American sculptor: b. Oshkosh, Wis., Dec. 21, 1876; d. Feb. 17, 1916. Her early years were passed in Oshkosh, Wis., where she began her art work as a child by carving a life-size portrait of her sister from a block of solid plaster. She studied under Augustus Saint-Gaudens, who recommended her as one of the strongest pupils he ever had when he sent her to Frederick MacMonnies in Paris. She was particularly known for her portrait busts. Her memorial statue to Frances E. Willard in the capitol at Washington (1905) was the first statue of a woman by a woman placed in that building. In 1911 her design was accepted for a statue for the new Wisconsin State House. Before that she had done much work of note, including the MacDowell bas-reliefs, *The Fountain of Life,* which won a prize at the Saint Louis exposition. Other works are the portrait relief of Augustus Saint-Gaudens and the portrait busts of George Rogers Clark and William L. G. Morton.

MEASLES [Rubella, morbilli]. An acute infectious and contagious disease whose etiology has not yet been demonstrated although it is regarded as due to a filtrable virus. It is most often observed during childhood before the 16th year. The disease is characterized by a rather slow onset, the incubation period being about two weeks. The symptoms begin with irritability, malaise, fever, loss of appetite, and frequently vomiting. The skin eruption, so characteristic of the ailment, appears in about two or three days in the form of reddish spots on the palate and mucous membranes of the cheeks and lips, the latter showing small bluish spots surrounded by a reddish margin, the so-called Koplik's spots. About the fourth day the rash appears, first on the face, and then spreading to the body and limbs. It is a characteristic maculo-papular, dark red, eruption, the macules or larger patches tending to coalesce so that in certain areas at the height of the disease. very little normal skin can

be seen. At this time there usually will be present, running at the nose, discharge from the eyes, and intolerance to light. Occasionally a violent cough will be a troublesome symptom. Within a few days the rash fades, finally becoming a brownish discoloration of the skin, with some desquamation. Fever may reach 104° or more at the onset but falls within a day or two, only to rise again with the appearance of the eruption, again falling to the normal within a week.

The disease is found almost everywhere and in crowded centers may reach epidemic proportions. It is rather uncommon in tropical countries at the present time and if found is generally mild and without severe complications. At one time, however, in the South Sea Islands, it decimated whole populations.

Usually measles is not difficult of diagnosis. The premonitory symptoms may not attract attention and this causes the disease to be conveyed easily, for this is precisely the time when it is most apt to be spread to others unless the case be isolated promptly. Drug rashes are occasionally mistaken for measles but once the skin eruption is full blown there is little likelihood of a mistake. The complications are many, and secondary diseases, such as severe bronchitis, pneumonia, and middle ear infections occur in a considerable proportion of cases. The prognosis is good and the mortality is probably considerably less than 5 per cent, the rate varying according to locality and virulence of particular epidemics. There is no specific treatment although some success has been achieved in prevention by the use of convalescent sera, concentrated placental globulin and other biologicals. Quarantine is usually enforced for two weeks from the onset. Rest in bed, with proper ventilation, is essential and the room should be darkened. Local symptoms are dealt with as they appear. Proper nursing, not necessarily by a graduate nurse, is important. The attending physician will ordinarily examine the throat and ears at each visit, to detect complications. The bowels should be kept open and a bland diet adhered to as long as the fever continues. A severe laryngitis should be looked upon as a possible indication of a complicating diphtheria and should be treated accordingly.

HAROLD W. JONES, M.D.

MEASURE, a definite unit of capacity or extent, fixed by law or custom, by which relative sizes and capacities are ascertained and expressed; as, a yard, a measure of length; a gallon, a measure of capacity; a square foot, a measure of area; a cubic foot, a measure of volume, etc. See WEIGHTS AND MEASURES.

Lineal Measure.—The measure of lines or distances; the standard unit of lineal measure in the United States is the yard. The system is based on the law of nature that the force of gravity is constant at the same point of the earth's surface, and, consequently, that the length of a pendulum which oscillates a certain number of times in a given period is also constant.

Unit of Measure.—A given quantity, used as a standard of comparison in measuring a quantity of the same kind. Every kind of quantity has its own unit of measure, and under different circumstances the same kind of quantity may have different units of measure.

Line of Measures.—The line of intersection of the primitive plane, with a plane passing through the axis of the primitive circle and the axis of the circle to be projected.

Measure of Angles.—The right angle being taken as the angular unit, its subdivisions are degrees, minutes and seconds. The right angle contains 90 degrees, the degree 60 minutes and the minutes 60 seconds. All smaller fractions are expressed decimally in terms of the second.

Measure of Magnification.—The measure of magnification, or magnifying power of any optical instrument, is the ratio of the magnitude of the image to the magnitude of the object, or, more precisely, the ratio of the apparent diameter of the image to that of the object.

Measure of a Ratio.—Its logarithm, in any system of logarithms, or the exponent of the power to which the ratio is equal, the exponent of some given ratio being assumed as unity.

In Music.—The quantity of notes which are placed in the bar, and which is generally called the time, of which there are but two kinds, namely, common time, containing an equal quantity of notes in the bar, and triple time, containing an unequal quantity. Common time is generally marked with a C at the beginning, which means that every bar contains four crotchets, or their value in other notes. There are also other kinds of common time which are marked 2/4, 6/4, 9/8. Triple time is marked 3/2, 3/4, 3/8, 9/8, 9/4.

MEASURE FOR MEASURE is the most characteristic of the group of so-called "dark comedies" produced in Shakespeare's middle period. Modern critics are agreed that *Measure for Measure,* first printed in the 1623 folio, must have been composed about 1603; and the critics' opinion, based almost solely upon evidence of style, can now be confidently supported by a piece of external evidence lately redeemed from suspicion of forgery; namely, a memorandum in the accounts of the royal Revels Office which records that *Measure for Measure* by Shaxberd was performed before King James by His Majesty's Players on Saint Stephen's night, Dec. 26, 1604. Few of Shakespeare's greater works are so unequal in quality or have evoked such diverse opinions. In certain details of form it is one of the most careless of the plays. The subject is intrinsically displeasing to modern taste (though vastly more refined here than in the original story); several of the characters (notably the goody-goody duke and the unmanly Claudio) repel the reader; and many of the devices of plot, especially in the perfunctory closing acts, are frank clap-trap. On the other hand, Shakespeare's moral beauty and dramatic brilliance are nowhere more loftily exemplified than in the best scenes—those, namely, in which Isabella's gracious figure appears. In a word, this play marks, and is the first to mark, the complete ascendency of spirit over form so notable in the last plays of 8 or 10 years later; it is the earliest to make conspicuous Shakespeare's utter heedlessness of rules and details and his uncanny splendor in silhouetting moral beauty against an all-encompassing mundane vileness. "This is a play as full of genius as it is of wisdom," says Hazlitt, and Masefield in a notable appreciation calls it "one of the greatest works of the greatest English mind." There is no evidence that *Measure for Measure* has ever been much performed (except in Germany), though an injudicious attempt to blend it with *Much Ado about Nothing* (*The*

Law against Lovers,' by Sir William Davenant) was popular in the latter half of the 17th century. Yet two English revivals in 1907 and 1908 (one by the company of Oscar Ashe and Lily Brayton, the other by the Oxford University Dramatic Society, supported by actresses) proved marvelously impressive. They fully established both the serene morality of the piece when honestly presented and also the genuine effectiveness of the usually slighted comic scenes. Shakespeare's source was a long, flashy play in two parts (10 acts), 'Promos and Cassandra,' by George Whetstone (1578), which in its turn is derived from an Italian tale in Cinthio's 'Hecatommithi.'

TUCKER BROOKE.

MEASUREMENT OF SHIPS FOR TONNAGE, or BUILDER'S MEASUREMENT, a method of computing the tonnage of merchant vessels, in use among shipbuilders. Its results are nearly double the legal or registered tonnage. See TONNAGE.

MEASUREMENT OF STREAMS. One of the many useful classes of work conducted by the United States Geological Survey; the measurement of streams having an industrial value. Wherever water is likely to be employed for power or irrigation the amount available is ascertained by that bureau. The volume varies greatly from season to season, and sometimes from year to year. Any calculation by the manufacturer or farmer which does not take this variability into account would be misleading. Moreover, streams differ among themselves in straightness, the character of their beds and other particulars. Accurate measurement is still further complicated by the lack of uniformity in the movement in a given cross section. What might be true for one point would not be true for other points to the right or left of it, or at a higher or lower level.

The first step in the work is to place a gauge in a permanent position, and employ a suitable observer to read it every day. The gauge is graduated to feet and tenths. Usually it is upright. It may be laid over slanting, however. In that case, the spacing is widened, so as to give accurate results. One observation a day is made, and its results transmitted on a postal card to Washington. The second factor in the hydrographer's computation is the velocity of the stream, at different heights. To ascertain this only occasional measurements are necessary. These are made by experts, but with their aid it is possible to prepare tables showing the total discharge of that particular stream for all the different gauge readings. After such tabulation is effected the maximum, minimum and mean flow for any month in the year can be told at a glance.

Velocity is ascertained with a meter lowered into the water. The instrument contains a tiny screw propeller, the number of whose rotations under the pressure of the fluid is automatically registered. Many types of meter have been devised. The kind which the bureau prefers has an electric wire leading up to a buzzer in the operator's pocket. There a click or other audible sound indicates to him the speed of the screw. He counts the number of revolutions for some definite period, usually fifty seconds, records it in his notebook and moves along a short distance to make another observation.

If measurements are made at various depths along a vertical line, the results will not be equal. For this reason hydrographers have studied to find, if possible, a level that would fairly represent the average velocity for any vertical. In this way they can simplify the labor. It has been found that such an average can be secured by taking the speed at a depth of from six-tenths to two-thirds of the way down from the surface. To obtain a correct idea for the whole stream, though, these tests must be made at a number of places between one shore and the other. No measurement at a single point can be trusted to be fairly representative.

MEASURING WORM, INCH WORM, LOOPER, or SPAN-WORM, a caterpillar of any species of moth of the superfamily *Geometridæ.* The creatures are characterized by the presence of only two pairs of abdominal legs, one upon the ninth, the other upon the anal segment, and by their peculiar form of locomotion, the rear of the body being brought forward toward the front legs and the body forming a loop at right angles to the surface upon which the insects walk. Nearly all the numerous species feed upon foliage, a few upon seeds in which they bore. Some are considered serious pests in orchards and upon shade trees; for instance, the canker worms (see APPLE, *Insects*), the lime-tree moth (*Hybernia tiliaria*), and *Cymatophora pampinaria,* which sometimes devastates cranberry plantations. The duration of the larva state is variable; from their great voracity they grow rapidly and shed their skins several times before attaining maturity; when arrived at this state they seek some sheltered spot in which to undergo the change to pupa form, some clinging to the lower surfaces of leaves while others bury themselves in the earth, those remaining in the air suspending themselves in various ways by means of their silky secretions, others enclosing themselves in silky cocoons. Those burying themselves also build cocoons around them, but many of these only line their cavity with enough silken threads to keep the wall from falling in. One of the European species, *Fidonia Plumistaria,* is distinguished by curious feathery antennæ. The caterpillars of this species are very injurious to fruit trees, especially those of the European magpie moth, *Abraxas grossulariata,* which inhabit gooseberry bushes, often entirely stripping them of their foliage. The caterpillar of the American canker worm moth. *Anisopteryx pometaria,* also belongs to this species of worm, the eggs being hatched in the spring; when grown they are about an inch long and of various colors, and are also dangerous to orchards. Most of the species, however, are of small economic importance. The caterpillars usually resemble twigs when at rest, their protective coloring and their attitudes serving to deceive their enemies. The caterpillars of a few species of the owlet moths, family *Noctuidæ,* walk in this way, since they also lack prolegs upon the middle abdominal segments. They are not, however, considered true measuring worms. The geometrid moths are usually of small size and inconspicuous but delicate and beautiful coloration. Consult Holland, 'The Moth Book' (New York 1903); and Packard's 'Monograph of the Geometridæ,' with colored plates, published by the United States Geological Survey (Washing-

ton 1876); *Cambridge Natural History,* vol. 6 (London 1899); Comstock, J. H. and A. B., *Manual for the Study of Insects,* 8th ed. (Ithaca, N. Y., 1909).

MEAT, in general, the flesh of animals intended or prepared for food, especially the meat of cattle, calves, sheep, lambs, and swine. For the convenience of our readers this series of articles is divided into four sections as follows:

1. Meats and Meat Production
2. Meat, Inspection of
3. Meat, Market Classes and Grades
4. Meat Packing.

1. MEATS AND MEAT PRODUCTION. There are scores of individual retail fresh beef, pork, veal, and lamb cuts, and more than 100 different kinds of fresh, cured, and smoked sausage products which may be obtained from the dressed sides of steers, hogs, calves, and lambs. Approximately 21,349,000,000 pounds of beef, pork, veal, and lamb were produced by American meat packers in 1948 which provided a consumption of 145 pounds per capita, plus a substantial volume of exports.

Meat as a food supplies quantities of high quality protein, an abundance of certain mineral elements, varying amounts of energy, and some of the vitamins.

Protein is one of the most important substances present in all living things. Without it, just as without water, certain mineral matter, and other more mysterious things, life would be impossible. Lean meat, for example, is one kind of protein. It contains water also, but most of the solid substance in it is protein. We need protein in order to grow, to be strong and healthy, and to repair our body substance. Protein takes part in almost all of the body functions.

Meat is rich in protein, but there are many shades of meaning applicable to the word protein. Meat, eggs, and milk provide complete protein; that is, protein containing all of the substances called amino acids that are necessary to life. Beans, peas, and cereals have less complete proteins. Fat meats contain protein, but the more fat they have the less proteins they contain. A clear salt pork contains very little protein but large amounts of energy and heat-yielding fats. Medium fat meats contain about two thirds as much protein as lean meats, and fatter meats contain about one half as much as lean meats, or even less when the proportion of fat is very large.

The protein of one food differs greatly from that of another. Each protein is made up of amino acids which are often referred to as building stones. In the process of digestion, proteins are broken up into these building stones and the nutritive value of protein depends upon the amino acids that are formed. Some, being absolutely necessary for body growth, repair, and maintenance, can be made by the body itself, while others cannot. The latter are called essential amino acids because they must be supplied by the food. Proteins of animal origin—meat—contain greater proportions of these necessary amino acids than do those of vegetable origin. They are of higher quality and are known as "adequate proteins."

Lean meat furnishes modest amounts of energy which we measure in calories. Meats containing some fat are richer sources of this energy, and very fat meats, such as bacon and salt pork, are among the richest sources of energy. Meat protein, as well as other proteins, can serve for repair material and fuel at the same time. When used as repair material, it is replacing a worn-out part of the body. The worn-out material is then used for fuel. The result is the same as though the meat protein were being used for both purposes.

Minerals are another nutrient to be found in meat. Lean meat furnishes mineral matter in amounts greater than does the average food. Liver, sweetbreads, and similar edible parts are rich in minerals (iron, calcium, and phosphorus). The human system needs mineral matter to build good teeth, and bones. In fact, every part of man needs certain mineral matter if it is to work properly. He needs calcium and phosphorus for bone especially, and iron for red blood, but we also need potassium, sodium, chlorine and a number of other minerals. The leaner meats and edible grades furnish almost all the minerals that the body uses, except calcium. Meat is rather rich in phosphorus needed for bones, for the brain, and, indeed, for all parts of the body. It is also one of the common foods richest in iron. However, it contains but small amounts of calcium—an element necessary for bones and teeth. Foods containing greater quantities of calcium than does meat are milk, spinach, cauliflower, cabbage, and other green leafy vegetables.

Certain meats have appreciable amounts of vitamins. All meats contain some vitamin A, and liver has this nutrient in large quantities. Pork, either fresh, cured, or cooked, provides vitamin B. Vitamin B is also present in other lean meat. Vitamin C is found in liver and kidney especially. A piece of fresh ham or fresh beef contains all of the vitamins. The fat has vitamin A and the muscle or lean, the others.

Since livestock comes to market in varying quantities from day to day, and season to season, it is not possible for meat-packing companies to process the same number of live animals daily or to ship a constant tonnage of meat. Meat production during the winter months, for example, is substantially larger than during the summer months. For this reason, the storage of meat products is an important factor in the industry. Because of the perishability of meat, storage facilities must be refrigerated. A large part of the meat in storage at any given time consists of products that are undergoing curing and smoking, but storage stocks usually represent only the equivalent of two or three weeks' meats supply.

The shortest possible time should elapse between the slaughtering of a live animal and its entrance into the cooler. The more quickly the animal is dressed and placed in the cooler, the less opportunity there is for the development of spoilage organisms. This is a fundamental principle in handling fresh meat and other perishable food products. The underlying principle of quick chilling is rapid circulation of air at proper temperature. After the beef animals, for instance, have been dressed, they are placed in the cooler while at a temperature of about 100°F. The sides hold considerable excess surface moisture, which is given off in a cloud of steam that rises and is condensed in the brine spray.

Proper spacing of the sides, which are suspended on trolleys from an overhead rail, is also important. They should be spaced in the cooler to avoid contact with each other. If there is contact it will cause discoloration and will also prevent free circulation of air about the meat, thus

lessening the opportunity for effective chilling. The temperature of this cooler will run about 35°F., with a humidity of 85 per cent.

Beef sides will shrink on an average of 2½ per cent from the hot weights in the first 48 hours. There will be an additional shrinkage of from one-fourth to one-half per cent in the next 24 hours.

The average person not associated with the meat business thinks of curing in terms of pork products. But considerable beef also is cured, and made more attractive and palatable by such curing as well as, in some cases, by subsequent smoking. Often curing provides a method of holding over beef cuts from a period of low consumer demand to a period of high demand.

Products handled in the beef-curing department may be divided into two general classifications. First, those which may be considered as cuts or primal parts—beef plates, flanks, rumps, rounds, and chucks—which are obtained by breaking up of sides in the beef-cutting department. Second, products sometimes termed variety meats —tongues, cheek meat, head meat, gullet meat, and hearts.

The fundamentals underlying the proper curing of both these classes of products are like those used in similar pork products. Some of the products are dry cured in tight containers, such as barrels, but most of them are pickle cured in vats or tierces.

When pork products are to be dry cured, they are either rubbed with the dry cure mixture, mixed with it in large revolving drums, or sprinkled with it as they are packed in the curing containers. The air is excluded as much as possible when packing the product, and, as a final precaution, sufficient second pickle is poured over the product after packing to displace any air remaining. The curing containers are then heated up, and the contents allowed to cure.

When vat curing is used, the meat products are immersed in a curing pickle in large, open wooden vats, commonly of the hogshead variety. Hogsheads have the advantage of being small enough to be moved to any convenient place. They can also be removed easily from the curing cellar for sterilization by washing and steaming and for exposure to the sunlight, and can be double-decked in order to utilize floor space. The meats are kept submerged in the pickle in these vats by wooden slatted frames which are fastened inside the top of the vat.

Vat curing is preferred by many packers because the operations are constantly visible, giving the supervisory force a better control than when closed containers are used. Also, in overhauling (which in vat curing consists of transferring the contents of one vat to another vat) positive and definite shifting about of the cuts or pieces in cure takes place. This gives all the surfaces of the pieces an equal opportunity to absorb the curing ingredients. Another advantage is that overhauling provides an opportunity for actual inspection of the product during the curing operation.

In tierce curing, the product is packed into the tierces which are "headed up" and then completely filled with the curing solution through a bunghole in the bilge. While tierce curing is not subject to such close control as vat curing, tierces possess the merit of being easily handled. Economy of floor space may also be obtained by piling them on top of one another.

Curing in tierces requires very close supervision. Careful inspection for "leakers" should be made prior to piling. It is good practice to leave the tierces unpiled for at least a day in order to locate any leak which may have developed. Unless the tierces are kept full of pickle at all times, the unsubmerged portions of the meat will not have the opportunity to absorb the curing ingredients and the contents of the tierce will not be uniformly cured.

CIVILIAN CONSUMPTION PER CAPITA OF MEATS AND LARD IN THE U.S., IN POUNDS, 1941–47

Year	All Meats excl. lard	Beef	Veal	Lamb and Mutton	Pork excl. lard	Lard	Meats and lard
1941 [1]	141.9	60.5	7.6	6.8	67.1	14.2	156.1
1942	139.1	61.3	8.0	7.1	62.7	13.6	152.7
1943	138.4	49.6	8.1	6.3	74.4	14.2	152.6
1944	152.7	53.6	12.3	6.7	80.1	14.5	167.2
1945	143.8	58.9	11.8	7.2	65.9	12.3	156.1
1946 [2]	152.8	60.5	9.9	6.7	75.7	12.0	164.8
1947 [3]	157.5	70.0	10.0	6.0	69.0	14.5	172.0

[1] Consumption figures for 1941–45, represent civilian consumption only, obtained by subtracting the lend-lease and other exports and military takings, from the total supply. The per capita civilian consumption was obtained by dividing the total apparent civilian consumption by the total population, adjusted for under-enumeration of children under 5 less 85 per cent of the military forces.

[2] Consumption and per capita figures are preliminary.

[3] Estimated by the American Meat Institute.

Meat production for the principal livestock countries of the world in 1946, exclusive of the Far East, reached 60.5 billion pounds. This is less than the 1945 production by 300 million pounds, and below the prewar (1934–1938) average by about 5.7 billion pounds. The meat output of the principal North and South American countries declined 1.5 billion pounds in 1946, but these countries produced approximately 55 per cent of the world production in 1946; about 58 per cent in 1945; and about 40 per cent in the prewar period (1934–1938). Meat production in Europe, on the other hand, was larger than in 1945, in spite of an emergency food situation, limited feed supplies and other adverse conditions.

European meat output, exclusive of the Soviet Union, in 1946, is estimated at about 5 per cent larger than in 1945, and 60 per cent of prewar. The most significant increases in production occurred in France, Italy, and Denmark, while a decrease took place in Switzerland, where pork production declined. In the Union of South Africa, meat production in 1946 was more than three per cent larger than the preceding year. The Middle East production was estimated at three per cent more than 1945, with the increases occurring in Turkey, Iran, and Iraq. Despite adverse weather conditions, the southern dominions of Australia and New Zealand reflected an increase in meat output for 1946.

Canada's total meat production for 1946, estimated at 2,061 million pounds, is about 12 per cent less than 1945.

The meat-packing industry has come a long way from the simple, crude pioneer methods of operation which were prevalent at its beginning. Little did John Pynchon, in 1640, dream that byproducts from the animals he dressed for this country's first commercial trade would be important factors in producing life-prolonging drugs

and hundreds of new items vitally necessary to our well-being.

As meat packing expanded, resourceful operators began to develop information of great value to the industry on the science underlying its operations, and thus to conserve and improve its products. Later, the American Meat Institute, an organization of about 600 meat-packing companies and sausage manufacturers, established a department of scientific research. The laboratory

MEAT CONSUMPTION PER CAPITA IN EUROPEAN COUNTRIES DURING PREWAR PERIOD[1]

Country	Pounds per capita	Per cent meat calories of total food calories
Denmark	119.0	12.9
Austria	110.2	11.5
France	105.8	8.4
Netherlands	101.4	10.3
Belgium	97.0	10.0
Germany	97.0	9.9
Finland	86.0	8.4
Norway	79.4	7.1
Hungary	75.0	7.8
Czechoslovakia	61.7	8.4
Poland	46.3	6.3
Greece	46.3	3.5
Bulgaria	44.1	4.5
Rumania	37.5	4.1
USSR	37.5	2.7
Yugoslavia	35.3	3.9
Italy	35.3	3.6

1 Source: Estimates by the Food Section, British Ministry of Economic Warfare, reported in "Food Consumption at the National Level" Charles B. Howe, Production and Marketing Administration, *Journal of Farm Economics*, August, 1946.

of this department, now located at the University of Chicago and staffed by a corps of able scientists, furnishes to members of the institute the scientific results of all successful experiments.

Large quantities of dehydrated meat were prepared during World War II. These products were stored for considerable periods of time and shipped long distances. Information was needed on the composition, vitamin content, and the effect of storage on the vitamin content of the products produced commercially. Through grants-in-aid from the Nutrition Foundation, Inc., cooperative studies were carried out in the institute's laboratories and in the department of biochemistry of the University of Wisconsin. Samples of dehydrated meat produced by many packers were analyzed for protein, fat, moisture, thiamine, riboflavin and niacin. Over a period of one year, these samples revealed practically complete retention of riboflavin and niacin during dehydration and storage, even at storage temperatures of 120°F. Thiamine was stable at 40°F., but at 70°F. there was a large loss at the end of 42 weeks.

Among other studies undertaken by the industry was the effect of time and temperature of processing on the vitamin content of pork luncheon meat. This study was in cooperation with one of the large commercial can manufacturers. Extensive studies were carried out in the plants of several meat packers on the factors influencing the keeping-time and quality of bacon. Quite recently extensive studies have been carried out in the use of corn sugar in curing bacon.

The institute's department of scientific research, established and supported by the meat-packing industry, contributed to the war effort by making available to the Quartermaster Corps and the Veterinary Corps of the Surgeon General's Office, many copies of publications that were used for instructional purposes. Hundreds of copies of *Color Control and Conservation of Sausage* and *Important Considerations in Handling Meats Prior to Canning* were furnished on request of the United States War Department. Harvard University, Texas Agricultural Experiment Station, and Northwestern University have carried on recent meat research supported by the institute. The studies on protein requirements of adults at Harvard University revealed that the protein requirement was about 17 per cent less on a diet in which one-third of the protein was from meat than on an all-vegetable diet. Results of the studies at the Texas Experiment Station indicated the specific amount of the ten indispensable amino acids in various cuts and organs of beef, pork, lamb and veal.

From time to time, government bureaus concerned with the production or conservation of food attempt to persuade the public mind to converge upon the subject of meat versus grain. There follows the usual discussion of the fact that it takes more than a pound of grain to make a pound of meat; the idea frequently being advanced that there should be a sharp shift from livestock production to the use of grains directly as human food, so that more people can be fed.

While it is true that more calories can be realized by using a pound of grain directly as human food than by feeding this grain to livestock, there are many factors which need to be considered, especially from a long-time standpoint. The large stock of data now available on the nutritional value of meat in the diet must be given careful thought and consideration. Meat and other animal products are essential for an adequate diet. It is recognized that meat is (a) one of the richest protein foods, providing protein of the highest biologic value; (b) an excellent source of the important B-vitamins, thiamine, riboflavin and niacin; (c) contains goodly amounts of much-needed fats, rich in the unsaturated fatty acids, considered by many nutritionists to be necessary in human nutrition; (d) provides essential minerals—copper, iron, phosphorus; (e) stimulates the appetite, thus assuring adequate eating of other needed foods; (f) is of high "satiety value"—a meal with meat means a feeling of satisfaction and of well-being; (g) its extractives stimulate the flow of the stomach's digestive juices, thus enhancing digestion.

There cannot be any dispute about the fac that the American people like and want meat and the effect that this strong desire has on morale cannot be overlooked. The American people do not want to be reduced to a diet of field crops.

Another point to consider in the controversy of meat versus grain is the maintenance of soil fertility, for the balanced use of labor and other resources are closely associated with livestock production. A sharp reduction in livestock population and feeding would substantially lower grain yields in the very near future. A sharp liquidation of livestock would provide more feed for other uses in the short run, but would hasten the accumulation of a grain surplus in the United States after the relief period has passed. One most important point which is apparently overlooked by those who favor a reduction in livestock production in favor of greater grain crops for food is that the production of meat and other meat-animal products utilizes large quantities of

grass and roughage which would be largely wasted if not fed to livestock.

One point which proponents of reduced livestock production harp on is that a pound of grain fed to livestock is equivalent to a pound of human food. This definitely is not correct, since grains are not generally consumed in their entirety by humans, but require processing which often results in a large loss in weight, as well as in nutritional value. The byproducts of this operation, of course, go back largely to animal feed.

It also is a fact that some animals used for meat feed exclusively, or almost exclusively, on grain or other forage, and that many others eat only small quantities of grain.

The species of livestock raised in this country principally for meat are cattle, hogs, and sheep.

For ranch livestock the most useful classifications are by sex, and age. Other qualities depend in part on the ancestry of the animals, care during their growth, and the type of feed they have consumed. These latter factors are of importance in determining the price which the producer receives when he sells his livestock, so he governs his action accordingly. Hogs are fed principally on corn, and the majority are shipped directly from the farms where they were bred to central livestock markets, or direct to the packing houses for slaughter.

At the market, livestock are divided into classes based on the sex of the animal. Cattle, for example, are divided into five classes: steer, heifer, cow, bull, and stag. Hogs are classified as sows, barrows, stags, and boars. Sheep are separated as ewes, bucks, and wethers. Sex is not an important classification in lambs and calves. Within these major classes the subclasses of "slaughter," "feeder" and "stocker," are used to indicate the condition of the animal. Animals ready for immediate use, or those where no benefit could accrue from additional feeding, are designated as slaughter.

The older and heavier cattle, which can be improved by fattening, are called feeders. The younger and lighter cattle, which usually are fed for a longer period of time, are known as stockers. These classifications are not precise and the various types shade into one another.

Other differentiations in sorting cattle are based on the use for which the particular meat is destined, and on the age and weight of the animal. Under *use* are included such subclasses as "butcher," which consists of inferior cows, calves, and heifers or "bacon," which includes the hogs whose physical structure makes their sides particularly suitable for bacon. The age classifications include designations such as "yearling" or two-year-old; and weight is termed by lightweight, medium weight, or heavyweight.

Grades which are based on variations in conformation, finish, and quality are of major importance to the packers, for these grades indicate the type of meat which can be secured from the particular animal. Conformation is judged by the shape and build of the animal, the relative proportions of the various parts of the animal. Breeding determines the conformation to a large degree, although feed and care are important. The term finish refers to the quantity, distribution, and quality of the fat on the animal. Fat is important in determining the tenderness and flavor of the meat. Quality is a comprehensive term and is judged by the probable condition of the flesh, fat, connective tissue, color, and juice of the meat. In beef, "marbling" or distribution of fat in the meat is also important in determining quality.

The standards for livestock are, for the most part, the same as the standards for dressed meat. This correspondence is obviously necessary, since the principal value of the animal is derived from the type and quality of the meat which can be secured from it after slaughter.

According to latest official estimates, the meat-yielding livestock on this country's farms, as of Jan. 1, 1947, were: All cattle and calves, 81,050,000 head; beef cattle, 38,469,000 head; hogs, 56,901,000 head, and sheep and lambs, 38,571,000 head. World cattle numbers at the beginning of 1947 were estimated at about 716 million head. This was an increase of 3½ million head over a year earlier. Decreases which were reported in all the North American countries, Australia, and the USSR were more than offset by increases in Asia, Europe, South America, and Africa.

An animal is not all meat. There naturally is shrinkage even under modern methods of preparation. The amount of meat varies from animal to animal or, in butchering terms, its "dressing" varies. In general, however, the yield of meat ranges from 50 to 55 per cent of the live weight of all cattle marketed; from 45 to 50 per cent of all sheep, and from 70 to 75 per cent of all hogs marketed, depending upon weight and finish.

CATTLE: ESTIMATED WORLD NUMBERS, BY CONTINENTS, AVERAGES 1931–1935, AND 1936–1940, ANNUAL 1944–1946

Continent or area	Average 1931–35	Average 1936–40	1944	1945	1946 [a]
	Thousands	*Thousands*	*Thousands*	*Thousands*	*Thousands*
North America	95,900	96,600	116,500	117,000	113,200
Europe	107,100	110,200	101,400	99,100	96,300
USSR	36,900	48,500	35,000	37,800	41,500
Asia	272,400	283,400	267,700	262,600	264,100
South America	104,900	105,600	109,000	110,400	111,200
Africa	60,500	61,400	67,600	68,000	67,100
Oceania	17,500	18,100	19,100	19,200	19,000
Total	695,200	723,800	716,300	714,100	712,400

[a] Preliminary.

As early as 1928 successful production of quick-frozen fruits and vegetables was going on. In fact, the very first experiment with quick-frozen foods was with fish. Haddock, sole, cod, and mackerel fillets were quick-frozen by the Birds Eye process in Gloucester, Mass. The first commercial quick-freezing of meat products was done in Boston in 1929.

Technically, gastronomically, and nutritionally, quick-frozen meats were and are successful. Quick-frozen meats for institutional use have the advantage of predefined cost, uniformity of size for servings; they are boneless, and have all but the minimum of fat trimmed off. The latest available figures on quick-frozen meat production show that in 1941 production reached its peak. One reason why food retailers have not put in large stocks of quick-frozen meats is that dealers must have refrigerated cabinets which will maintain extremely low temperatures to keep these meats from defrosting. Packers maintain temperatures of —20°F. in the coolers holding quick-frozen meats. The average temperature of a refrigerated meat case for fresh meats today is 38°F.

The frozen meat cuts which have been the most popular in the past have been hamburger or chopped steak, rib or loin lamb chops, club steaks, chip steaks, roasts, sausage links, and corned beef hash. A tendency seems to be developing in the retail field to sell cuts which have been prepackaged without freezing.

It largely depends upon the efficiency of the meat packing industry and upon farmers' production and soil conservation practices whether the American people continue to eat well and have the food they like and need for good nutrition.

WESLEY HARDENBERGH,
President, American Meat Institute, Chicago, Illinois.

2. MEAT, Inspection of. Meat, to be fit for human consumption, must have been derived from healthy animals slaughtered under conditions which assure the elimination of diseased meat and freedom from contamination. The edible portions must be separated from the inedible portions in such a way that meat to be used for human food is handled in a sanitary manner. The purpose of meat inspection is to accomplish this, and its procedures and organization are markedly different from other food-control programs. The inspection that will assure a wholesome meat supply must consist of personal supervision by the inspector of each step in the slaughtering and related operations.

The first consideration in an effective meat-inspection program is the construction and equipment of the packing plant. The outside premises, particularly livestock pens, and railroad car-loading and truck-loading areas must be paved, drained, and so arranged as to permit their being cleaned regularly. Adequate space must be provided in the plant for each operation, and care must be taken that all materials used in floors, walls, and ceilings are such that they can be easily cleaned. The water supply must be ample, pure, and distributed throughout the plant under adequate pressure and in sufficient quantities for each operating need. Floor drains should be so located with respect to the various operations as to accommodate those which waste considerable quantities of water. The sewage disposal must be carefully laid out, since large quantities of waste materials result from the slaughtering operation. All equipment used throughout the plant must be constructed so that it can be readily kept clean. It must also be adequate to handle the volume of operations, and its proper location in the plant has a bearing on the maintenance of sanitary conditions. Dressing rooms and toilet facilities for the workmen must be located away from the departments in which the edible product is prepared and handled, and they must be adequate for the number of workers in any given plant.

The health of animals is of primary concern. Each animal prior to slaughter must be examined by an inspector in order to insure that only healthy animals go into the production of meat. The carcass of every animal passed for slaughter must also be given a postmortem examination, to eliminate it, or any part of it, if diseased. The inspectional supervision in the slaughtering department assures the handling of the edible portions of the carcass in such a way as to avoid their contamination by contacting unclean equipment, hides, skin, feet, diseased material, and the contents of sinuses, the digestive tract, the urogenital tract, and the udder. Diseased, unclean, and otherwise unfit meat is condemned by the inspector and destroyed under his supervision, this condemned product being later converted into fertilizer and similar material.

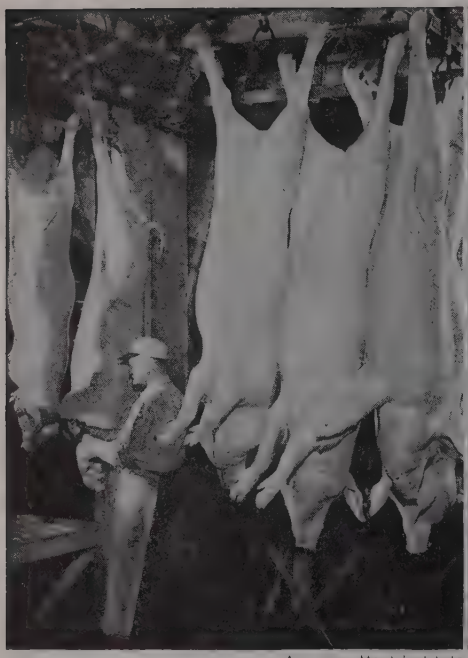
Inspectional supervision over the slaughtering operation assures delivery of clean and wholesome meat to the curing, smoking, sausage, and canning departments. In these departments sanitation and the prevention of adulteration also come under the inspectional control. The equipment used in processing the meat, the method of processing—temperatures employed, fitness of the ingredients added to the meat, and its final packaging—must be supervised to assure distribution to the consumer of a wholesome product, free from adulteration.

In the United States, with its federal, state, and local political divisions, the federal government has jurisdiction over interstate commerce; each state exercises general control within its boundaries; and each local government has its food control responsibility. Federal meat inspection is administered by the Meat Inspection Service of the Bureau of Animal Industry of the United States Department of Agriculture, operating under the Federal Meat Inspection Law enacted in 1906. This law gives the federal agency jurisdiction in packing plants which engage in interstate commerce. The state and local governments take over the responsibility for food control within their respective jurisdictions, including handling, after the federal government's work is done, until the meat is purchased by the consumer.

Historical.—Prior to the development of railroad transportation, meat production and processing, like many other industries, were primarily local enterprises. In fact, the meat industry in Europe and England still consists largely of local, in many cases municipal, slaughtering plants, and the large part of meat preparation is conducted in the local butcher shops. In the United States, with centers of population developing hundreds of miles from the large livestock-producing areas and with the building of great networks of railroads, livestock slaughtering and meat processing have tended to become centralized in the large livestock-producing and meat-consuming areas. This development received added impetus with the advent of refrigerated freight cars. Large meat-packing centers grew up principally in the midwest, and the industry developed with little or no inspectional control. The first national legislation passed in 1890 was intended as an aid to the exportation of food animals and meat from the United States

Photographs from: (top) Great Northern Railway; (center) Chicago and North Western Railway; (bottom) Armour and Company

Top: Loading sheep aboard freight cars at Cascade, Montana. These animals will be shipped to one of the great slaughtering centers in the Midwest. *Center:* Herded in pens at West Chicago, Illinois, these sheep will soon be killed. *Bottom:* The cattle killing floor of a huge Chicago plant.



Amer can Meat Institute

Hogs being brought from the de-hairing vats.

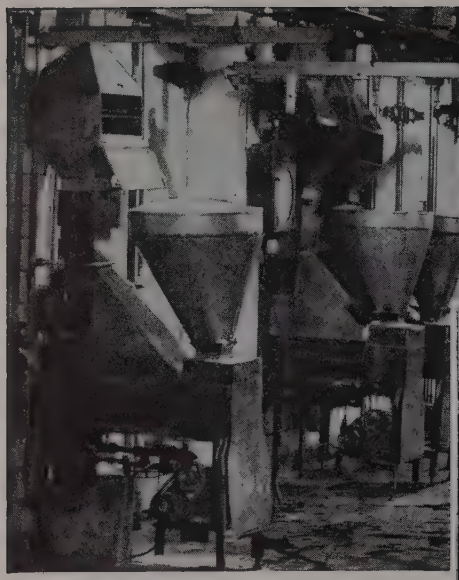
By Charles McKinney from American Meat Institute

Dressed beef carcasses hanging in the cooler.

By Charles McKinney from American Meat Institute

Government inspectors examining head and throat glands of slaughtered hogs.

Photographs: (top and bottom) from American Meat Institute; (center) by Torkel Korling from American Meat Institute.
and center: **Cured slab bacon and pork shoulders wrapped in stockinettes being hung in smokehouses.** ***Bottom:*** **Hams being removed.**



Above: **A battery of modern ovens used in the preparation of smoked sausages.** ***Right:*** **Canning tamales. An old Mexican favorite, the tamale is becoming increasingly popular in the United States.**

Photographs (above) from A. E. Wiemer from Oscar Mayer and Company; (right) by Schube-Soucek from Armour and Company.

By Charles McKinney from Armour and Compan

A sausage linking machine.

to European countries. Subsequent enactments in 1891 and 1895 improved the inspectional control, particularly with respect to the handling of condemned meats. The growing meat-packing industry received considerable adverse publicity during the Spanish-American War, augmented later in Upton Sinclair's book entitled *The Jungle* (q.v.) published in 1906. In fact, the subject became a matter of such national concern, that President Theodore Roosevelt gave it his personal attention, which resulted in bringing about the enactment of a comprehensive Meat Inspection Law on June 30, 1906. This act applies to cattle, sheep, swine, and goats, and the meat from these animals.

The Federal Meat Inspection Service.—Under the Federal Meat Inspection Law of June 30, 1906, a comprehensive inspection service was organized, recognizing that for adequate control, inspectional supervision over each step in the slaughtering and processing operation is essential. During 1946, the service employed nearly 3,000 inspectors who were assigned to more than 1,000 meat-packing plants located in 350 towns and villages throughout the United States. A description of the functioning of this service will outline an effective meat-inspection system.

Application for Inspection.—Meat-packing plants which intend to engage in interstate or foreign commerce are required to apply for federal meat inspection. Applicants send in to the meat inspection office at Washington, D.C., properly executed application forms stating their volume of business. These must be accompanied by drawings of the applicant's plant, giving specifications and full information concerning its construction and equipment. If the drawings and specifications meet the necessary requirements to assure cleanly operations and opportunity for efficient inspection, a survey is made of the plant to see whether it conforms with the drawings. If it does, the grant of inspection is issued.

Ante-mortem Inspection.—Animals are placed in properly lighted holding pens where the inspector can move freely among them and study them both at rest and in action. Animals which the inspector does not pass are segregated for further examination, and healthy ones are driven into the plant for slaughter. Animals segregated for further examination are placed in two categories, depending on the findings: Those affected with any condition which would cause their condemnation on post-mortem examination are identified as "U.S. condemned" and are not permitted to be slaughtered as food animals; and the class of animals which present no conclusive evidence of disease but do show symptoms that justify suspecting the presence of some abnormal condition. They are identified as "U.S. suspect," and must be slaughtered separately, afterward undergoing a special post-mortem examination.

Post-mortem Inspection.—The inspection in the slaughtering department is usually referred to as the post-mortem inspection. Actually, the examination of the carcass, its organs and other viscera, which constitutes the post-mortem inspection is only part of the responsibilities of the inspector. He must also regulate the operations in the slaughtering department to eliminate contamination of the meat during each step of the intricate slaughtering operations. The first step in the post-mortem inspection of cattle carcasses is a close examination of each head, consisting of incising the lymph glands, which are studied with all exposed surfaces of the head. Since the head is a common avenue of infection, the finding of a diseased condition there gives indication of what should be looked for in further examination of the carcass. Meanwhile, the carcass has gone on to the dressing bed, where it is eviscerated. The viscera, both thoracic and abdominal, are presented for inspection, using equipment best suited for the particular layout. The larger slaughtering plants have self-sterilizing, moving-top viscera inspection tables. These convey the viscera individually to the inspector so that he can conduct his examination conveniently and in a well-lighted location. This inspection consists of incising the bronchial and mediastinal lymph glands, palpation of the lungs, incision and opening of the heart for observation of the inner and outer surfaces as well as the cut surfaces, incision of the portal lymph glands and bile duct, with observation of both sides of the liver and of the remainder of the abdominal viscera. The carcass passes on from the evisceration position, but before it enters the refrigerator it receives an inspection as it hangs from the rail which consists of a careful observation of all surfaces, and palpating the body lymph glands. If an abnormal condition is found anywhere, the inspector immediately identifies all parts of the carcass with sections of a "gang-tag," each bearing the same serial number reading "U.S. retained." The carcasses and viscera so identified are assembled for what is called a final inspection, more detailed than the earlier routine one. If, on this final inspection, a condition is found affecting the wholesomeness of the meat, it is marked "U.S. condemned" and destroyed for food purposes under an inspector's supervision.

The post-mortem inspection of the carcasses of other species varies only slightly from the outline given for cattle.

Inspection of Meat Processing.—The inspectional supervision of the handling of the passed carcasses and parts, and their manufacture into meat food products begins as soon as they leave the slaughtering department. After being thoroughly chilled, the carcass is removed to another refrigerated room where it is cut into its commercial parts. The products of the carcass-cutting department that go into curing, smoking, sausage making, canning, and so on, require considerable inspectional supervision, in order to assure proper regard for cleanliness and sanitary conditions in preparation up to the time the product is shipped from the plant. Salt and other materials used in curing the meat are examined to make sure that they are clean and free from adulteration. The vat in which the curing solution is prepared must be emptied and cleaned regularly, and the filter through which the solution passes must be in good working condition and cleaned out regularly. The receptacles used for curing the meats must be of such construction as to permit their ready and frequent cleaning, and the inspector must eliminate all other possible sources of contamination by giving strict attention to the ceiling and structures over the curing vats, to make certain that they are dry and free from loose particles, and that all drainage lines are in working condition.

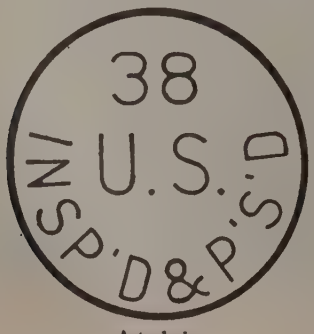
Sausage-preparing operations are both varied and complicated. Modern processing proceeds rapidly, and a considerable volume of the product is handled within a short time. The layout of the

sausage-preparing department and the type and arrangement of the equipment used must permit adequate inspectional supervision. The equipment must be so constructed that it can be easily and thoroughly cleansed, and all trucking and rail areas must allow the manufacturing operations to proceed in an orderly manner and large volumes of the product to be moved without confusion. The casings used for sausage are examined carefully to insure their cleanliness, and must be flushed before their use is permitted.

The canning of meats must be surrounded with safeguards which will assure the proper preparation of the contents and adequate processing of the sealed product. The cans intended for use are cleaned thoroughly, immediately before filling, and are handled mechanically to avoid soiling of the inner surfaces. Each can is flushed in an inverted position with running water at a temperature of at least 180°F. The closure of the can, too, receives careful attention after filling since the subsequent processing is effective only if this is perfect. The inspection prevents delay in completing the processing of the canned product, for otherwise spoilage of the contents might occur between the time the product is placed in the can and when it is heat-processed. Each lot of canned product is identified by tagging the baskets or cages with a tag which will change color on going through the heat-processing; this definitely precludes failure to heat-process after closing. All canned products are required to be plainly and prominently marked on the container in code or otherwise, with the identity of the contents and date of canning.

Sampling for Laboratory Examination.—As an aid to inspectors, seven laboratories are located strategically throughout the country. These laboratories not only analyze ingredients used in the preparation of meat products but also the finished products themselves. The results of the analyses are furnished the inspector for his appropriate action at the plant. In addition to articles of food, the laboratories also analyze cleaning materials, substances used to control vermin, coatings on the surfacing of equipment for meat handling, and many other items that come in contact with meat or are used on premises where meat is handled.

Mark of Inspection.—Each carcass which passes the inspection is identified by marking on it, using a harmless purple fluid, a circular brand bearing the abbreviated inspection legend. Also, each prepared piece of meat capable of being branded is identified with the same mark of inspection. Following is a facsimile of this brand:



Actual size

Each package containing inspected meat, or the label on this package, bears the inspection legend in full. This is always in the same form so that it can be readily identified as the mark of the federal meat inspection, and is in the following form:

Actual size

Labeling.—Before a meat packer operating under federal meat inspection may use a label on his product it must have been approved by the inspection service. When the label is submitted by the packer with his request for approval, it must be accompanied by the formula showing the kinds and amounts of the various ingredients used and also a complete description of the method employed in preparing the product. When the label is reviewed, a decision must be made as to whether the product as planned is the one the purchaser would expect to be identified with this particular label. It must contain certain required labeling information, and it is not permitted to bear any misleading feature. Each label must show the appropriate name of the product, the ingredient statement, the name and address of the manufacturer or distributor, the net weight statement, and the mark of inspection. Any word or design on the label which may be misleading, concerning the origin of the product, its composition, its quality, or its nutritive value would be reason for withholding approval.

Export.—Inspection of meat products for export was one of the first functions, and still remains an important activity of the Federal Meat Inspection Service. Before a shipmaster is permitted to clear a United States port with meat or meat food product for export, he must have, covering the shipment, an export certificate issued by the meat inspection service. This certificate is not only evidence of inspection but also indicates that other special requirements of the country to which the meat is being exported have been complied with. This export certificate has become recognized throughout the world, and wherever meats from the United States go they are accepted on the basis of this identification.

Import.—The Tariff Act, approved June 17, 1930, contains a provision that requires all meat products offered for importation into the United States to be examined and passed by the federal meat-inspection service. Each consignment of import meat must be accompanied by a certificate from the country of origin, and the certificate to be acceptable must be executed in the prescribed form and from a country where the meat-inspection service is considered to be the equivalent of that of the United States. When the importer

declares a consignment of foreign meat, he presents the foreign meat-inspection certificate to the meat-inspection office at the port of entry and requests inspection for his product. If the certificate is in proper form, an inspection is conducted and the product released only if it meets the same requirements which are applied to domestic product. The customs officials will not clear a shipment of imported meat until they are informed by the meat-inspection office at the port of entry that it has passed the inspection.

Horse Meat.—The Federal Meat Inspection Act was amended July 24, 1919, to extend the inspection to horses and horse meat. Under this amendment inspection procedures similar to those applied to other animals are conducted in plants which slaughter horses for the production of human food. Federal horse meat inspection is also limited to those plants which are engaged in interstate or foreign commerce. Prior to World War II, there were only seven inspected horse meat plants. The major part of the production of those plants was exported to Europe as cured horse meat. Toward the close of World War II, the number of inspected plants doubled, due to the increased demand from Europe for horse meat.

Horse meat plants are required to be separate and apart from plants which prepare meat from other species. Furthermore, it is required that horse meat be identified as such, to distinguish it from other kinds of meat. The mark of inspection applied to horse meat is quite different in design, and green marking fluid is used in applying the horse meat stamp which is in the following form:

Actual size

Statistics.—During the twelve month period ending June 30, 1946, ante-mortem and post-mortem examinations under federal inspection were conducted on over 80,000,000 animals and carcasses, of which 34,049 animals were condemned on ante-mortem inspection and 319,091 carcasses were condemned on post-mortem inspection. During that period inspectional supervision covered the preparing and manufacturing operations involving over 13,000,000,000 pounds of meat food products, of which 7,980,799 pounds were condemned on reinspection.

References.—Ditewig, George, "The Meat-Inspection Service of the United States Department of Agriculture" (*Yearbook for 1916* of the Department of Agriculture); Mohler, John R., "The Inspection Stamp as a Guide to Wholesome Meat" (*Miscellaneous Circular No. 63*, United States Department of Agriculture, 1926); Joss, E. C., "National Meat Inspection in the United States of America" (*Proceedings* of the Twelfth International Veterinary Congress, 1934); *Yearbook of Agriculture, 1939* (reprint); The Meat-Inspection Regulations of the United States Department of Agriculture.

A. R. Miller,
Chief, Meat Inspection Service, Bureau of Animal Industry, United States Department of Agriculture.

3. MEAT, Market Classes and Grades.[1] Grading of livestock and meats had its beginning when men first started trading in these commodities. In appraising the relative merits of a product the buyer or seller applied some of the principles of grading and standardization as used today. Through the gradual evolution of markets and marketing processes, there developed in men's minds certain concepts of standards for varying degrees of excellence of product which ultimately resulted in recognized classes and grades. With these concepts, a terminology came into use for identifying the standards so that they would have uniformity of meaning.

Because of limited transportation and communication facilities, market areas at first tended to be narrowly localized. Each area developed its own grading system which resulted in considerable variation between areas in the grading systems and in the terminology used. Coincident with the westward expansion and settlement of the United States and the development of its great livestock and meat industry, there came a strong need for more uniformity and accuracy in grading livestock and meats and a terminology that would be uniformly interpreted in all markets so as to facilitate trading. This was especially true after the advent of the railroad refrigerator car, about 1880, which made it possible to ship great quantities of dressed beef from the midwest to the more populated areas along the Atlantic seaboard.

In 1902, the Animal Husbandry Department of the University of Illinois published results of the first study on meat and livestock grading as carried on in commercial trading in this country, and the terminology used in identifying the classes and grades commonly recognized. This study included detailed descriptions of the classes and grades in general use and recommendations for a standard grading system and terminology that would be uniformly understood and accepted throughout the land.

In 1916, the United States Department of Agriculture used the results of the Illinois studies as a guide in formulating the first tentative United States standards for grades of beef. Although these standards were originally designed to provide a basis for a national meat market reporting service, they were put to practical tests in numerous ways by many commercial concerns. Revised on the basis of results of these tests, they were promulgated by the secretary of agriculture on June 3, 1926 as the Official United States Standards for Grades of Carcass Beef and published in *Service and Regulatory Announcements No. 99 (BAE)*. These standards provided the basis for grading when the voluntary beef grading and stamping service was begun in May 1927.

Official standards for grades of veal and calf carcasses were likewise promulgated in 1928, and for lamb and mutton carcasses in 1931. Tentative standards for classes and grades of pork carcasses and cuts also were developed but have not yet been promulgated as official standards.

[1] U.S. Standard for Grade, issued by the United States Department of Agriculture.

The Department of Agriculture now maintains a meat grading service in every major meat processing or meat marketing center in the country. This service is available upon request from any financially interested party. It is operated on a self-supporting basis, the necessary funds being derived from fees collected from individuals and concerns who use it. Grading is done in accordance with class and grade specifications set up in the official standards for meat from the different species of animals. After the grade has been determined by an official grader, a special stamping device is used to apply the appropriate grade name on the exterior surface of the carcass or cut.

BASIS FOR CLASSIFYING AND GRADING

Class.—As used in the federal classification and grading system for meats, class refers to carcasses or wholesale cuts derived from the same species or kind of animal and having a similar commercial use. Carcasses or cuts included in a class will show marked differences in the physical characteristics associated with relative desirability or value, and grade is a measure of the extent to which these physical characteristics vary from those considered to be ideal or nearest perfection.

Grade.—This is an indication of the inherent characteristics that determine the desirability of the product in relation to other meat of the same class. Determination of grade involves an evaluation of the carcass or wholesale cut with two major considerations in mind: (1) the relative proportion of the more desirable to the less desirable parts of the carcass or cut and the ratio of edible meat to bone, and (2) the degree of palatability or satisfaction that is likely to be derived when the meat is consumed. The extent to which a carcass or wholesale cut attains perfection in fulfilling these two considerations is determined from a combined evaluation of three major grade factors—conformation, finish, and quality. Because these factors are inherent in meat they are not subject to change by reason of differences in trade preferences, seasonal conditions or any other unstable or fluctuating factor, and therefore, they provide the basis for a grading system which has proved to be both comprehensive and adequate.

Conformation.—As used in connection with the grading of meat, conformation means the shape, outline or form of the carcass, side, or wholesale cut of meat. Although primarily a function of the development of the muscular and skeletal systems, conformation is also affected by the degree of fatness of the animal at the time of slaughter. Conformation is a direct measure of the first major consideration in determining grade, namely, the relative proportions of the more desirable and less desirable parts and the proportion of the edible to nonedible parts within a cut. Best conformation implies a thick, well-rounded appearance together with a small compact skeletal structure. Poor conformation implies an angular, thin, sunken or irregular appearance, together with a large, rangy skeletal structure.

The best physical guides for evaluating meat on the basis of the second consideration—the relative palatability and general desirability of meat for food purposes—are the finish or degree of fatness in the meat and evidences of quality. These two factors are very closely interrelated and, for purposes of this discussion, no attempt is made to indicate that they have separate influences. The manner in which each is manifested in meat, however, is worthy of mention.

Finish.—This refers to the proportion, character, and distribution of exterior, interior, intermuscular and intramuscular fat in the carcass or cut. Best finish implies a smooth, relatively even covering of fat over the exterior of the carcass. It also involves liberal deposits of fat between the muscles, and between the muscle fiber bundles. These latter deposits are commonly referred to as marbling. Poor finish implies absence of or only slight quantities of fat over the exterior surface of the carcass or cut. Uneven distribution of fat results in bunches and rolls on certain parts of the carcass. A high degree of finish adds much to the attractiveness of the carcass or cut, but its chief significance lies in the fact that, up to a certain point, at least, increases in fatness are associated with increased palatability, and thus the degree of fatness serves as an index to the degree of quality.

Quality.—This is a characteristic of the flesh and of the fat included therein. The physical characteristics denoting quality in meat are rather difficult to describe and define. Quality involves the amount, consistency, and character of the extractives that permeate the muscle fiber and other flesh tissue. It is strongly influenced by the amount and distribution of marbling. Although not a determinant of quality, color serves as an excellent index. Best quality implies full, well developed, firm muscle tissue or flesh with a minimum of strength in fiber and connective tissue and liberal marbling and juiciness other than free moisture. The cut surface shows fine texture and smoothness to the touch and sight. Poor quality is noted by coarse texture, liberal quantities of connective tissue, and little or no marbling. Such flesh usually lacks juiciness but, if abundant, the juice is thin and watery. The meat is stringy, tough, inferior in flavor, and has a low ratio of muscle fibers to connective tissue and bone.

STANDARD CLASSES AND GRADES OF MEAT

The following outline shows the classification and grading schedule used in grading meats from the different species on the basis of the official U.S. Standards.

Beef.—During the process of slaughtering, a beef carcass is separated into two halves by splitting it down the center of the back. This reveals the longisection of the dorsal vertebrae and their attached cartilages from which an estimation of the degree of maturity of the animal can be made. After chilling, the sides are further divided into hindquarters and forequarters. These quarters are frequently subdivided into wholesale cuts. Although varying somewhat in different parts of the country, the most widely used method of making wholesale cuts provides for the following cuts from the forequarters: Chuck, rib, plate, brisket and shank. The cuts usually made from the hindquarters are the loin, round, and flank. Combinations of these cuts have other names, thus the loin and rib combined are referred to as a "set"; the chuck and rib combined are called a "back"; the chuck, plate, brisket, and shank combined are referred to as a "triangle" or "rattle."

Carcasses of bovines are derived from animals of five different sex conditions—steers, heifers, cows, bulls, and stags. Steer carcasses are identified by the typically rough and rather

irregular fat in the region of the cod, the relatively small pelvic cavity and a curved "aitch" bone (pubic symphysis). As a class these carcasses are also rather thickly fleshed, are plump and full, and have the highest average quality of

Species	Class	Grade
Cattle..	Beef (steer, heifer, cow).	Prime, Choice, Good, Commercial, Utility, Cutter, Canner
	Stag	Choice, Good, Commercial, Utility, Cutter, Canner
	Bull	Choice, Good, Commercial, Utility, Cutter, Canner
	Veal	Prime, Choice, Good, Commercial, Utility, Cull
	Calf	Prime, Choice, Good, Commercial, Utility, Cull
Sheep..	Lamb	Prime, Choice, Good, Commercial, Utility, Cull
	Yearling mutton	Prime, Choice, Good, Commercial, Utility, Cull
	Mutton	Prime, Choice, Good, Commercial, Utility, Cull
Swine..	Barrows and Gilts	No. 1, No. 2, No. 3, Cull
	Sows	No. 1, No. 2, No. 3, Cull
	Stags	No. 1, No. 2, No. 3, Cull

any of the kinds of beef. Heifer carcasses are identified by the presence of typically smooth fat in the region of the udder, a slightly larger pelvic cavity, and a straighter aitch bone than is typical of steers. As a group, they tend to be slightly less thickly fleshed and more angular than steers. Cow carcasses are identified by their large pelvic cavity, nearly straight aitch bone, and general angularity throughout. The udder has usually been removed. Hips are usually prominent and the bones are quite hard and white and the cartilages on the end of the dorsal vertebrae are frequently entirely ossified. Bull carcasses are identified by extremely bulging rounds, heavy crested necks and thick shoulders. The flesh is quite dark and coarse. Stags usually have characteristics which are intermediate between those of bulls and those of steers.

All beef from steers, heifers, cows, and stags, except the very leanest, is ordinarily sold as fresh or "block" beef. Bull beef is generally used in the making of certain types of sausage and other manufactured meat products.

The original federal standards for grades of beef provided for the grading of each of the five class groups according to separate standards. In 1939, the standards were amended to provide only one standard for the grading of beef from steers, heifers, and cows. Inasmuch as the beef from these three groups comprises practically all the beef sold as retail cuts to consumers, this change greatly facilitates the purchase of meat by grade at the consumer level.

The federal standards for grades of beef (steers, heifers, and cows) consist of seven grades. They are prime, choice, good, commercial, utility, cutter, and canner.

The prime and choice grades of beef include carcasses which are compact, thickly fleshed, and which have very liberal quantities of fat over the exterior surface and between and within the muscles. Because these grades include only carcasses produced from young animals, the meat is also fine in texture and bright in color.

Carcasses grading utility, cutter or canner are much more angular, rangy, and thinly fleshed than those in the prime and choice grades, and have little or no fat over the outside or between or within the muscles. Utility, cutter or canner grade carcasses are largely from animals advanced in age, and the meat is also usually dark in color and coarse in texture. Carcasses grading good and commercial are usually intermediate in conformation and, particularly in the commercial grade, there may be a great deal of variation with respect to the maturity attained by the animals prior to slaughter. Because maturity and fatness are considered compensatory in their effects on quality, there is likewise a considerable variation in fatness among carcasses of these grades. Beef carcasses having characteristics indicating that they were produced from relatively young animals will qualify for the good or commercial grades with considerably less finish or fatness than carcasses from more mature animals.

The federal standards for grades of bull and stag beef include six grades. They are choice, good, commercial, utility, cutter, and canner. Standards for grades of these two classes are formulated on much the same basis as those for steers, heifers, and cows.

Veal and Calf.—Meat from bovine animals which are younger than those which produce beef is termed veal or calf. The distinguishing characteristics between veal and calf are the color and character of the flesh and fat.

Veal is produced from very young bovine animals which have subsisted almost wholly on milk up to the time of slaughter. The flesh is very light colored, and the fat is rather waxy and pinkish white in color. It is common practice to leave the skins on veal carcasses until offered for sale. This is done to preserve the light color and to prevent undue evaporation of moisture from the carcasses. Usually, the carcasses are not split down the back at the time of slaughter, although they are frequently divided into halves, quarters or even wholesale cuts prior to sale.

Calf is produced from immature bovine animals which are usually somewhat older and larger than those that produce veal. These animals are usually from 5 to 8 months old at the time of slaughter and their carcasses weigh from 200 to 300 pounds. Calf carcasses may be dressed like veal, with the skin left on and not split down the back, or they may be dressed like beef with the skin removed and the carcass split into two sides. Calf is sold as sides, quarters, or wholesale cuts.

Because both veal and calf carcasses are derived from very young animals, sex condition has not developed sufficiently to affect the physical characteristics of the carcass. In the normal marketing of these classes, therefore, little or no importance is attached to this factor. The standards consist of six grades of calf and veal, namely: prime, choice, good, commercial, utility and cull. Grading is done according to standards that are formulated on much the same basis outlined for beef. In comparison with beef, however, calf and veal have considerably smaller quantities of fat over the outside of the carcass and practically no marbling within the muscles even in the higher grades. Conformation required for each of the grades of calf and veal is comparable to that required for beef of corresponding grades.

Lamb and Mutton.—In the marketing of carcasses and wholesale cuts of ovines (sheep), the class determination is based largely on de-

gree of maturity or age of the animal at time of slaughter. Because age markedly affects meat flavor, carcasses of sheep and lambs are divided into three classes—lamb, yearling mutton, and mutton. The proportion of the total supply sold as lamb far exceeds that included in the other two classes.

Lamb carcasses are produced from animals of less than about 12 months of age. They are distinguished from yearling mutton and mutton carcasses by their general conformation, which usually is more compact and blocky, by their smaller, redder bones, especially the ribs and shanks, and by the presence of a so-called "break joint" on their front shanks. The color of their flesh tends to be of a lighter red color than that of the other age groups.

In market channels, lambs as a class are further divided into three more or less specific groups. These are hothouse lambs, spring lambs, and fed lambs. Most hothouse lambs are born in the late winter and, as a result of very special care and management, are made ready for market before or by the Easter season. The supply of these lambs is very small and the demand for them is limited largely to a very restricted outlet in a few large cities, mostly in the East. Hothouse lambs are usually dressed by leaving the head, pelt, and pluck (heart, lungs, diaphragm, and liver) attached to the carcass.

A spring lamb is one that is born in the winter or early spring and marketed at an age of about 5 to 7 months. Most of these lambs are produced in the general farming sections and in California and Arizona where winter shelter and excellent early spring grazing are usually available.

Fed lambs are lambs which have been fattened on grain or other concentrates before being marketed for slaughter. Most of them are born in the spring in the range country of the Rocky Mountain and Western states where pastures are generally insufficient to fatten lambs to a satisfactory slaughtering condition. These lambs are shipped off the range in the fall and are sent to feed lots where they are fed for a period of two to four months before being sold for slaughter.

Yearling mutton carcasses are from animals of about 12 to 24 months of age. They are distinguished from lambs by their rather long, angular conformation, their somewhat dark flesh, and their whiter, flatter ribs and longer, whiter shanks. They may or may not show a break joint.

Mutton carcasses are identified by their white hard rib bones and shanks, dark flesh and the absence of the break joint on the front shank. Instead of the break joint such carcasses have a so-called "round" or "spool" joint. This is the functional pastern joint at which the foot must be removed after the ossification of the break joint.

Official United States standards for grades of lamb carcasses, yearling mutton and mutton carcasses include six grades. They are prime, choice, good, commercial, utility and cull. Carcasses and wholesale cuts of the higher grades are very compact, thickly fleshed, and full in all parts. They are required to have rather extensive fat covering. Carcasses in the lower grades are angular and irregular in their conformation, have little, if any, fat covering and their flesh is usually quite dark. Within each age group, carcasses that show evidence of being from comparatively young animals will grade slightly higher than carcasses from older animals of equal finish.

In the wholesale meat trade, mutton carcasses are sold in the form of wholesale cuts to a much greater extent than lamb carcasses.

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4. MEAT PACKING. The American packing industry is the outgrowth of three unique factors: (1) enormous grazing and agricultural areas available for raising and feeding meat animals; (2) the remoteness of these areas from main areas of consumption; and (3) a large urban population of industrial workers who require substantial quantities of meat.

It is a tribute to the vision of the pioneers of the contemporary American meat industry, men like G. F. Swift, P. D. Armour, and George H. Hammond that, as early as the 1870's, they realized the possibilities of large centralized slaughtering and meat storage operations in the great rail centers of the country. Their courageous formula of operation, which has had much to do with the development and the present world preeminence of the American livestock industry, was to buy for spot cash, at any time, all the livestock the grower chose to offer. The packer assumed the risks of finding a market for this meat, and of storing the surpluses produced in the months of heavy livestock runs for distribution during the months of lighter supply. This policy, requiring at certain seasons enormous amounts of bank credit, has made American livestock as instantly convertible into cash as a government bond.

Meat packing is a fast-moving, exciting and often baffling business—a middleman operation depending upon 4,500,000 American livestock farmers and ranchers for its raw material. It sells its product to about 350,000 retail meat outlets and restaurants which in turn supply the daily needs of 145,000,000 consumers. Due to changing crop and livestock supply conditions and to changes in consumer purchasing power the industry's pattern and tempo of operation are never quite the same from year to year. In the modern phase of its development from the 1870's through the first two generations it was probably more of a family business than any other great contemporary industry in the United States. The many quick and far-reaching decisions as to the daily purchase of livestock and the sale of product were best handled by owner managers. Each business in its earlier stages required hard and long application and an *esprit de corps* best furnished by members of a family. With the advent of the third generation, family control and management is no longer quite so general.

Functions of American Meat-Packing Industry.—The basic functions of the American meat-packing industry can be summarized:

(1) It takes all livestock offered by growers at any time for cash.

(2) Slaughters and subdivides carcasses into cuts required by retailers and consumers.

(3) Prolongs usability of meat through refrigeration, curing, smoking, cooking, and canning.

(4) Stores a portion of the meat produced (mainly pork) in freezers to carry it from the winter period of surplus production to the season of underproduction in the summer and early fall.

(5) Processes part of the meat into palatable

consumer products such as hams, bacon, sausage, canned meats, and lard.

(6) Distributes meat products under refrigeration to 300,000 retailers throughout the United States and in foreign countries.

(7) Saves all byproducts for transformation into such important products as leather, soap, glue, animal feeds, fertilizers, and pharmaceuticals such as insulin, liver extract, adrenalin, pituitrin, thyroid extract, and many others.

Historical Development.—There were no domestic meat animals on the American continent when Europeans first discovered it. Cattle, hogs, and sheep were imported from Europe by the early explorers and settlers. Hogs were generally permitted to roam wild (as they still do in some parts of the United States) and were rounded up and even hunted with muskets when needed for food.

The first evidence of an organized meat-packing industry in what is now the United States appears in the taking over of some of the British trade in salt pork with the West Indies by New England farmers during Cromwell's revolt and rule in England—less than 50 years after the landing of the Pilgrims at Plymouth. The first person known to have entered the business commercially was a Captain John Pynchon of Massachusetts, who between 1662 and 1683 slaughtered and barreled large numbers of hogs. Beef was also packed in the early days, as was venison and even bear meat. This was the beginning of the American meat-packing industry, so named because in its early stages it occupied itself chiefly with salting and packing its products into barrels —the only method then known by which meat could be preserved and transported.

About the year 1795 there came a new spur to livestock production in the United States. "Mad Anthony" Wayne had finally routed the Indians near where Toledo stands, thus opening Ohio and the Ohio Valley to safer settlement and farming. The collapse of the Whisky Rebellion in western Pennsylvania tempted corn farmers there to put more of their corn into hogs instead of hogsheads. Settlers moving into the fertile lands beyond the Alleghenies raised livestock in rapidly increasing numbers. By 1830, Cincinnati, centrally located in this region, had developed into the country's first packing center. It was even known as "Porkopolis" and shipped its barreled pork by water and later, by rail all over the country and in export. But fresh meat, one of the most perishable of commodities, could be transported to eastern cities, to supplement the local supplies, at that stage only by driving the animals hundreds of miles, or later, by rail shipment to the points of consumption. No one had as yet thought of the refrigerator car.

In those early days, meat packing was almost solely a winter operation, because frost was needed to chill the carcasses and keep them from spoiling. American ingenuity, however, soon introduced ice for refrigeration. Early packing house coolers were so constructed that enough ice could be stored in great decks above the coolers to last until the next ice crop was available.

Cincinnati reached its zenith as a packing center in the 1850's. Thereafter, the center gradually shifted to a younger city at the head of Lake Michigan, Chicago, which was rapidly becoming the metropolis of an agricultural valley of unrivaled fertility. The Civil War, with its large requirements of meat supplies for the Northern armies, was a great spur to livestock production in the upper Mississippi Basin. In the decade of the 1860's, Chicago became the country's and the world's greatest meat-producing center—a position it retains today.

The reasons for Chicago's pre-eminence were not far to seek. Location had made it a great natural railway center whose radiating lines could bring in vast quantities of livestock, and readily distribute meat products. Situated on the easterly side of the country's principal livestock-producing section, it was in the direct line of movement to the east. The concentration of the packing industry in Chicago, and later in other rail centers farther west came in an era when railways furnished the only reliable means of year-round transportation.

With the development of the motor truck and paved roads after World War I, together with cheap long-distance telephone service and radio to spread market information and facilitate trading, a process of decentralization occurred in the industry. Three hundred thousand miles of paved highways now permit farmers to market their livestock at centers nearer their farms and in smaller lots than was feasible when carload lots had to be assembled for shipment to distant markets. As a result, packing houses have followed the livestock into the country, as witness the development of interior plants throughout the corn belt. More recently, numerous packing houses have been constructed in the south, a region which in the second quarter of this century witnessed a great increase of livestock raising. This again stimulated the early method of buying livestock directly from the producer, as contrasted with the buying through commission houses at the great central markets, characteristic of the industry's "railway age." The movement toward decentralization is now reaching a state of balance with the central market buying. Historically, the packing industry has moved as close to its livestock as prevailing conditions have permitted in order to diminish the large freight costs and losses incident to moving live animals.

Livestock Buying.—The meat-packing industry buys its livestock in five ways: (1) At the public stockyards in the large central markets; (2) by direct purchase from the farmer at the packing house or at the packer's country buying station; (3) from dealers located at country points to whom farmers have sold their livestock; (4) in auction rings run either by individuals or farmers' associations; (5) by sending their buyers to farms and ranches to buy livestock there from the producers.

The great central markets located in the country's larger cities are also known as terminal markets or public stockyards. Official United States Department of Agriculture data on livestock receipts are based on the activities of about 70 of these terminal markets. The Chicago market receives the greatest number of cattle, with Kansas City, Omaha, Sioux City, and East St. Louis next, in the order given. Chicago also receives the greatest number of hogs, with East St. Louis, South St. Paul, Indianapolis, and Omaha runners-up, in that order. The largest calf receipts are at East St. Louis, with Fort Worth, South St. Paul, Milwaukee, and Jersey City next. The greatest number of sheep are received at Denver livestock yards, with Fort Worth, Kansas City, and Chicago next, in that order.

Central Markets.—Livestock sent to terminal markets is generally consigned to commission firms who represent the seller and who operate under the supervision of the Federal Packers and Stock Yards Act. Yardage, weighing, and commission charges are deducted from returns made to the seller. Anyone may purchase livestock on these open terminal markets. The principal purchasers are packer-buyers, who buy for their local packing house or for reshipment to company packing houses in other cities, and order-buyers who represent packers located in other cities. In some instances, such packers may have their own buyers on the market. Each buyer purchases what he pleases.

Direct Buying.—Under the direct selling method, the packer holds himself in readiness to purchase at his packing plant or outlying buying stations whatever livestock the farmer chooses to bring in. The farmer pays no yardage commission nor weighing charges under this method of selling.

Dealers.—Dealers owning livestock may sell it to the packer under any of the methods mentioned above, but generally they deliver it to the packing house or to the packer's country buying station. Packer-buying stations have greatly increased in recent decades due to increasing competition for livestock.

Auction Markets.—Livestock auction markets have also increased in number during recent years. Latest available figures (1948) indicate that there are about 1,200 of these markets of which 900 are located in the corn belt.

PACKING HOUSE OPERATIONS

Because of the perishability of meat, modern packing houses consist largely of refrigerated and air-conditioned rooms. All packing house products, with the exception of canned meats, must be held constantly under some degree of refrigeration, ranging from 10° to 20°F. below zero up to around 50°F. above zero. This entails expensive construction including heavy costs for insulation and refrigeration.

Slaughtering Operations.—General meat packers handle all four species of livestock—cattle, hogs, calves, and sheep, though many smaller concerns handle only one or two species. Hogs and cattle require separate dressing lines; calves and sheep are often dressed on the same dressing line, but at different times. All livestock is killed by severing the blood vessels of the neck, generally while the animal is hanging head down. Cattle are first stunned so as to permit their being handled. Since bleeding is very rapid, the animal loses consciousness rapidly, probably in a few seconds.

All species are eviscerated on the dressing floor. Cattle are split down the middle of the backbone into sides; calves and lambs are not split. The hides of cattle and the pelts of sheep are removed. The calf skins are not removed until after the animal is thoroughly chilled and often not until it is in the retailers' hands. Hogs are not skinned; instead, they travel through a long scalding tub in which water at 140°F. loosens the bristles from the skin. They are then run through mechanical dehairing machines where steel scraping blades attached to flexible revolving belts remove practically all the hair from the carcass. The hog is then hung by its hind legs on a spreader trolley which is placed on the rail on which it is moved slowly forward by an activated chain. This moving chain was probably the first application of the principle of line production (that is, moving the product past the operator) in the United States and perhaps in the world (Henry Ford states in his autobiography that he got the idea of his assembly line for manufacturing automobiles by inspecting the "disassembly" lines of the meat packers).

Removal of fine hairs still remaining on the hog carcass is accomplished either through shaving with knives or through immersing hog carcasses momentarily in melted rosin. The coating of rosin, which cools promptly, when stripped from the carcass carries with it all the remaining hair. The rosin is reheated, strained, and used again and again. Hog-dressing lines can be run at varying speeds, but 600 hogs per hour is the highest speed permitted by the Meat Inspection Division of the United States Department of Agriculture.

All hog-dressing operations are performed as the hogs move head down past the workers. After evisceration and removal of the head, the carcasses are split down the backbone. A wide-bladed cleaver is used after its path has been marked with a portable circular saw. The split must be exactly in the middle in order to leave an equal amount of backbone on each pork loin. Thereupon follows removal of the leaf lard from the carcass. This rich fat overlying the kidney is used in larger plants for manufacture of neutral lard, an ingredient found in some oleomargarines.

After dressing operations are completed, all species of livestock are immediately run on rails into chill rooms in which the air is sharply refrigerated either by sprays of chilled brine or by unit coolers through which the air is drawn by mechanical blowers. The more rapidly the carcasses are chilled (without freezing them) the less the later spoilage and the better the bloom (bright pink color) of the meat. In modern chilling rooms all species of livestock except heavy cattle can be sufficiently chilled (to an internal temperature of 34° to 38°F.) within 18 to 24 hours to permit shipping or cutting.

Cutting Operations.—All except the lower qualities of calves, sheep, and lambs are sold in fresh condition. Most of them go to the retail trade in carcass form, but many packers are willing to break these carcasses, that is, cut them into their primary parts so that the retailer may buy only the parts he needs for his trade. These "primal parts" for veal and lamb are the legs, the loin, and the rack or forequarter.

Beef carcasses, after chilling, are rolled on high rails into sales coolers where they are graded and marked by packers or government graders. In abattoirs located in cities many buyers come to the meat-packing plants and purchase their beef "on the rail" but most beef is quartered by cutting each side in two, and shipped to packer branch houses for sale, or shipped to the packer's customers according to numbered specifications printed in packers' price lists. Much beef is broken into primal cuts by the packer for the convenience of retailers. These main cuts are the round, loin, rib, chuck, and brisket.

For grades of market beef, veal, pork products, mutton, and lamb, see MEAT, MARKET CLASSES AND GRADES.

Curing.—Just as primitive man discovered that his meat would keep longer in chilly weather he probably discovered that prolonged soaking in salt water had a preservative effect. Chilling and

salt-curing are still the most extensively used methods for maintaining or improving the keeping qualities of meat.

Probably 95 per cent of all meat cured by the packing industry consists of pork cuts including hams, bellies, picnics, pork shoulder butts, and certain fat cuts. The other 5 per cent consists of certain beef cuts which are salted and made into dried beef.

There are three methods of curing—dry salting, dry curing, and pickle curing.

The rougher, heavier bellies, fat backs, and plates are subjected to dry salting, which involves their being packed in salt and piled in the curing cellar to a height of about three feet; the salt gradually penetrates and preserves the meat.

In the dry-curing process (a very accurate and delicate cure used primarily on better grades of bacon) fixed quantities of curing ingredients are sprinkled over the bacon bellies as they are packed tightly into a covered metal box and left to cure in their own juices for about three weeks.

In sweet pickle curing, which is used primarily for hams and picnics, a new method of cure was introduced during the 1940's. These joints are now injected with a brine curing solution through a tube clamped to the proper artery. The brine is forced under pressure into the capillaries where it instantly reaches every minute part of the cut, thus greatly expediting the cure. After the joints have been "pumped," they are placed in mild brine for not less than ten days to allow the curing ingredients to take effect and impart a cured flavor. Hams and picnics which under former methods were kept in cure for from 20 to 80 days (depending upon size), can now be turned out in 10 to 15 days and with milder salt flavor than before.

Smoking.—This interesting preservative process undoubtedly originated when primitive man attempted to preserve his meat by drying it over a slow fire. He soon found that only cured meat could be handled in this way without spoiling, and, also, that the smoke of hard wood not only helped preserve the meat but imparted a warm brown color and a delicious flavor. Today this process still is used to give hams, bacons, and many sausage products their final attractive color and tang. Smokehouses of varying sizes are used, some holding as much as 50,000 pounds of meat, with heat, humidity, and smoke conditions accurately controlled.

Sausage.—There can be little doubt that sausage was a familiar product in the early civilization of man. It is mentioned by the Chinese and the Chaldeans many centuries before the Christian era. From the time of the Greeks, sausage has been a staple food. Its development is due largely to the fact that salting, spicing, and stuffing meat particles into a protective casing was found to be another admirable way to preserve meat; but spicing also permitted the creation of many fine blends of flavor. Many nationalities have contributed to this important development. The Italian people, on account of their warm climate, originated many of the so-called "summer sausages" which, made and dried in cooler seasons, could be kept into the summer. The Germans had much to do with the development of the so-called fresh or domestic sausages such as frankfurters, pork sausage, liver sausage, ham sausage, and headcheese.

Sausage is such an important product of the meat-packing industry that its manufacture constitutes a large-scale business in itself, requiring exact technical knowledge and expert handling. Sausage making is really a branch of the culinary art and has in many plants reached a high degree of excellence. High-speed grinders, choppers, and mixers are required to comminute and blend the various meats and spices. This meat batter is then placed into vertical cylindrical stuffers and put under pressure of a pneumatically activated piston. When nozzles over which the casing has been pulled are opened the meat flows into the casing.

Different sausages undergo varying treatment after that. Some, like pork sausage, are promptly packed and sold fresh. Many others are smoked for a number of hours, and then cooked in hot water showers to complete the heating process. The so-called dry or semidry sausages are smoked for periods ranging up to several days and are then hung in air-conditioned rooms for drying, some varieties for several days, others for many weeks.

The popularity of sausage is indicated by the fact that in 1947 approximately 1,600,000,000 pounds were produced in the United States under federal inspection. This was probably only one half of the total, since an equal quantity was produced for sale within the states under state and local inspection laws. Sausage manufacture enables the meat packer to utilize wholesome material which would otherwise have to be marketed in a form less pleasing to the appetite, thus adding to the variety of nutritious meat protein foods which can be placed on our tables. Most of the time, the sale prices of sausage products are below those of the principal cuts of meat, such as steaks, chops, and roasts.

Canning.—The final method of preserving meat is through canning, a process not perfected until the 19th century. Various types of meat and sausage are hermetically sealed in cans under some vacuum, often at the rate of 150 cans per minute. The cans which drop into metal baskets are then locked into steam chests called retorts, where the contents are sterilized at temperatures ranging from 220° to 250°F. After cooling with water in the retorts the cans are dried, labeled, and boxed. Since canned meat is sterilized it requires no refrigeration and will keep for indefinite periods. Among the most popular canned meats produced by the meat-packing industry are luncheon meat, chopped ham, corned beef hash, chili con carne, frankfurters, and pork sausage.

Marketing and Distribution.—States west of the Mississippi produce about three quarters of the nation's meat but consume only about one third. Consequently, meat and meat products move eastward and westward from the corn belt in large quantities. More product is now shipped to the west coast than before World War II, because of the rapidly increasing population in that region.

Meat packers sell their products out of the packing house or out of their branch houses in three different ways: through house salesmen, foot salesmen, and peddlers. Large buyers, such as chain stores, other packers, jobbers, and sausage manufacturers are generally handled by the first method. Foot salesmen bring or send in orders from the larger independent meat markets and restaurants. Peddlers who carry bulk stocks of manufactured goods like sausage, smoked meats, and boiled hams in refrigerated trucks serve the smaller buyers, such as small meat markets and

delicatessen stores, whose orders are too small to be put up and delivered separately.

Delivery is made by meat packers either from the packing house or from branch houses, of which the larger packers have over a thousand located in most cities of 20,000 and over. Packers use either their own or hired refrigerated motor trucks for deliveries within trucking range. For points beyond, refrigerator cars are used to serve the car-route salesmen and branch houses. The territories of several salesmen are often served, as the car is partially unloaded at various points before reaching its final stop. Merchandise is promptly delivered to retailers by local draymen.

Intense competition prevails in selling meat products. As many as 15 packer salesmen may call on a metropolitan retailer each week—perhaps somewhat fewer in smaller cities and towns. The industry extends credit to its customers for an average period of two weeks, which, in periods of high prices, may aggregate $250,000,000 for the entire industry.

Economics of the Industry.—Any attempt to depict the American meat-packing industry should include a discussion of its economics. Few other industries have quite the same set of economic conditions to deal with. The supply of livestock available to the industry varies from year to year with the amount of feedstuffs farmers have on hand, for beef and pork are merely corn and forage promoted to a higher level through the chemical laboratory of the meat animal. Large corn crops unfailingly encourage livestock raising; small crops curtail it. Except as feed for livestock, 85 per cent of American corn has no value, and little of it leaves the county in which it was grown until it has been converted into livestock, poultry, or dairy products. While a shortage of feed may not immediately decrease livestock numbers, it has a prompt effect on the weight of the animals, with much the same effect on the meat supply.

The first point of economic interest is, then, that the meat-packing industry has no control over its supply of raw material. Here it contrasts with the numerous industries which acquire their raw material in accordance with their ability to sell their products. The packer cannot regulate or even predict the flow of livestock to market because each of the 4,500,000 livestock farmers in the country markets his stock when he pleases, and because livestock in contrast with all other crops (except poultry) may be marketed in any stage of maturity.

In the next place, because livestock and meat are highly perishable, all livestock coming to market must be promptly bought and dressed by the packing industry. From 75 to 80 per cent of the meat produced must be sold, distributed, and eaten within a week or ten days. Meat and livestock must therefore be defined as perishables in uncontrolled supply which economists (and meat packers) say must be sold for what they will bring. Uncontrollability is really the important factor. Bread is a perishable, but it is stable in price because it is produced only as needed. It is in controlled supply. Perishables in controlled supply are in an economic sense not perishable at all, but partake of the economics of nonperishables. But meat is like fresh fruits and vegetables in that its price level must be such that the available supply moves into consumption before spoilage sets in.

The next point of economic interest is that lean meat enjoys a highly elastic quantitative demand. Here again it contrasts with bread, which people buy in rather stable quantities irrespective of its price. The appetite of the American people for lean meat has apparently never been satiated. Packers know that people will eat as much meat as they can afford, and that, if the price were too low, stocks would be promptly depleted and many people who wanted meat would have to do without it. A relatively slight reduction in meat prices has a promptly stimulating effect upon demand; conversely, price advances progressively reduce consumption. In other words, the American housewife buys meat, not so much by the pound as according to the money in her purse.

The relationship between the national buying power and meat prices has recently been the subject of much research. It is an interesting fact that in recent years the retail value of meats and lard has ranged between 6 and 6½ per cent of the national disposable income.

Cost Finding.—Most industries assemble their products and arrive at their final costs by adding up the components entering into the finished article. The meat-packing industry starts with live animals of known cost and then proceeds to disassemble them into many cuts and byproducts, all jointly and inseparably produced. This gives rise to a special byproduct or group cost problem. Packers have found no formula under which a true cost can be placed upon individual pork products because of the fluctuating values of the many other products to which they are related. Moreover, in the fresh-meat trade, market value takes precedence over costs which are useful primarily as a guide to future buying operations.

Industry Statistics.—The packing industry involved in 1947 a capital investment of about $940,000,000. On the basis of the latest census figures, it employed 250,000 people with an annual payroll of $887,000,000. For many decades the dollar sales per year were the highest of all American industry. In latter years, due to the upswing in steel and automobiles, it has vied with them for top position. Production for all branches of the meat industry (not including country butchers and farm slaughter) in 1947 amounted to about 21.2 billion pounds of meat and 2 billion pounds of lard, an average of 58 million pounds of meat per day. This meat was produced by more than 4,000 packing companies ranging from a number of very large concerns doing business on a national scale down to small establishments employing only a few men and doing only a local business.

The meat-packing industry is extremely competitive, as is evidenced by the fact that its profits over many decades have ranged from one to one and one-half cents per dollar of sales. This profit, amounting to only a fraction of a cent per pound of meat sold, is an imperceptible factor in the price paid for meat by consumers. The packing industry, moreover, returns a greater percentage of the consumer's meat dollar to producers of its raw material than most other agricultural processing industries. In July 1948, this return to producers was 73 per cent, whereas poultry and eggs returned 71 per cent, dairying 61 per cent, all fruits and vegetables 36 per cent, and bakery and other cereal products 29 per cent.

OSCAR G. MAYER,
President, Oscar Mayer & Co., Chicago.

MEATH, mēth, Eire, county in the province of Leinster, with an area of 577,824 acres. It is bounded by the counties of Louth, Monaghan, Cavan, Westmeath, Offaly, Kildare, and Dublin and by the Irish Sea. The county town is Trim, and the main rivers are the Blackwater and the Boyne. The Royal Canal passes near the southern border. Most of the land is very fertile, being favorable for the principal crops which are potatoes, turnips, and oats. The chief occupations, in addition to farming, are textile-making and stock raising. There is no good harbor despite the seacoast, although the rivers provide both trout and salmon. Meath was made a county during the time of Edward I, but its boundaries were not fixed until much later. Two of the noted landmarks are the ancient round towers at Kells and Donaghmore. The royal palace at Tara, the monasteries of Duneek and Clonard, and the fort at Trim are other distinguished relics of the section's long history. Pop. (1943) 65,298. Consult Healy, John, *History of the Diocese of Meath* (Dublin 1908).

MEAUX, mō, France, a town in the department of Seine et Marne, located 28 miles northeast of Paris, on the right bank of the Marne River. It is famous for its beautiful setting and many notable church buildings and castles. Meaux has been the seat of a bishopric since 375 A.D. The Cathedral of St. Etienne, built from the 12th to the 16th centuries, contains the tomb of Jacques Bossuet (q.v.), bishop of Meaux and a renowned orator. The ancient episcopal palace dates from the 13th to the 16th centuries. The town has been in existence since Roman days when it was the capital of the Gallic tribe of Meldi. It was besieged in the 15th century by Henry V of England and became the first Protestant town in France. During World War I it suffered from the German drive toward Paris, although the enemy was stopped here and turned back to the Aisne. Again in World War II it became the scene of fighting and was occupied by Germany until the liberation of France in 1944. Pop. (1946) 13,030.

MEBANE, North Carolina, a village located in both Alamance and Orange counties, altitude 678 feet, situated 23 miles northwest of Durham, and served by the Southern Railway. Founded in 1854 by Frank Mebane, it became an industrial and tobacco market town and the trade center for a large farm area. In addition to having the oldest furniture factory in North Carolina, its other manufactured goods include mattresses, bedsprings, and cotton yarns. The annual Six-County Fair is held each fall at Mebane. Pop. (1940) 2,060; (1950) 2,068.

MECCA, měk'ä (Arab. *Makkah*), Saudi Arabia, the holiest city of Islam, capital of the territory of Hejaz, located about 45 miles east of its Red Sea port Jidda with which it is connected by road. The Mohammedans called the city Umm-al-kora, meaning "Mother of Cities," deriving its sanctity from having been the birthplace of Mohammed. Mecca is situated in a narrow, sandy valley, enclosed by barren hills from 200 to 500 feet high. Jabal Khandama, with a height of about 3,000 feet, is located nearby. After heavy rains the water flows down from the hills into the city, often filling the streets with water.

Ancient walls barred the valley at only three points where gates led into the city. Its early importance came about because caravans crossing the desert used Mecca as a stopping place on the well-traveled incense routes. In addition, even before the time of Mohammed, it was also a holy shrine of pilgrimages, where religious festivals were held at various places in and around the city. After the people of Medina refused to recognize Mohammed as the new Prophet, he made his followers turn toward Mecca as the holy place instead of Jerusalem. In every mosque, the house of worship for Mohammedans, there is a niche in the direction in which Mecca lies, toward which the faithful look as they engage in their daily prayers.

The great mosque of Mecca, with its courtyard and colonnades, occupies a central square which divides the city into the northern upper and the southern lower towns. Lively bazaars almost surround the mosque and also occupy the smaller streets. Between pilgrimages, the university hall in the mosque is used for lectures on law and science. Streets are wide and unpaved, and the stone houses are often three stories high. The city is large enough for more than three times its normal population in order to provide room for the pilgrims, as apartments in almost every house are rented to strangers. During three or four months of the year Mecca is the greatest market in the East. Since idolatrous ages, visitors have been the source of wealth for local inhabitants, who are largely settlers or children of settlers, attracted by the opportunities for prosperity. The sherifs of Mecca, who are the descendants of Mohammed, became a numerous and wide-spread group. They wear the same costume, priding themselves on the green robe which is the identification of their heritage.

The colleges of Mecca have fallen into decay, and vast libraries which once existed have disappeared. With the exception of the mosque, there are no outstanding buildings in the city. The waterworks were constructed in 1571 by Sultan Selim II. With a strange combination of color and shabbiness, Mecca is one of the famous places of the world.

History.—The markets around Mecca attracted travelers of several tribes from many countries. Ideas were traded as well as articles, and a religious center developed in which beliefs could be exchanged. After Mohammed returned as master in 629 A.D., Mecca became primarily a religious center, with the Kaaba as the holiest site. Merchants with their caravans across the desert were secondary to the great hordes of worshippers who came to pay tribute at their holy city.

Fairs were held at varying distances from Mecca, toward which the travelers advanced until they reached the religious center. The calendar for religious ceremonies was arranged so that they coincided with a time when food products and merchandise could be sold. The people of Mecca and surrounding places flourished as a result of these annual trades. Despite the fact that the geographical location was largely desert, there was very great prosperity. Under the name of religion, commerce and business expanded. The merchants of Mecca, with the impetus of Islam, built a real empire, for all the smaller

markets and fairs were secondary to the location of the Kaaba. In the peak era, gems, drugs, silks, and other valuable commodities were brought from every corner of the Mohammedan world. This was followed by periods of war and strife, when Mecca was finally taken by the Carmathians in 930 A.D. The greatest loss was the sacred black stone from the Kaaba which was not regained for many years. The Egyptian influence which spread across the area was at its strongest in the 13th century. With the Turkish supremacy in 1517, additions were made to the temples and the sanctuaries. The Turkish authority lasted almost continuously until World War I, despite the Wahhabis (q.v.) and their movement for the reform of Islam. King Husain of the Hejaz overthrew the Turks in 1916, and since 1924, when Mecca became part of Saudi Arabia, has been ruled by its king, ibn-Saud.

The Kaaba.—The Kaaba has been the main worship place of Mecca since before the time of Mohammed. Abraham and Ishmael were supposed to have built it after a divine revelation. Later the traders from foreign lands brought their idols and established them here. Mohammed threw out the idols and made it the Moslem shrine. The Kaaba is a stone building with a door about seven feet from the ground. Although there are no windows, older historians have described it as having five, made of stained glass. The principal object is the black stone which Gabriel gave to Abraham and survived the period of idol-worship. Pilgrims arriving at Mecca kiss the stone as their first obligation. The Kaaba has many sacred corners for worship and dedication. One place is the legendary spot where Abraham stood when he built the temple. In the time of Mohammed the outside walls were covered with a striped cloth, and pilgrimages continue to bring coverings of embroidery and brocade. It has had many beautiful articles of decoration, such as silver doors and lamps, although many of them are gone. There is a well that tradition says was the source of the water with which Hagar baptized her son Ishmael. (See KAABA).

Pilgrimages to Mecca.—The last of the five pillars of Moslem faith is the obligation to make a holy pilgrimage to Mecca and Medina. Every person, faithful to the religion, must perform this duty at least once during his life. The pilgrimage takes place annually at a specified time, serving to develop a feeling of solidarity among the Moslems. People of all races and of varying degrees of poverty and wealth meet on an equal basis in their common devotion, for Islam does not recognize any barriers of race, nationality, or color. Women are permitted to make the journey as well as men. The pilgrims converge mainly from three directions. Those coming from the south are Mohammedans from Java, Sumatra, Indochina, India, and Iran, who pass across the Red Sea and on to Jidda, the port of Mecca. The northern group are from Asia Minor and Turkey, who go to the holy city by both land and sea routes. From the west, Egyptians, Moroccans, Algerians, and Tunisians reach Jidda through the Suez Canal. During some years more than 40,000 have passed through the canal on the way to Jidda. Throughout the pilgrimage a seamless garment must be worn, although a new one is put on before entering Mecca. No person is allowed to shave. or cut his hair or nails, or shed blood, or uproot any plants.

Arriving at Mecca, he must pass seven times around the sacred Kaaba and seven times between two adjacent mounds. On the way to Mina, which is outside Mecca, in the name of Allah he throws seven stones at the devil at each of three pillars. At Mina he also sacrifices a camel and a sheep, or some other horned domestic animal. The sacrifice falls on the tenth day of the month, which is celebrated throughout the Islam world as the Feast of Sacrifice. When a Moslem has completed the pilgrimage with all its many ceremonies, he is permitted to place the title *hadji* before his name. During the 20th century, between the two world wars, the average number of pilgrims was about 172,000 annually. Pop. (1946 est.) 120,000.

See also ARABIA; KORAN; MOHAMMED; MOHAMMEDISM; MOSQUE.

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MÉCHAIN, mā-shăn', **Pierre François André,** French astronomer: b. Laon, Aug. 16, 1744; d. Castellon de la Plana, Spain, Sept. 28, 1804. He became a mathematical tutor and also devoted himself in free time to the study of astronomy. In Paris he gained the interest of the famous French astronomer Joseph Lalande (q.v.), who assisted him in getting a government position where he was engaged in the survey of the French coast and in astronomical observations. In 1782, Méchain was elected a member of the Academy of Sciences; in 1785 he became editor of *Connaisances des Tempes,* in which were published some of his most valuable scientific papers. The National Convention in 1791 commissioned him with Jean Delambre (q.v.) to measure the arc of the meridian between Dunkerque, France and Barcelona, Spain. Their resulting calculations failed to satisfy Méchain because of a slight discrepancy. Although he was appointed director of the observatory at Paris, he persuaded the board to measure the arc between Dunkerque and the Balearic Isles. He died of fever in Spain while on the mission. His accomplishments included not only the observation but also the discovery of several planets.

MECHANIC FALLS, Maine, a village in Androscoggin County, altitude 280 feet, situated on the Little Androscoggin River. Since 1850 paper mills have been located here. Freelan O. Stanley, an inventor, was once principal of the high school and, with his twin brother Francis E. Stanley, built the early engines for their automobile, the Stanley Steamer, in Mechanic Falls. Pop. (1940) 1,999.

MECHANICAL DRAWING. See DRAWING, MECHANICAL.

MECHANICAL ENGINEERING has been recognized as a separate branch of engineering since the formation of the Institution of Mechanical Engineers of Great Britain in 1847. Previous to that time there was but one branch of engineering in Great Britain other than military engineering, represented by the Institution of Civil Engineers (founded 1818), that was concerned with engineering for civilians. The development of textile machinery, steam engines, machine tools, pumping machinery, turbines, and locomotives of that time made such a diversity of interests for civilian engineers that these and allied subjects were called mechanical engineering. A similar division into specialties occurred in the United States when the American Society of Civil Engineers of 1852 was followed by the American Institute of Mining Engineers in 1871, the American Society of Mechanical Engineers in 1880, the American Institute of Electrical Engineers in 1884 and the American Institute of Chemical Engineers in 1908, as well as a number of others with more limited activities.

Mechanical engineering deals with the design, construction, and operation of machines and devices of all kinds, and with the research and sciences upon which these depend. Among these machines are the prime movers such as engines and turbines using air, gas, steam, and water as operating media; pumping machines and other hydraulic apparatus; steam boilers; heating, ventilating, air conditioning, and refrigerating equipment; transportation structures used in aviation, automotive engineering, railroads, and ships; machine tools; special machines for industry and for the construction of buildings, roads, and harbors. In fact, mechanical engineering enters into the work of all engineers when machines are to be developed for the processes of specialists of the other branches of engineering. As mechanical engineering includes the construction and operation of its structures, manufacturing methods, management, and personnel relations are important subjects of study and research, as well as economics, statistics, and sociology because of designs calling for great expenditures of money and for the services of the public.

To understand better the extent of the activities and interests of mechanical engineers, the following lists of professional divisions and of technical committees of the American Society of Mechanical Engineers (A.S.M.E.) are given:

Professional Divisions: applied mechanics, aviation, fuels, graphic arts (printing), heat transfer, hydraulic (cavitation, hydraulic prime movers, pumping machinery, water hammer), industrial instruments and regulators, management, materials handling, metals engineering, oil and gas power, power, process industries, production engineering, railroad, rubber and plastics, textiles, wood industries.

Technical Committees: standardization committees, research committees, safey committees, boiler code committees, power test code committees. Each of these groups is under the direction of a main committee which determines the policy of the group.

Although the titles in the above lists are quite clear to most people, it will be well to examine in some detail the work of certain of them.

Machine Designing.—Production engineering has as its basic subject machine design. This includes the study of analytic mechanics, mechanisms (kinematics), properties of materials including elasticity, strength and fatigue, chemistry, metallurgy and metallography, and production. Safety methods, management and control, and psychology are also used in production engineering where devices are built to function in accordance with the requirements determined by a theoretical study of a process or product. Such problems occur when power is to be produced by a gas turbine, or a machine is developed for electric deposition of tin upon a fast-moving strip of thin steel of great length for tin sheets, or one for the generation of high pressure steam of high superheat from some type of fuel. In other cases, machine elements are to be assembled to operate efficiently and dependably in proper sequence to reap, thrash, and bag wheat from a field when operated by automotive equipment, or to fill, cap, and deliver containers with some product held in a supply chamber. For all of these problems studies must be made on materials to be handled as well as on those used in the structure and their properties, and behavior may be ascertained only by research. Models of proposed solutions are made to fix the final design and to determine data not known when the design is initiated. Machine design is used in the production of hydraulic presses of high pressure by which airplane parts, gun shells and casings, body parts for automobiles, and metal containers are formed from sheet metal. It is also used in the production of printing presses for the daily newspaper or for multicolor lithographs in which sheets or strips of paper are carried from piles or rolls at a supply station, printed, cut, folded, and piled at the delivery point without any human aid in handling.

In the design of machines the subjects of vibrations, critical speeds, stress concentration, and fatigue are of great importance.

When parts of a machine are reciprocated or unbalanced parts are rotated, vibrations may be set up which result in excessive stresses or in movements of surrounding structures which may be at some distance from the moving part. To protect the machine and surrounding structures, the cause of the vibrations must be eliminated or lessened and sufficient materials must be used at places of excessive stress. The mathematical study of the forces set up by moving bodies to solve these problems is part of subject of mechanics and the applied mechanics division of the A.S.M.E. publishes results of investigations on vibrations. Instruments have been devised to measure vibrations of machines, and determine the amount and location of unbalance so that corrections may be made and parts of machines may be balanced before their incorporation into a structure.

In rotating shafts with attached parts the amount and distribution of loads and the size of the shaft fixes certain speeds of rotation at which excessive stresses may be set up. These are known as critical speeds and the shaft diameters must be chosen so that the speed of operation is not near the critical speed. If the operating speed is above the lowest critical speed, as critical speeds have harmonics, care must be taken to prevent rupture on passing through this low value.

When changes occur in the shape of the section of a machine part, the stress distribution so varies that an excessive value may occur at a given point. This is known as stress concentra-

tion and the amount of material used near this point is determined so that the concentration does not produce a stress above the allowable working stress. By the loading translucent models of structures photoelastic pictures from polarized light give the variation of strains so that stress distribution can be known.

When a load is removed and applied intermittently or reversed a great number of times, the part is subject to so-called repeated stress and as a result the stress at which the part will fail is much less than the ultimate stress because of the fatigue of the material. Investigations extending over many years and covering different types of loading and different structural materials have fixed the safe allowable stresses to be used when repeated stresses occur. See also Elasticity; Kinematics of Machinery; Mechanics; Strength of Materials.

Fuels and Heat Transfer.—The subject of fuels includes the study and use of solids, liquids, and gases; their transportation, preparation, and combustion, utilizing scientists and other engineers for this activity. The chemistry of combustion fixes the efficient utilization of fuel to produce the maximum amount of available heat by determining the necessary volume of the combustion space, the air fuel ratio, the manner of ignition, the temperature of ignition, the production of slag, and the condition of the fuel for proper ignition. The chemical analyses of the fuels and their products of combustion give the completeness of combustion and enable one to compute the heat losses in the exhaust gases when the temperatures of these are known. Theoretical considerations fix the amount of dissociation at high temperatures. By thermocouples and optical pyrometers high temperatures are measured.

The divisions of power and oil and gas power are concerned with the transformation of the energy of the fuels in engines and turbines with steam and by internal combustion in engines, turbines, and jets. In these applications the laws of thermodynamics (q.v.) are used to determine heat transfer and the conditions for the most efficient use of heat energy. Heat transfer by radiation, conduction, and convection depends upon temperature and the properties and surface conditions of the materials from which, to which, and through which it is transferred. If heat is to be transferred though a partition, the velocity of the substances on the two sides of this wall, as well as their properties, also affect the heat transfer. In investigations for new data and for the determination of performance instruments must be available for measuring temperatures, mass flow, and velocities, as well as viscosity, density, conductivity, and other physical properties of all substances taking part in the actions.

When the fuel is used in a boiler to produce superheated steam, the mechanical engineer must know the controlling factors for the heat transfer through steam-forming surfaces wetted with water, through superheaters, through economizers, and through air preheaters. He must, in the United States, follow the rules of design prescribed in the boiler code of the American Society of Mechanical Engineers as this is law in many states. He endeavors to increase the efficiency of the boiler by reducing the losses due to the temperature and composition of the flue gases, the radiation and conduction through the boiler setting, and the heat lost through the blow down necessary to maintain the proper condition of the water in the boiler. The mechanical engineer studies feedwater and boiler water to prevent foaming, incrustation, corrosion, and the embrittlement of steel for the water side of the boiler, and he scans the readings of his control instruments for evidence of soot on the gas side requiring the operation of the soot blower.

In 1824 it was shown by Nicolas Léonard Sadi Carnot (q.v.) that in any heat engine for highest efficiency of transformation all heat should be added to the cycle at one fixed temperature, that all heat should be removed from the cycle at another temperature, and that these temperatures should differ as much as possible. In the development of prime movers for the transformation of heat energy into mechanical energy this principle has guided the engineer in his arrangement of the cycle. When the principle could not be exactly followed, the nearest approach to it was made consistent with costs. If the increased yearly cost of apparatus to make a cycle more nearly equivalent to the Carnot cycle is not equal to the yearly savings from the improvement in efficiency, the change is not justified.

One attempt to approach the Carnot cycle without excessive pressures has been the use of binary vapors in engines and turbines such as the steam and sulphur dioxide engines of Prof. E. Josse and the mercury vapor and steam turbines of William LeRoy Emmet. In the latter, mercury vapor was used to reduce the top pressure and this vapor at exhaust was used to produce steam in a boiler which acted as a condenser for the mercury vapor. The steam was superheated, used in a turbine, and condensed in the usual manner. Josse eliminated the very low pressures of the final exhaust.

The most recent developments in prime movers have been the gas turbine and the airplane and rocket jet. The gas turbine has certain advantages in weight and cost although it requires the utilization of much of its generated energy for operation. Oil and gas have been used as fuels. In 1947, investigations and constructions were being made in which coal was used as the fuel for the gas turbine.

Since the latter part of the 19th century, internal combustion engines using gas, gasoline, and fuel oil have been perfected and are the most important forms of prime movers. Research and development are constantly improving performance as well as the properties of the materials used in construction. See also Internal Combustion Engine; Jet Propulsion.

Power Plants.—The design of power plants for the production of electrical energy is such an important phase of mechanical engineering that it is advisable to examine the various elements of this design. A preliminary study is made with the electrical engineers and business executives of a system of the present and future demands for energy at or near a given territory. From the ultimate demands for a steam plant and from the types and possible sizes of boilers and prime movers, the number and sizes of the units are fixed and the ultimate space requirements are determined, including the space for fuel storage, the amount of cooling water, and the needed transportation facilities. When internal combustion engines or gas turbines are to be used, this study would fix the same quantities, while

for a hydroelectric station the study is only made after a site is selected for which the necessary hydraulic and geologic data are known. The site finally selected from available land depends on price, soil conditions for foundations, available water supply, transportation facilities, fuel cost, including freight charges, facilities for removal of refuse, land occupancy in vicinity of site, and relation of location to the energy demands of the system. The layout of the plant follows the selection of equipment to meet the theoretical requirements for efficient and reliable operation of the station. The equipment includes fuel-handling machinery and storage structures with apparatus for preparation of solid, liquid, or gaseous fuel, boilers and accessories, pumps, draft fans and motors, chimneys and flues, and instruments to control operation and measure performance. The prime movers include engines and turbines with condensers when steam is used, piping for steam and water with pumps for air and water. The piping must be erected so that expansion may occur on changes in temperature. This requires extensive calculations of stresses in parts and forces on anchors. Models of the piping of reduced scale may be used to check results or to furnish needed data. Expansion in machines as well as in piping must be permitted to prevent rupture of piping or foundations. In plant layout, traveling cranes are provided for original erection and for removal of parts for inspection or repair.

In the layout of hydroelectric power plants the study of the stream flow at a selected site covering the record of many years and the probable storage capacity fixes the prime power available throughout the year, and from financial and physical considerations the secondary power for part of the year is determined as well as the operating head. From these the number and size of the units may be fixed with consideration of the size limitations of shop and transportation facilities. From the selected size, possible speeds of the electric generators and the operating head, the type of turbine is fixed by the so-called specific speed (speed multiplied by the square root of the horsepower divided by the five-fourths power of the head). For high heads the specific speed is often low and a Pelton type of water wheel is used, while with low heads the high specific speed demands a propeller type of turbine. For intermediate specific speeds the Francis type of turbine is used. It sometimes happens that the specific speeds available and the head with the actual speed of rotation fixes the greatest power from one unit. To prevent the separation of the water from the turbine blade, known as cavitation and due to low pressure in the draft tube, the depth of water at the discharge of the draft tube below the tail-water level is made equal to a computed limiting depth. The draft tube is the conduit between the turbine and the discharge canal or tailrace. It is used so as to place the turbine at an elevated position and as a regainer of much of the kinetic energy of the water at the discharge point of the runner. Cavitation produces erosion of the blades and its occurrence must be prevented.

The design of the dam and its construction result after the study of the geologic conditions at the selected site has fixed the permissible bearing power of the soil. When the dam is a high concrete structure, this is cooled by refrigeration during construction to remove the heat generated in the aging of the concrete so as to reach a safe state before the water is impounded in the storage reservoir. Penstocks or pipes are designed to bring water to the turbines and the tailrace must be cleared to deliver the discharge freely. Studies must be made of the backwater curves above and below the station to ensure a known rise of the water at the upper end of the storage reservoir and the stream supplying it and to make certain that the tail-water level is that desired at the power plant. The backwater curves or surfaces of the streams are computed for the maximum flow conditions. To prevent damage to the dam, excess water in times of flood is discharged over a spillway designed to care for the probable maximum flow at the site. The design includes ice chutes for winter and fishways to care for fish which ascend the stream for spawning.

In fixing the number and size of units for a station, spare equipment must be installed in an isolated station to care for the outage of the largest unit; while in a system station the number and size of units are fixed by the maximum output desired, any outage being cared for by other stations. Stations with equipment of high efficiency are used as base load stations operating at full load, the changes in system load being carried by other stations. A stand-by station to be operated when failures occur in other stations or for occasional short peak loads is designed with less efficient and less expensive equipment because of its infrequent use. The few hours of use do not justify high costs.

In all central stations complete instruments and regulators are used to give records of operating conditions and performance so that improper conditions may be corrected and from which costs of production can be determined and efficiencies of various elements computed.

For the pumping of water and its distribution, large pumps, welded pipes, and canals have been designed and built. These have required the testing of models to determine the effects of changes in design and anticipated performance of the full-size project. See also ELECTRICAL ENGINEERING; HYDRAULICS; POWER HOUSES; PUMPS AND PUMPING MACHINERY; TURBINE.

Heating, Ventilating, Air Conditioning, Refrigeration.—The subjects of heating, ventilating, and air conditioning of buildings and the heating and refrigeration of materials require a knowledge of heat transfer, the properties of fluids and gases, the properties of building materials and of the materials to be stored or processed, as well as the requirements for health and comfort of persons. This division of engineering includes not only the selection of equipment but also its design, manufacture, and operation. During the period of World War II this field of engineering was greatly expanded owing to war conditions as well as for the necessity of uniform atmospheric condition for the processes of many industries.

These subjects require the determination of the heat loss or gain through partitions, walls, floors, and roofs after the application of insulating materials, and the amount of heat from illuminants, machines, materials, and occupants, and finally the necessary addition or removal of heat to maintain a required condition. This heat is transferred by conduction or radiation through conduits or radiators carrying a fluid to absorb

or deliver heat or by air in condition to effect the same result by convection. The computations are based on the results of research regarding heat transfer of surfaces and materials by convection, conduction and radiation, the heat developed by manufacturing and physical processes, by lighting equipment and machines, by materials to be stored, and by human occupants. Studies have been made to fix condition of human comfort as well as those required by manufacturing processes. The effect of the wind and the sun on heat demand has been found by research which is continuing after many years.

Although radiators for direct heating and neated air for indirect heating have been used extensively, radiant heating from fluids in pipes imbedded in partitions, floors, or ceilings is now (1947) being applied in many buildings for convenience, comfort, and efficiency.

To prevent heat loss from buildings or from pipes and ducts conveying the heating fluid, insulating materials are applied. These materials and their amounts at any particular location depend on temperature difference as well as upon exposure, velocity of the ambient fluids, and atmosphere. Their composition and properties have resulted from extensive research and design of manufacturing processes.

Control apparatus has been developed by mechanical engineers by which the temperature and humidity are maintained throughout a region in which heat demands and occupation may vary over a wide range. Not only are thermostats and humidostats employed, but valves are operated by relays so that the necessary alterations are made to the system to meet the changed conditions.

Mechanical refrigeration is accomplished by producing a low pressure around a liquid refrigerant so that it will vaporize and remove heat at low temperature and then by compression producing such a pressure that the resultant vapor in tubes will be condensed by the abstraction of heat by the surrounding water or air at atmospheric temperature. Compressors used for this purpose of maintaining low pressure in one part of the system and a higher pressure in another part are of the piston and cylinder form when the pressure difference is great and of the centrifugal form when small differences of pressure are required. At times these pressure differences are maintained by the partial pressure of a noncondensible gas in the evaporating section of the systems, and then permitting the pressure to rise by separating the noncondensible gas for condensation, or the low pressure may be maintained by absorbing the low pressure vapor by a liquor or adsorbing it by a solid from either of which it is released at high pressure by heating the resultant liquor or solid. In each of these systems the method of action is the equivalent of that first stated.

Refrigerants are supplied to heat transfer coils or surfaces for the removal of heat from materials or spaces. When the accidental escape of fluid or vapor would be deleterious to persons or materials, heat is first removed from brine by the refrigerant and the brine is circulated in the regions to be refrigerated. The piping used for circulating the primary or secondary refrigerant must be fully insulated whenever conditions exist under which heat may be absorbed by it. Not only the piping but the cooled spaces must be carefully insulated by various materials developed for this purpose. These include cork products, mineral wool, asbestos, aluminum foil, fiberglas, and flotofoam, a synthetic plastic.

To obtain the large amount of cooling water for the condensers of refrigerating systems, cooling towers are used in which the warming of air supplied by fans and the evaporation of some of the falling hot water so cools the latter that it may be sent to the condensers to continue its heat removal.

The cycles used in refrigerating machines remove heat from places required to have low temperature by vaporizing liquid refrigerants places in coils. After the vapors are withdrawn from the coils and compressed to a higher pressure, they are condensed by cooling water at atmospheric temperature. The refrigerant then repeats the cycle and is thus reused indefinitely. The heat in the water is heat from the cooling coils, plus heat equivalent to the work of compression. Such heat is usually thrown away, but in the second half of the 19th century, William Thompson (Lord Kelvin) suggested that it might be used for heating buildings in cold weather. This "heat pump" of Thompson's was never used commercially until after the first quarter of the 20th century. In these applications, heat is drawn at low temperature from the atmosphere, or from well water, by the evaporation of the refrigerant, so that this heat, plus heat from the work of compression, can be used for space heating. The cost of such heat is only that of the small amount of power used for the compressor. After installation, the same equipment may be used in summer for air conditioning by merely shifting a few valves or dampers, which interchange the functions of the evaporator and the condenser.

Ice making is one of the applications of mechanical refrigeration for which studies have been made to produce clear ice from raw water, eliminating the work of distillation. See also AIR CONDITIONING; BUILDING MATERIALS, EQUIPMENT, AND TECHNIQUES; HEATING; REFRIGERATION; VENTILATING.

Railroads.—Railroad mechanical engineering is concerned with the development and improvement of motive power, cars and the air conditioning and refrigeration of them, the elimination of friction in bearings of wheel axles, the reduction of vibration of cars, the treatment of boiler water, the improvement of combustion, the operation of shops, and the maintenance of all equipment. During the fourth decade of the 20th century the Diesel engine for motive power was so increased so that by 1945 over 3,000 Diesel units were in service. These engines were connected to generators which supplied electric energy to motors on the locomotive trucks eliminating the vibrations of the steam locomotive and giving uniform torque on starting. In 1945 steam turbines were applied by gears to driving wheel axles of a locomotive and later designs were being completed for the application of a gas turbine to the locomotive. To reduce the crank pin loads on locomotives, four cylinders were applied in place of two large cylinders.

Marine and Aviation Engineering.—Marine mechanical engineering is devoted to materials handling, fire protection, drainage, steering, water supply and plumbing, kitchen equipment, elevators, heating, ventilating, air conditioning, and refrigeration, as well as to boilers and prime movers.

The professional division of aviation is concerned with the theoretical study of flight, the design of the plane and its parts, the power plant and accessories as well as air conditioning for temperature, humidity, and pressure. The manufacturing and maintenance methods, the materials to be employed for parts and the instrument to be used for operation are all as important as the design principles used in planning. Not only are wind tunnel tests necessary but materials and production methods must be tested for suitability, accuracy, strength, and durability. Testing of finished planes or models in flight and in special maneuvers with instruments for measuring performance and stresses in various structural elements supplement the works of the wind tunnel. There are peculiar requirements for the airplane power plant which demand special study for engine, turbine, or jet. The variation of air density and temperature require special devices or materials such as superchargers, or special lubricating oils. See also AERONAUTICS.

Materials Handling.—Materials handling includes the design, construction, and operation of cranes, elevators, conveyors, traveling belts, chutes, transveyors, cableways, hoists, draglines, shovels, and excavators, car handling devices, ship loading and unloading devices, industrial railways, tractors, trucks, coal and ash conveyors, trolleys, and pneumatic conveyors. These are really devices planned by the principles of machine design after data relating to power for driving and peculiarities of operation have been determined by research. Studies must be made of the required performance and the cost and adaptability of different devices or systems by which desired results may be accomplished. See also CONVEYOR.

Wood Products, Textiles, and Metals.—The division of wood products is concerned with all steps from logging to the final product, and includes the studies of the wood during these stages as well as the machines required throughout the processes. The developments of compressed plywoods and the methods of gluing have extended the use of wood for many purposes. (See also WOOD CHEMISTRY AND NEW USES.)

For textiles, mechanical engineers not only design and produce machines for carding, spinning, weaving, and knitting but they lay out, build, equip, and operate the mills in which these machines are employed. Mill operation of the process industries require a study of management, production control, labor relations, purchasing and selling as well as maintenance and power supply. (See also TEXTILE MACHINERY.)

Metals engineering covers the construction of machine tools, furnaces, rolling mill equipment, and the instruments for control of the operations and the testing of products. Many of the operations dependent on human strength have been made mechanical. Devices for safety and human comfort have been introduced. Conditions of operation have been made uniform so that product can be predicted. The tools used in metals industries have been improved and the metallographic studies have so changed their quality that longer life of service and less power demand have been secured.

Professional Training.—To prepare for the profession of mechanical engineering one may advance from the shop through study at the company institute of many organizations, or through home study, or one may advance through practice after graduation from a four-year course in a school of engineering. In each of these cases the engineering training is based, in the United States, on the graduation from a four-year high school program, or its equivalent. The studies include four years of English, four years of mathematics, one or two years of science, three or more years of foreign languages, and electives from such subjects as science, history, civics, or music to bring the total credits to 14 or 15 one-hour courses each extending over a year. Because of the future development of the young engineer, his studies in the school of engineering, in the company institute, or in self-education should be extensive and intensive and designed to develop in him the ability to analyze and reason from known data with self-reliance, persistence, thoroughness, dependability, loyalty and the spirit of cooperation, rather than to give him merely facts from which to find solutions to problems. The training should fit him to develop ability, breadth of knowledge and judgment after the formal training is completed.

With this in view, the course of study includes a thorough grounding in mathematics through differential equations, physics, chemistry, metallurgy, English, economics, social science, and psychology to which are added subjects common to most engineering courses and special mechanical engineering subjects. The general engineering subjects so prepare the graduate mechanical engineer that he may enter one of the other branches of engineering should opportunities and conditions make such a change advisable. The success of many engineers in branches different from that from which they graduated is evidence of the value and thoroughness of the training in those general courses.

These general subjects include engineering drawing and descriptive geometry (universal language of engineering), elementary surveying, power generating machinery, mechanism, statics and dynamics of analytic mechanics, strength of materials, thermodynamics, direct and alternating current electric machinery, hydraulics, machine design, and a course dealing with engineering administration. Among the special mechanical engineering subjects from which selections are made are heat power, engine and boiler design, power plants, heating, ventilating and air conditioning, refrigeration, hydraulic power, production methods and mechanical engineering laboratory.

Free electives are open in languages, philosophy, art and archaeology, biology, astronomy, geology, and politics.

The records of the graduates of engineering schools indicate that after a few years many become supervisors or administrators rather than designers and producers, and for this reason the curriculum of the school of engineering should be planned to develop breadth of vision and the sympathetic consideration of the views of others while it trains the student thoroughly in the professional subjects which he must know to guide others under his administration.

Throughout the United States the practice of professional engineering as an individual requires a state license. This is granted by a state board upon the presentation of evidence of approved practice of engineering for eight years and the passing of an examination.

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MECHANICAL MOVEMENTS, POWERS AND APPLIANCES. The primary, fundamental mechanical contrivances are termed the mechanical powers, seven in number and all based on the principles of either the lever or the inclined plane. The common classification is the lever, wheel and axle, cord and pulley, toothed wheels (these four operating on the lever principle), and the inclined plane, wedge and screw (operating on the principle of the inclined plane). What are known as the mechanical movements (sometimes called mechanical motions) include about 750 of the more or less simple and common combinations, covering practically all the fundamental arrangements of the mechanical powers for machine building and engineering work. They constitute the groundwork which the machinist or student of engineering must master before he can make much headway in understanding the complex problems which arise in practice.

Taking first the simple lever, it is found to be of three classes: (1) those in which the fulcrum is situated between the power and the weight; (2) those in which the fulcrum is at one end of the lever arm with the weight nearer to it than the power; and (3) those in which the fulcrum is at the end with the power nearer to it than the weight.

In the first, if the weight W is nearer to the fulcrum, there is a mechanical advantage —illustrated by the crowbar, which on account of the great difference in the length of its arms is advantageously used to overcome great resistance. Scissors and nippers are double levers of this class. If the power P is nearer to the fulcrum, there is a mechanical disadvantage, and if the weight and the power are at an equal distance on either side of the fulcrum, the power is equal to the weight and gives an arrangement similar to the ordinary balance.

The distinction between the gain of power

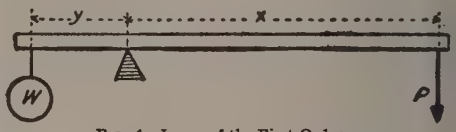


FIG. 1—Lever of the First Order.

and the loss of velocity, and the reverse of these conditions, as depending upon the position of the fulcrum, is exemplified by the shears used for cutting metal and those used for cutting cloth, respectively. In the former, short blades with long handles overcome a great resistance slowly; while in the latter, long blades operated by short handles, move quickly.

In the second class there is always a mechanical advantage. The wheelbarrow is an example of the simple lever. The fulcrum is at

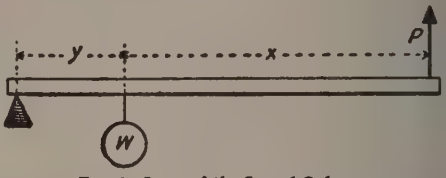


FIG. 2—Lever of the Second Order.

the centre of the wheel, the weight acts downward at the centre of gravity of the load and the power is applied at the ends of the handles. A hinged nut-cracker is an example of a double level of this kind.

In the third class there is always a mechanical disadvantage; but great rapidity of movement is obtained. The human forearm is an example of a simple lever of this class. The fulcrum is at the elbow-joint, the weight acts downward at the hand and the power is applied

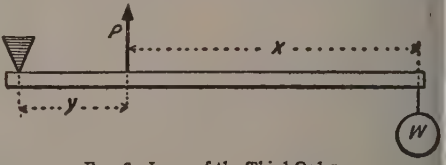


FIG. 3—Lever of the Third Order.

obliquely by a tendon from the biceps muscle attached near the elbow. A pair of tongs is an example of a double lever of this class.

The wheel and axle consists of two cylinders of different sizes rigidly connected together and turning about a common axis. The larger cylinder is called the wheel and the smaller the axle. The power is applied to the end of a rope wound around the wheel and the weight is raised by a rope wound around the axle;

see Fig. 4. The diameter of the larger cylinder or wheel being twice that of the smaller cylinder, or axle, a power of one pound at *P* will balance a weight of two pounds at *W*. This is essentially a form of lever, and «the power is to the weight lifted as the radius of the axle is to the radius of the wheel.» The principle is applicable to all forms of hoisting machines, steering gear of ships, fusee clock

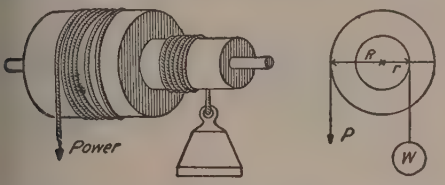


Fig. 4.

and watch movements, etc. If the axle be fixed and the wheel be loosely mounted to revolve on it, we have the ordinary machinist's loose pulley and a variety of uses suggest themselves. If the axle be fixed to the body of a carriage and the wheel allowed to rest on level ground, we find that the carriage can be drawn along with slight effort, requiring a push or pull representing only a small fraction of its weight.

The cord and pulley shows the further uses of the wheel as a lever. In the arrangement shown in Fig. 5 the upper points *F* are fixed, being virtually fulcrums; a downward pull of one pound one foot on the cord *P* will raise the weight *W*, which may weigh nearly two pounds, a half foot; it would balance two pounds but for the loss by friction.

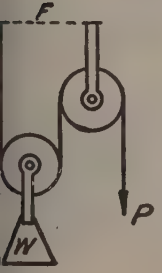


Fig. 5.

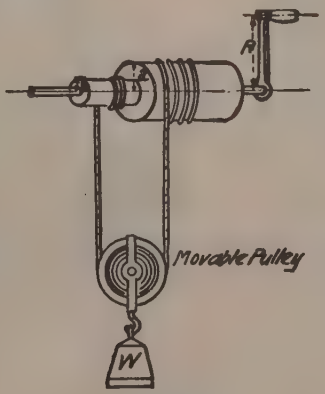


Fig. 6.

In Fig. 6 a movable pulley is shown in combination with the wheel *a* and axle *b* and a crank *R* is added. If the crank is one foot long, the wheel one foot in diameter and the axle six inches in diameter, one turn of the crank may draw up the right hand cord about three feet, and lengthen the left hand cord about 18 inches, resulting in raising the pulley and attached weight *W* 9 inches. As the crank handle has traveled about six feet, or eight times as far as the weight is raised, the leverage is 8 to 1, and a boy who can put 50 pounds of effort on the crank can raise nearly 400 pounds at every turn, and in eight turns he will raise it six feet, the distance of travel of the crank at one turn.

A very common arrangement of pulleys, called stepped pulleys, is shown in Fig. 7, as positioned for driving a lathe. The steps of the pulleys on the lathe are supposed to be 3, 6, 9 and 12 inches diameter, respectively. The belt is shown on the 12-inch power pulley and 3-inch lathe pulley, and obviously, if the power shaft is making 100 revolutions per minute, the lathe-shaft will make 400. If the belt be shifted to the next step, where the proportions are 9 to 6, the 100 revolutions of the power shaft will give 150 revolutions of the lathe shaft. On the third step 6 to 9 is the proportion and the lathe will rotate at a speed of 66⅔ revolutions; on the fourth step it is 3 to 12, and the 100 revolutions of the power shaft will give but 25 of the lathe shaft. See Pulley.

Toothed wheels, now commonly called gearwheels, illustrate another type of wheel leverage. Spur gears are shown in Fig. 8; here the smaller gear-wheel rotates twice to cause one revolution of the large wheel; thus a small wheel secures increased power at reduced speed.

In Fig. 9, the large wheel, being the driver, turns both the small wheels in the same direction, but oppositely to itself, and gives the shafts of the small wheels two revolutions to one of the large wheel. In Fig. 10 are shown bevel gears, which coact at right angles. It is apparent that almost infinite combinations of such gears are possible. See Wheel Gearing.

The inclined plane is simply a rigid fixed

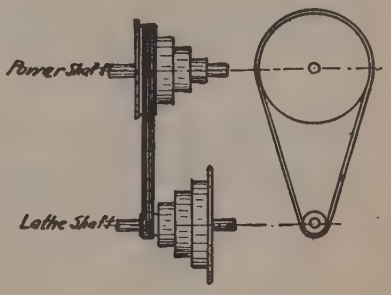


Fig. 7.

plane inclined to the horizon at an angle, and upon which a weight tends to slide down by gravity, or up the slope of which a weight may be pushed or rolled by a force usually horizontal in its action. In Fig. 11 the sliding weight would fall back if the power was withdrawn; it also shows power applied horizontally to move a rolling weight up the plane. In this latter case a continuing power of less than a pound will push a pound roller up the incline because the power has a distance greater than the height overcome in which to exert itself.

The inclined plane principle is used in rolling barrels up on a wagon, in loading logs on a sled, in the operation of a mountain railway and in the cam, which is described later. The employment of the principle does not reduce the work of lifting to the top of the plane, but extends the time of the lift, so that a smaller force used for a longer time does the work.

The screw is essentially an inclined plane wound spirally around a cylinder, in the form of an advancing groove, known as the screw-thread. A cylinder having such grooves cut interiorly like the inside of a nut is termed a female screw. The screw shown in Fig. 12 has two grooves spiraling around and is therefore double-threaded. There being eight threads to

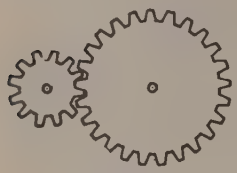


FIG. 8.

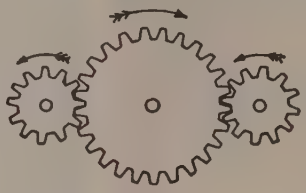
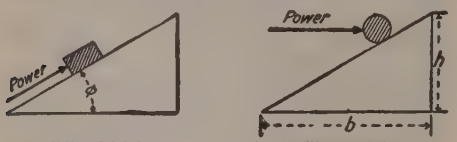


FIG. 9.

FIG. 10.

The wedge (Fig. 11a) is a double plane and gives power at the expense of speed. It is sometimes considered as a combination of two inclined planes placed base to base. The mechanical advantage increases as the angle of the wedge decreases — «the power being equal to twice the resistance into the sine of the angle of the wedge.» The relation, however,



Sliding Weight. Rolling Weight.

FIG. 11.

has but little practical value since the resistance due to the friction is very great. The principle is used in many forms of cutting tools such as the knife, the chisel, axe and plane. For working in comparatively soft materials, the angle is kept small and the edge sharp; but for harder materials the angle is increased. Metal planing tools have very large angles, ranging from 60

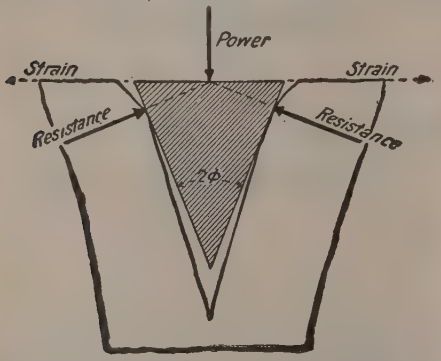


FIG. 11a.

degrees to 80 degrees. When the wedge is employed for cleaving wood, the cohesion and friction combined produces so great a resistance that the force is applied in the form of a blow from a heavy body, and the resulting strain is equal to the force of the blow multiplied by the length of the wedge divided by its width. See WEDGE.

the inch, the pitch of this screw may be regarded as one-eighth of an inch, the distance between threads; or as one-fourth of an inch, the distance between one spiral and the next turn of the same spiral. The principle of the screw is used in the screw propeller (q.v.), and the lifting jack or jackscrew. See SCREW.

A mechanical movement is some simple combination of the elementary powers described above. Perhaps the simplest are the familiar crank (q.v.), cam (q.v.) and cylinder and piston. (See STEAM AND STEAM-ENGINES). A

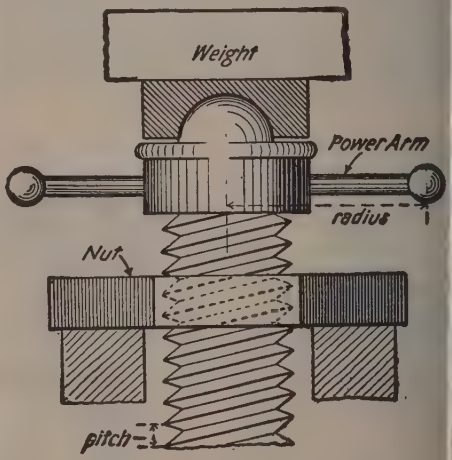


FIG. 12.

few of the more familiar movements are here grouped and illustrated. If fully mastered and understood they will be of great assistance to the student of mechanics in understanding the more difficult and complicated descriptions and drawings of modern machinery.

Fig. 13 is a rack and pinion, for converting rotary motion into linear motion, or the reverse, according to whether the rack or pinion is the driver.

Fig. 14 shows a pinion between two racks. If the lower rack be fixed and the pinion rolled one foot the upper rack will move two feet. In this way the stroke of a piston can be doubled.

Fig. 15 is a gear-wheel and worm, for changing a rapid rotary motion into a very slow rotary motion. One rotation of the worm turns the gear-wheel the distance of one tooth.

Fig. 16 is a group of bevel gears, positioned as in the differential on the rear axle of an automobile. Either of the large bevel-gears may drive the other through the small bevel-gear.

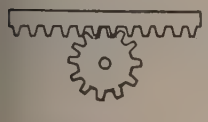


Fig. 13.

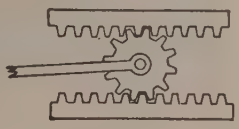


Fig. 14.

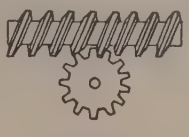


Fig. 15.

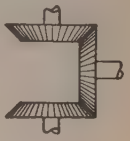


Fig. 16.

Fig. 17 is a mangle wheel and pinion. The pinion *P* drives, traveling around the long C-shaped rack, rotating the mangle first into one direction then in the reverse direction.

Fig. 18 is a pair of eccentric gear-wheels, either of which may be the driver. The rotation of the driven wheel is alternately slow and rapid.

Fig. 19 shows a couple of pump-cams. As they touch at every point of their rotation they may be used to raise a column of water by lifting.

Fig. 20 is a diagram of a crank and piston movement. It will be noticed that the spot *s* on the centre of the piston rod describes an oval. The nearer this spot is placed to the piston the more elongated is the oval. If the student will make a pattern of this in cardboard and test it in various positions he will get a far better understanding of why a crank motion is so generally preferred in machinery for altering rotary into reciprocating motion — the change is so gradual that jar is obviated.

Fig. 21 is a lazy tongs or combination of levers which support each other and permit rapid change of position.

Fig. 22 is a combined bell-crank and wheel-crank for altering rotary motion into reciprocating. The wheel drives and as the pin *p* travels in the slot it raises and lowers the rod *r*, rapidly in one direction, more slowly in the other.

Fig. 23 is a parallel motion. To whatever distance the bars are moved they are held parallel by the slanting connections.

Fig. 24 is a shears for cutting metal. The wheel *w* and pin operate the upper blade, giving a long leverage for increased shearing power.

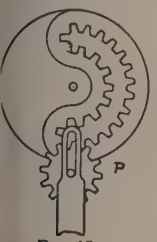


Fig. 17.

Fig. 18.

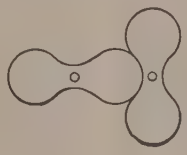


Fig. 19.

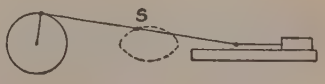


Fig. 20.

Fig. 25 is a toggle joint. Only a slight force is required to throw the two levers into line exerting a vastly multiplied energy over a short distance. It is used in many machines to apply a sudden pressure.

Fig. 26 is a universal joint, permitting a rotating shaft to be bent to a slight angle as necessary, without interfering with its working.

Fig. 27 is a three-throw cam. The three-pointed wheel measures the same at every point of its diameter, and as it rotates gives a reciprocating motion to the rod, moving it back and forth three times to each revolution.

Fig. 28 is a heart-cam for giving irregular reciprocation to the rod.

Fig. 29 is an ore-stamp. The cam shaped like a long *s* raises the stamp twice during each revolution and leaves it free to drop by gravity.

Fig. 30 shows a drum-shaped cam *C* whose groove moves the shaft *S* of the large wheel *W* alternately to the right and left.

Fig. 21.

Fig. 22.

Fig. 23.

Fig. 24.

Fig. 31 is an eccentric, or wheel mounted out of centre, so that through the encircling straps it gives a reciprocating motion to the rod. It is much used on steam-engines.

Fig. 32 is a pair of pulleys connected by a twisted belt for reversing the direction of rotation of one of the shafts.

Fig. 33 is a two-speed gear. The pulley *a*

being the driver, the upper large pulley is driven on one speed; when the belt is shifted to *b*, which is a loose pulley there is no driving; when the belt is shifted to *c* the other drive at a different speed is effective.

Fig. 34 is the steering gear of a sailing vessel, showing how the turning of the hand-wheel *w* is made to shift the ropes *rr* and throw the tiller *t* of the rudder to right or left.

Fig. 35 is a positive «silent» chain drive. Either the chain or gear-wheel may drive. It is used on auto-trucks and a variety of heavy machinery where belts are inadequate.

Fig. 36 is an intermittent motion given the toothed wheel by the rotation of the notched pinion. Every time the notch comes around it advances the wheel one tooth.

Fig. 37 is an escapement. The levers are connected with a pendulum or the like and at every swing allow the wheel to turn one notch.

Fig. 38 is a ball governor as used on steam-engines. When a certain speed is exceeded the balls are thrown out by centrifugal force, and rise, opening a valve or adjusting a cut-off and thus reducing the speed back to the normal.

«Compound motions» are obtained by combining any two or more of the simple motions, and machines are built up by combining the simple motions harmoniously.

Fig. 25.

Fig. 26.

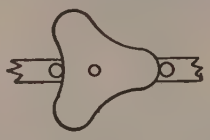


Fig. 27.

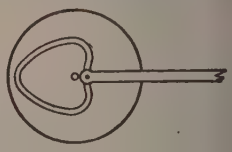


Fig. 28.

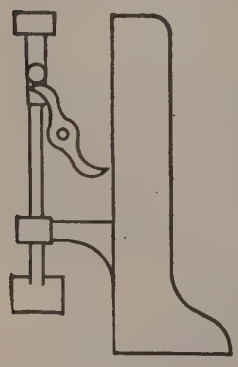


Fig. 29.

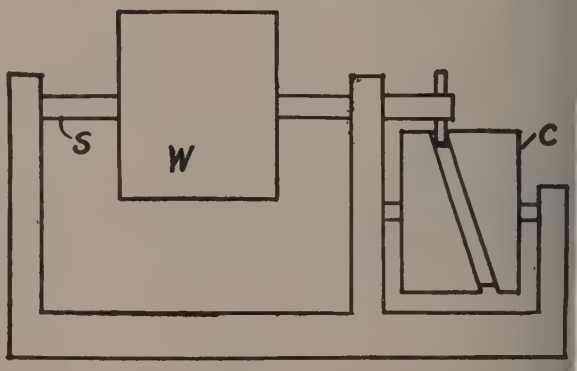


Fig. 30.

«Pendulum motion» is the oscillatory motion of a body in the arc of a circle, the body being attached to a rod which vibrates to and fro from a fixed axis. In the ideal simple pendulum, consisting of a body attached to a string without weight and vibrating from the point of suspension without resistance of any kind whatever, a material body once set in motion would continue to swing to and fro forever.

Under these conditions it has been noted (1) that the time of vibrations of a pendulum through short arcs is independent of the lengths of the arcs and that when the length of the arc is constant, as in the case of clock devices, the times of vibration are equal; (2) that when the force of gravity is constant, as is the case of any given point on the surface of the earth, the time of vibration varies directly as the square root of the length of the pendulum, so that, if a pendulum of a given length vibrates in one second, a pendulum one-quarter as long will vibrate in one-half of a second, and one four times as long will vibrate in two seconds; (3) that when the length of the pendulum is constant, the time of a vibration varies inversely as the square root of the force of gravity; and (4) that when the time of vibration of two pendulums at different points on the surface of the earth is equal, their lengths vary directly as the force of gravity. See PENDULUM.

«Perpetual motion» is a continuous or incessant motion supposed to be attainable by a mechanical device with inherent motive energy, and, therefore, which when once set in motion is capable of continuing that motion indefinitely or perpetually. Such a device or machine, if practicable, might be termed a «perpetual movement.»

The various forms of mechanical movements embodying the principles of one or more of the mechanical powers already described are so innumerable that a detailed description of them is impracticable within the scope of this article; but they are classified as follows into several important groups according to the general purposes for which they are used.

«Transmission of power appliances,» consisting of ropes, belts and various forms of gears, pulleys, etc.

«Measurement of power appliances and devices,» used for determining velocities, pressures, weights, number and quantities, such as brakes, counters, dynamometers, gauges, indicators, meters, planimeters, testing machines and weighting machines.

«Steam power appliances,» comprising boilers, locomotives, locomotive engines, oscillating engines, rotary engines, steam-engines, steam turbines, valves and valve-gears, parallel motion gears, governors and other engine devices.

«Steam appliances,» such as injectors, steam pumps, condensers, separators, traps and valves.

«Motive power machines,» such as gas-engines, internal-combustion engines, heat-engines, solar engines, etc.

«Hydraulic power appliances and devices,» consisting of various forms of waterwheels, water-motors, turbines, pumps, syphons, water-lifts, ejectors, hydraulic or water rams, meters, indicators, pressure regulators, valves, pipe joints, filters, hydraulic presses and hydraulic

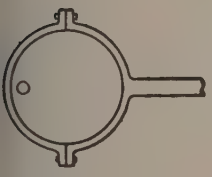


FIG. 31.

FIG. 32.

FIG. 33.

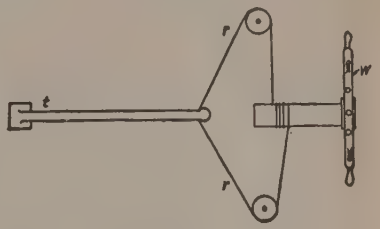


FIG. 34.

metal-working machinery such as riveters, rail-benders and punches.

«Air power appliances,» devices and apparatus consisting of air compressors, air pumps, air water-lifts, barometers, bellows, blowers, blow-pipes and compressed-air tools such as pneumatic drills, hammers, riveters and shearing machines. Also, gauges, ventilators and musical instruments.

«Electrical power and construction appliances» such as generators, motors, wiring devices, controlling and measuring devices, lighting arrangements, electric furnaces, heaters, fans, searchlights and drilling machines.

«Navigation appliances» used for operating

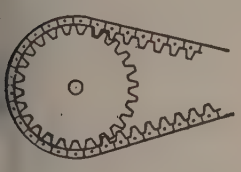


FIG. 35.

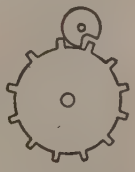


FIG. 36.

steamships, sailing vessels and yachts, such as sails, rope knots, block and tackle, paddle wheels, screw propellers, steering gear, anchors, windlasses, capstans, cranes, etc.

«Road appliances,» used in the construction of roads, highways and railroads, such as scrapers, rollers, excavators, vehicles, automobiles, bicycles, motor adjuncts, wheels, road gates, lamps, etc.

«Gearing,» consisting of rack and pinion devices, spiral, elliptical and worm gears, differential and stop-motion gears, and epicyclical and planetary trains.

«Motion and controlling devices,» consisting of rachets and pawls, cams and volute cams, cranks and variable cranks, intermittent and stop motions, wipers, shafts, couplings and gyroscopes.

«Horological apparatus and devices,» mainly used for measuring time, such as spring and pendulum clocks, watch and chronometer movements, electric clocks and sundials.

«Mining machinery and appliances,» such as quarrying and cutting machines, borers, drills, valves, blowers, ventilators, safety lamps, hoisting drums, conveyors, crushers, pulverizers, hydraulic nozzles, presses, air-blast and magnetic separators, steam shovels, dredges, haulage appliances, furnaces and automatic dumps.

«Mill and factory appliances,» such as hangers, shaft bearings, ball bearings, steps, couplings, universal and flexible couplings, speed gears, shop tools, screw threads, hoists, stamp-mills, saws, punches, shears, bending machines, grinding machine, cotton presses, looms, knitting machines, etc.

«Engineering construction appliances,» such as mixing machines, testing machines, stump and pile pulling machines, blocks and tackle, hoisting machines, tackles hooks, pile drivers, automatic dumps and dumping cars, stone grips, derricks, conveyors, timber splicers, metal welding devices, tools, wood-preserving apparatus, cable carriers, dams and embankment escalators and moving platforms, «Ferris» wheels, high structures and buildings, roof and bridge trusses, trestles and bridges.

FIG 37.

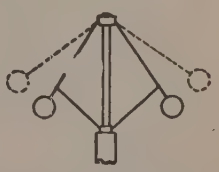


FIG 38.

«Agricultural machines and implements,» such as plows, tethering hooks, wash boilers, washing machines, mowers, grain harvesters, threshing machines, cream separators, refrigerating machinery, cold storage houses, refuse crematories, silos, kilns, ovens and furnaces.

«Draughting devices,» such as dividers, dotting pens, parallel rules, curve delineators, trammels, ellipsographs, pantographs, etc.

«Tools,» hand and machine, such as saws, chisels, mallets, planes, borers, etc.

«Perpetual motion devices,» consisting of various forms of hydraulic, hydrostatic and magneto-electric apparatus.

Bibliography.— For descriptions of a great variety of special movements, appliances and

devices, consult the works on the subject by Hiscox, Rheile, Ruleau and Spon, also the special articles on the various forms of appliances enumerated under the general classes stated in this article.

CHARLES H. COCHRANE,
Author of 'Wonders of Modern Mechanism.'

MECHANICAL SIZING. Classification of Dry Granular Material.— The mechanical classification of dry granular material is the result of the action of several natural laws operating in conjunction with a mechanical device so arranged as to permit the balancing of the action of one law with another. The combined motion places the relative action of the dry granular material completely under control of the mechanical device. The first active law in mechanical sizing is termed the laws of selectiveness. When mixed particles of various sizes of granular material are under agitation upon a level plane, the finer particles sink to the bottom and engage the surface while the coarser particles rise to the top without regard to the specific gravity of such particles. The second active law is called the law of displacement or the displacement of the centres of gravity of particles upon an inclined plane. The relative difference in the tendency of coarse and fine material of granular shape to move down an inclined plane is due to the difference in the displacement of their centres of gravity upon the same angle of plane. The third active law is the law of friction of mass or the "coefficient of friction."

Close observation of the action of these laws as well as the influence of other forces led to the design of a "mechanical sizer" simply arranged to best meet the requirements of these laws. In order to assist the law of selective action on an inclined plane, a series of several hundred tapered riffles or grooves are placed on the inclined surface of what is termed the deck of the device. This permits the "fines" to sink to the bottom of these grooves and forces the discharge of larger particles over the top of the riffle, in accordance with the action of the law of displacement of centres of gravity. This is accomplished by the feeding of dry material to the inclined deck while the same is being agitated forward and backward by a specially designed head motion, which pushes the deck forward at one speed and causes it to return at a higher speed. This sets up what is termed a progressive action of material on the deck or causes the granular particles to travel in a forward direction, under the government, however, of the law of selective action and the law of displacement aided by the law of friction of mass. Under operation, the device is fed with dry ore, sand, grain or the like, the feed engaging a feed board where a preliminary rough separation is accomplished by a modified application of tapered riffles. The feed then engages the table deck at the head of its proper zone and here, because of the length and the great number of riffles, almost any desired number of carefully sized products may be taken off by placing receptacles at the bottom and far edges of the deck, from which falls, when in action, a constant sheet of granular material graded carefully from coarse particles to fine dust.

Mechanical sizing is applicable to every form of dry granular material such as crushed ore, salt, coal, sand, emery, cereals, unbroken or crushed, or, in fact, there is no field in dry sizing now filled by metallic screen devices that cannot be filled by a mechanical sizer and often with greater economy and efficiency. This is proved by the fact that metallic screens blind and lose their efficiency while the mechanical device cannot clog or blind and automatically cleans itself. Specific gravity has practically no effect upon mechanical sizing for the reason that granular particles of the same contour and volume, when placed upon an inclined plane, have the same displacement of their centres of gravity with the result that a particle of lead and a particle of sawdust of the same size and shape will discharge from the table at the same point, although the specific gravity of the one is many times that of the other.

MECHANICAL TERMS. Words, compound words and short phrases, having definite meanings other than those of ordinary usage and specifically applicable to the use of tools and other mechanical appliances; to the construction and operation of machines, and to the methods employed and the manipulations required in the working and manufacture of the various kinds of materials used and the articles employed for engineering, structural and other industrial purposes.

A great many of these terms have been in use from the very beginning of the present period of industrial and manufacturing development, and are satisfactorily employed at the present time according to their original significance; but the creative mechanical effort of the last 40 years has either developed or produced so great a variety of mechanical devices and machines that the mechanical terminology has been expanded to include a much greater number of terms, which are more or less familiar to every one excepting those by whom they are habitually used in the execution of the particular line of work to which they are applicable.

Furthermore, the specializing methods of modern manufacturing systems, involving the restricted use of special terms, has not only tended to develop a class of one-sided workmen who are unquestionably skilful in their special lines of work and deplorably poor if not absolutely deficient in all other lines; but, the use of such methods has tended to increase the ever-widening gulf which separates any one class of workmen from the rest, by eliminating the necessity of a mutual knowledge of the special terms used in allied processes, by the special classes of workmen employed therein.

At the present time the number of mechanical terms amounts to several thousands. Eliminating those of a more or less fanciful character, and also those employed in individual shops, the terms having definite meanings capable of universal or wide application probably exceed 12,000 in number, the great majority of which are employed in the metal manufacturing and metal working industries.

A superficial examination of this terminology conveys the impression that a definite classification of the various terms would be either impossible or quite difficult, but a closer inspection shows that they may be very conveniently divided into several general classes

according to the character of the work, machines and structures to which they are applicable, as follows: (1) Terms applicable to the processes and methods employed in the production of raw materials and rough work, and in the preparation of rough work for subsequent finishing operations; (2) terms applicable to the methods, processes and machines employed in the working of suitably prepared raw material into the form of simple articles, into the parts of complex machines and into structural shapes in general; (3) terms employed in the work connected with the preliminary and final erection of machines, engines and structures; (4) terms used for the purpose of describing special forms of mechanical appliances and mechanical movements according to their field of application; (5) terms employed in operating the various classes of engines and machines; (6) general terms employed in connection with the execution of mechanical and structural engineering work; and (7) terms employed in connection with the use of the tools and appliances, and the application of the various methods and processes, in the reproductive arts.

In considering the matter of the application of technical terminology it is well to prescribe marked lines of demarcation between the terms employed in connection with the different kinds of work, as for example — between the terms applicable to mechanical work and those employed in connection with electrical work. As a rule, the distinction is quite clear, but when the terms are used for the purpose of describing appliances, devices and apparatus the line of demarcation becomes somewhat indistinct, and the precise meanings of the terms require careful consideration.

One of the most interesting examples of the varied technical application of a common term is that afforded by the use of the word "damper." It is familiarly known as a plate, valve, cover or other suitable contrivance for regulating the amount of draught in the flues of a furnace or boiler. As a specific mechanical term it is applied to the "dash-pot" or small cylinder which forms a portion of the engines of the Corliss type, in which they act as a "buffer-case" and prevent the too sudden closing of the steam and exhaust valves. As an electrical term it is applied to a metallic cylinder which is placed in such a manner that it nearly or entirely encompasses the iron core of an induction coil for the purpose of effecting a variation in the intensity of the current produced in the secondary battery. As a term employed in musical construction and operation it is applied to the strip of felt or other soft material employed in a piano-forte for the purpose of modulating the vibration of the strings.

A more varied technical application obtains in the case of the common word "pitch." As used in connection with mechanical work it refers to the distance between the centres of two adjacent teeth on a gear-wheel, to the distances between bolts, rivets and boiler stays or similar parts arranged equidistantly. Also to the inclination or rake of the teeth of saws, to the angle at which a plane-iron is set on its stock and to the height or angle of a roof-truss. As an electrical term it refers to the successive corresponding conductors on the armature of a dynamo and the number of coils advanced in making end-connections between the coils of an armature winding divided into segments. It is also applied to designate the frequency of a tone vibration produced electrically. As a musical term it refers to a succession of tone vibrations.

The character of a technical term or the class of work to which it belongs is usually very clearly indicated by the textual matter on any particular subject, but in the case of mechanical and electrical terms when the distinction is not obvious, the special character of a term may be ascertained only by the nature of the power generated, controlled or applied.

For further information see articles under the titles AERONAUTICS-NOMENCLATURE; FOUNDRY AND FORGE SHOP TERMS; ENGINEERING TERMS; ELECTRICAL TERMS; LOCOMOTIVE, PRINCIPAL PARTS OF; TOOLS; VALVES; VALVE TERMS, and WORKSHOP TERMS, in this Encyclopedia.

MECHANICS (*μηχανή*, a machine), or DYNAMICS, the science that treats of forces (*δύναμις*, force), and of the motions produced by them. The notion of a force, as evinced to the senses as a push or pull, is common to all, but the notion of force as that which produces or destroys motion, which is the proper definition of force, is modern, and is to be ascribed to Newton, the chief founder of the science. It is a familiar fact that two opposite pushes or pulls may neutralize each other's effects, and thus fail to produce motion; we then speak of them as forces in *equilibrium*. The portion of Mechanics that treats of forces in equilibrium is denoted by the term *Statics* (root *στα*, stand), contrasted with which we have the subject of *Kinetics* (*κινέω*, to set moving), which deals with the effects of forces in acting to produce motion in bodies. Since we can distinguish motion only in matter, the laws of motion involve the essential properties of matter, so that Dynamics is a branch of Physics — indeed, its most fundamental branch, for, until recently, it was the effort of physicists to reduce all explanations of physical phenomena to descriptions of matter in motion.* Nowadays the tendency of interpreting mechanics in electromagnetic terms is making itself felt. As in geometry, instead of dealing with actual substance, we make abstraction and conceive of points, lines and surfaces apart from the substance in which they lie, so we may make abstraction and consider the motion of points, lines or geometrical configurations, quite apart from any matter or physical properties. This geometry of moving configurations or geometry of space and time is generally distinguished by the name of *Kinematics* (*κίνημα*, motion), and is included under treatments of Dynamics only for convenience, as it is impossible to make dynamical investigations except in kinematical terms.

The ancients knew but little of Mechanics, and what they did know belonged exclusively to Statics. Archimedes was familiar with the principles of the lever and of the pulley. Leonardo da Vinci generalized the principle of the lever, and Stevinus (1548–1620) demonstrated the principle of the inclined plane and of the composition of forces. Varignon clearly enunciated the principle of moments, and also of the

* *Utinam cætera naturæ phænomena ex principiis mechanicis eodem argumentandi genere derivare liceret.* Newton 'Preface to Principia.'

composition of forces. Galileo, in the course of his investigations on the inclined plane, came to a recognition of a particular case of the Principle of Virtual Work, which was made general by Daniel Bernoulli. These are the chief names in the development of Statics. The beginnings of Kinematics were made by Galileo, who determined the laws of falling bodies, and introduced the fundamental idea of acceleration. Huygens, in his 'Horologium Oscillatorium,' published in 1673, examined in detail the laws of the pendulum, introduced the ideas of moment of inertia, of the centre of oscillation and of kinetic energy. Most important of all was the work of Newton, who in his 'Principia Philosophiæ Naturalis' (1687), not only universalized the idea of force, and introduced the notion of *mass*, but laid down the exact definitions and principles from which it has never been necessary to depart. Since the work of Newton the chief names have been d'Alembert, Lagrange and Hamilton, who have given us methods of great generality and convenience, but without changing in any essential the principles laid down by Newton.

1. Statics.—Although the principles of Statics may be logically deduced from those of Kinetics by assuming all velocities to be zero, it is simpler to follow the historical method and treat statics first, since we may dispense with the idea of time, and thus with the preliminary study of kinematics. We begin by assuming the identical nature of all forces. For instance, the effect of any force may be neutralized by a pull on a string fastened to the point at which the force is applied. The tension on a string is produced by equal and opposite pulls on its two ends, and it may be cut anywhere, if at the cut end is applied a force equal to the one previously applied to the end. Such a force may be produced by the weight of any body hanging from the end of the string. But as a weight always acts vertically downward, while forces may act in any direction, we may suppose the string carried over a smooth pulley with horizontal axis, whose effect is assumed to be merely to change the direction of the string without changing its tension. Thus any force in any direction may be equilibrated by the tension of a string produced by a certain weight. Two forces are equal when they are equilibrated by the same weight. Two weights found to be equal (by equilibration), when hung from the same string, produce double the tension produced by one, and thus forces may be measured in terms of a single weight. A force having magnitude and direction may be geometrically represented by a line parallel to it, and of a length proportional to its magnitude. To this line an arrow-head may be attached to indicate the sense of the direction of

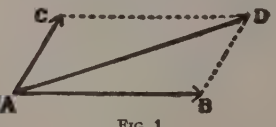


Fig. 1.

the force. We may now enunciate the principle, capable of experimental verification, that when two forces, represented by AB, AC, Fig. 1, are applied at the same material point A, they may be replaced by a single force whose direction and magnitude are represented by the diagonal AD of the parallelogram formed on the sides AB, AC. (The direction of the arrows must be observed). This is the principle of the *Parallelogram of Forces*. Obviously it may be replaced by the equivalent statement that if we form a triangle by placing at the extremity B of one or the lines representing the forces the initial point of the line representing the other force, BD, and complete the triangle, the line drawn from the initial point of the first to the terminal point of the second line will represent the *resultant* of the two forces, that being the term applied to the single force which replaces their effect. The original forces AB, AC, are said to be the *components* of AD. From the properties of the parallelogram, $AB \sin (BAD) = AC \sin (CAD)$, so that the magnitudes of the components are inversely proportional to the sines of the angles they make with the resultant. Obviously the two forces may be equilibrated by a force equal but opposite to the resultant, so that if we draw AE equal and opposite to AD (Fig. 2) the three

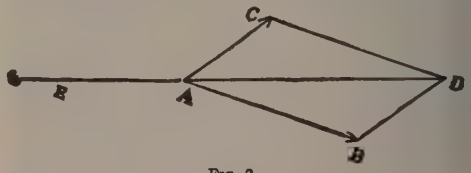


Fig. 2.

forces AB, AC, AE will be in equilibrium. As the angles BAD and BAE are supplementary, their sines are equal, similarly DAC and CAE; consequently we have $\frac{AB}{\sin (CAE)} = \frac{AC}{\sin (BAE)}$, and in turn considering each of the three forces as equilibrating the other two we get the theorem that the magnitudes of three forces in equilibrium are proportional to the sines of the angles lying opposite them respectively. This may be experimentally verified as in Fig. 3, where weights P, Q are hung

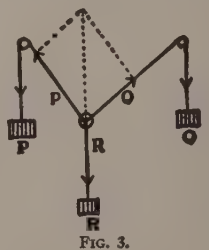


Fig. 3.

from strings passing over pulleys, and united at O to a string carrying a weight R. If a parallelogram be drawn on lengths proportional to P, Q, its diagonal will be vertical, and proportional to the weight R. A convenient form of the experiment is one in which the three strings are horizontal, and O is the centre of a horizontal circular table, on whose rim the three pulleys may be placed, their relative positions being read off on a graduation of the edge of the table.

Obviously, by a reversal of the previous process, a given force may be resolved into components in any two given directions, as only one parallelogram can be drawn on a given diagonal, whose sides have given directions. If these directions are at right angles to each

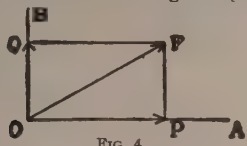


FIG. 4.

other, as in Fig. 4, OP is the *component* of OF in the direction OA and OQ the component in the direction perpendicular thereto. The length OP is called the *projection* of OF in the direction OA, and we have $OP = OF \cos (POF)$. Having found the resultant of two forces applied at a common point, we may compound this resultant with another force, and so on, the simplest rule of procedure being by an extension of the triangle method above, that is, apply the initial point of each line representing a force to the terminal point of the preceding line; then the line drawn from the first initial point to the last terminal point will represent the resultant. The slightest consideration will show that the resultant is independent of the order in which the forces are compounded. This construction is known as the polygon of forces (Fig. 5). It is ob-

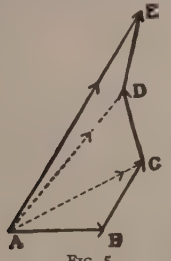


FIG. 5.

viously not restricted to forces lying in the same plane.

In order to deal analytically with the composition of forces, it is convenient to assume three rectangular axes of co-ordinates, OX, OY, OZ (Fig. 6), and to resolve every force

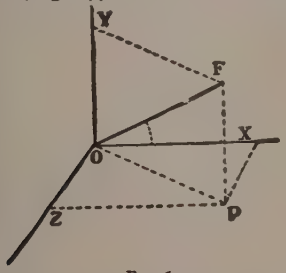


FIG. 6.

into three components along each. Thus OF may be resolved into the mutually perpendicular components OY and OP, and OP may be resolved into OX and OZ. Calling the resultant F, the components respectively X, Y, Z, we have

$$(1)\qquad \begin{aligned} X &= F\cos(Fx),\\ Y &= F\cos(Fy),\\ Z &= F\cos(Fz); \end{aligned}$$

$$(2)\qquad X^2+Y^2+Z^2 = F^2[\cos^2(Fx)+\cos^2(Fy)+\cos^2(Fz)] = F^2,$$

since the sum of the squares of the direction cosines of any line is identically equal to unity. Since the projection in any direction of any broken line is the same as that of a straight line with the same ends, it is evident that the projection of any resultant is the same as the algebraic sum of the projections of all its components. Thus the analytical expression of the principle of the parallelogram or polygon of forces is, if F is the resultant, X, Y, Z its components along the axes,

$$(3)\qquad \begin{aligned} X &= X_1+X_2+\ldots X_n = \Sigma X,\\ Y &= Y_1+Y_2+\ldots Y_n = \Sigma Y,\\ Z &= Z_1+Z_2+\ldots Z_n = \Sigma Z. \end{aligned}$$

Any geometrical or physical quantity which possesses direction as well as magnitude, and is compounded according to the parallelogram law, and to which the whole of the above exposition applies, is called a *vector*, and the preceding process is called the *composition of vectors*.

2. A body so small that we may neglect the differences of position of its different points is called a *material particle*. The only principle necessary for the treatment of forces acting on such a particle is that for equilibrium the resultant of all the forces applied to it must vanish. The particle may be free or it may be subject to certain geometrical constraints, for instance, it may be obliged to move on a certain surface. Then there will be certain forces acting between the particle and the bodies causing the constraint, these forces being known as *reactions* due to the constraint. A surface is said to be smooth if the reaction between it and a particle at rest is normal to the surface. Thus let F, Fig. 7, represent a

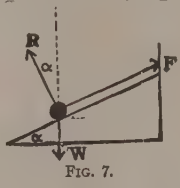


FIG. 7.

force applied to a particle of weight W, resting on an inclined plane making an angle α with the horizontal. Let F be parallel to the inclined plane. Then the three forces, W. F. and R, the reaction, normal to the plane, are in equilibrium. Writing these proportional to the opposite angles, as above, we obtain

$$(4)\qquad \frac{F}{\sin\alpha} = \frac{R}{\cos\alpha} = \frac{W}{1},$$

which determine F and R in terms of W. The same equations are obtained by resolving in the direction of the tangent and of the normal to the plane. The equation $F = W \sin\alpha$ shows that the force required to sustain a particle on a smooth plane is to the weight of the particle in the same ratio as the height of the plane to its length, as was shown by Stevinus and Galileo.

In the problem just treated, it is evident that the resultant of the applied forces W and F is opposite to R, that is, is normal to the plane. Similarly for equilibrium on any smooth surface, it is necessary that the resultant of all the applied forces shall be normal to the surface, for if it had any component parallel to the tangent plane this component would move the particle along the surface. Since the particle is constrained to move on a surface, there will be a relation between x, y, z, the co-ordinates of the particles, $\phi(x, y, z) = 0$, which is the equation of the surface; and since the direction cosines of the normal n are given by the equations

$$\cos(nx) : \cos(ny) : \cos(nz) = \frac{\partial\phi}{\partial x} \cdot \frac{\partial\phi}{\partial y} \cdot \frac{\partial\phi}{\partial z},$$

if X, Y, Z are the components of the resultant of the applied forces, we have as the condition for equilibrium

$$\cos(Fx) = \frac{X}{F} = \cos(nx), \text{ etc.,}$$

or

$$\frac{X}{\frac{\partial\phi}{\partial x}} = \frac{Y}{\frac{\partial\phi}{\partial y}} = \frac{Z}{\frac{\partial\phi}{\partial z}}. \tag{5}$$

If the surface is not smooth, the reaction between the particle and the surface is not normal, but there is a tangential component which is called *friction*. The force of friction is peculiar in that it cannot produce but only hinder motion, and in having its direction determined as opposite to the direction in which the other forces tend to make the particle move. The law usually assumed governing friction is that when motion is just about to take place the friction, or tangential component of the reaction, is proportional to the normal component, the factor of proportionality being a constant for two given substances, such as those composing the particle and plane, as above. Suppose that in the problem of the inclined plane the force F is the force of friction. Then we have $F = \mu R$, where μ is a constant for the given particle and plane called the coefficient of friction. Equations (4) then give

$$F = R \tan \alpha = \mu R, \quad \mu = \tan \alpha,$$

when the particle is just about to slide down. If the plane is any steeper than the value of α thus given, equilibrium is not possible. This angle is called the *angle of friction*.

3. Let us now consider a *rigid* body, that is, one composed of a continuous distribution of matter having the property that the distance between any two of its points is invariable, no matter to what forces it is subjected. It is evident that if equal and opposite forces, P and Q, Fig. 8, be applied to such a body at

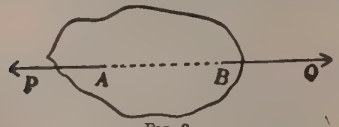


Fig. 8.

two points A and B such that the line AB has the direction of the forces, no motion will be produced, for reasons of symmetry with respect to AB. Equilibrium is also independent of the position of B on the line AB. Consequently the force Q might be applied at A, where it might be compounded with P, giving a vanishing resultant. The principle that any force applied to a rigid body may be considered as applied at any other point in its line of direction is known as that of the *transmissibility of force*. As an application, if the lines of direction of three forces, P, Q, R (Fig. 9), intersect in a common point O, they

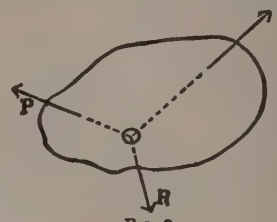


Fig. 9.

may be transferred to that point, and if they satisfy the conditions for the equilibrium of forces applied to a material particle, they will produce equilibrium of the rigid body.

Suppose we have two parallel forces P and Q applied at any points A, B, of a rigid body, (Fig. 10). If we apply at A and B any two

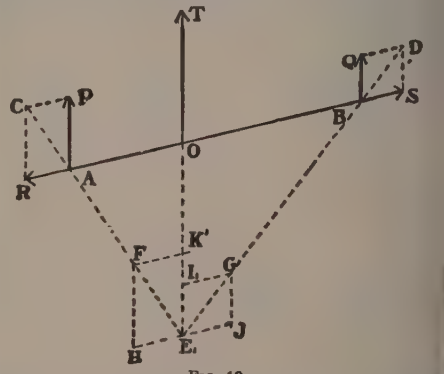


Fig. 10.

equal and opposite forces AR, BS, in the direction of AB, equilibrium will not be affected. Compound these respectively with AP, BQ, and transfer the resultants AC, BD, to the intersection of their lines of direction E and there resolve them into components in the original directions. From the equality of the parallelograms $EKFH$ and $APCR$, $ELGJ$ and $BQDS$, the components EJ and EH are equal and opposite, so that there remain only the components EK and EL, in the same direction, equal to the given forces AP, BQ, respectively. Thus the resultant of two parallel forces in the same direction applied to a rigid body is a force in the same direction equal to their sum. Obviously it may be considered as applied at any point O in the line EK. Suppose O to lie on AB. By similar triangles $\frac{AP}{AR} = \frac{OE}{AO}$, $\frac{BQ}{BS} = \frac{OE}{BO}$, and by division, since $AR = BS$, $\frac{AP}{BQ} = \frac{BO}{AO}$. Thus the distance of the intersection of the line of direction of the re-

sultant with AB from A and B is inversely proportional to the forces applied at those points. This is the principle of the lever, as known to Archimedes.

If the forces P and Q are the weights w_1, w_2, of two particles, placed at AB, the point O is called the *centre of gravity* of the two particles. It is also called the weighted mean point of points AB with the weights w_1, w_2. If we project the points A, B, O upon the co-ordinate axes, the projections of AO, BO, are in the same ratios as the lengths themselves; consequently if their co-ordinates are respectively $x_1, y_1, z_1, x_2, y_2, z_2, \bar{x}, \bar{y}, \bar{z}$,

$$\frac{\bar{x}-x_1}{x_2-\bar{x}}=\frac{\bar{y}-y_1}{y_2-\bar{y}}=\frac{\bar{z}-z_1}{z_2-\bar{z}}=\frac{m_2}{m_1},$$

or

$$(6)\qquad \bar{x}=\frac{m_1x_1+m_2x_2}{m_1+m_2},\ \bar{y}=\frac{m_1y_1+m_2y_2}{m_1+m_2},$$

$$\bar{z}=\frac{m_1z_1+m_2z_2}{m_1+m_2}.$$

By a generalization, we obtain for the centre of gravity of any number of points, or the resultant of any number of parallel forces,

$$(7)\qquad \bar{x}=\frac{\Sigma mx}{\Sigma m},\ \bar{y}=\frac{\Sigma my}{\Sigma m},\ \bar{z}=\frac{\Sigma mz}{\Sigma m}.$$

If the two forces AP, BQ, are in opposite directions, instead of Fig. 10 we have the construction of Fig. 11, and the resultant is evi-

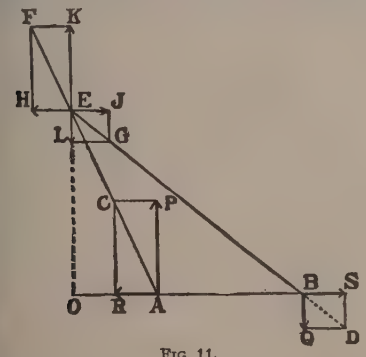


FIG. 11.

dently equal to the *difference* of the two components, while the point O lies outside the segment AB. We may say that in general the resultant is equal to the *algebraic* sum of the components. In Fig. 11, if AP and BQ are made more nearly equal, the point O recedes to a greater distance, and in the case of equality, when we have AC parallel to BD, O must be infinitely distant. The same result is given by the formulæ (6), putting $m_1+m_2=0$. In other words, two equal, parallel and *oppositely* directed forces applied to a rigid body cannot be replaced by a single resultant. Such a pair of forces is called a *couple*. The perpendicular distance between the two lines of direction of the members of the couple is called its *arm*. The product of the magnitude of either force by the arm of the couple is called the *moment* of the couple. The plane of the couple is the plane containing both forces. We have shown that a couple cannot be equilibrated by any single force, but it may be by another couple. This couple may be chosen in an infinite variety of ways. It may easily be shown by drawing the members of the second couple as about to be prescribed, and compounding the forces two and two, by the rules already given, that the equilibrating couple may be equilibrated by any of the following, and that the given couple may accordingly be replaced by: 1° An equal and parallel couple in any plane parallel to its own; 2° An equal couple in its plane turned about its point of symmetry; 3° A couple in the same place having different arm and forces but the same moment. Thus all that characterizes a couple is the magnitude of its moment and the direction of the normal to the plane of the couple. The couple then behaves like a directed quantity, and may be symbolized by a line in the direction of the normal to its plane, whose length gives the magnitude of the moment. That couples are also compounded by the vector law is easily seen, for consider for forces of the two couples to be applied at two points AB in the line of intersection of their two planes. This can be done by bringing the couples to have the same arm. Let P_1 P_2 (Fig. 12) be the members of one couple, Q_1Q_2 those

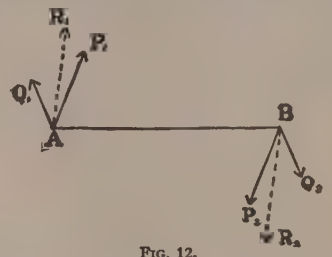


FIG. 12.

of the other. Compound P_1Q_1 by the parallelogram law to R_1, P_2Q_2 to R_2. These being equal, parallel and oppositely directed, form a couple which, having the same arm as the original couples, has its moment proportional to R, that is, found by the parallelogram construction. If lines are laid off perpendicular to the three planes of AB and P, Q, R, respectively, and proportional to the three moments, they will also follow the parallelogram law. Thus a couple may be represented by a vector perpendicular to its plane. This vector we shall speak of as *the couple*, and shall disregard the resolution into two separate forces.

Let us now consider the effect of any number of forces applied at various points of a rigid body. At any point O (Fig. 13) apply two equal and opposite forces $P'P''$ equal and parallel to a force P applied at A. We thus have the force P' equal to P applied at O instead of at A, together with the couple PP''. Similarly all the forces applied at other points may be considered applied at O, by introducing in each case a couple. All the forces at O may be compounded into a single resultant, and all the couples into a single couple. Thus the resultant of any number of forces applied to a rigid body is a single force together with a single couple. Evidently the resultant force does not depend upon the position of the

point O, while the resultant couple does. In order to have equilibrium, both the resultant force and the resultant couple must vanish.

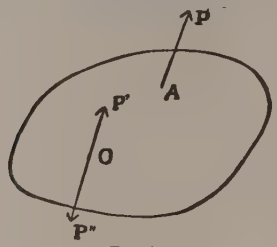


FIG. 13.

In order to express these conditions analytically, we must find an expression for the moment of a vector about a given point, that is, the product of the magnitude of the vector by the length of the perpendicular dropped upon it from the given point. This moment is thus numerically equal to the area of the parallelogram formed with the given point as one corner and the given vector as one side. As plane areas may be projected on other planes by multiplying by the cosine of the dihedral angle between them, which is equal to the angle between their normals, it is evident that the area of the parallelogram, and hence the moment, may be represented by a vector perpendicular to its plane, as already shown for the moment of a couple. Thus it is only necessary to find expressions for the three projections of a moment. Let the vector F (Fig. 14), with components X, Y, be applied at a point having the co-ordinates x, y. Its moment about the origin is equal to the area of a parallelogram having as adjacent sides lines drawn from the origin to points x, y and X, Y. This area is equal to $xY-yX$. But this is the projection in the XY-plane of the area of the parallelogram on the lines from O to points x, y, z, and X, Y, Z. It therefore represents the Z-component of the required moment. Similarly the three components are obtained.

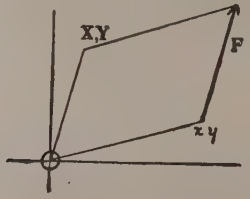


FIG. 14.

(8) $L=yZ-zY, \quad M=zX-xZ, \quad N=xY-yX.$

The moment of a couple is the sum of the moments of its two members, and if X, Y is applied at x_1, y_1,—X,—Y at x_2, y_2, we obtain for the moment of the couple

$$x_1Y-y_1X-x_2Y+y_2X=(x_1-x_2)Y-(y_1-y_2)X,$$

which evidently does not depend on the choice of the origin, but only on the vector F and the *relative* position of the two points of application, since only differences of x_1x_2, y_1y_2 appear.

The analytical statement of the conditions for equilibrium of a rigid body is then

(9) $$\Sigma X=0, \quad \Sigma Y=0, \quad \Sigma Z=0;$$
$$\Sigma(yZ-zY)=0, \quad \Sigma(zX-xZ)=0,$$
$$\Sigma(xY-yX)=0,$$

the first three expressing the vanishing of the resultant force, the last three the vanishing of the resultant couple. These principles suffice for the treatment of all problems concerning the equilibrium of a rigid body. For example, the extended principle of the lever follows from the theory of moments. Consider now the problem of a ladder standing on a smooth floor and leaning against a smooth wall (Fig. 15). The resultant of the weights

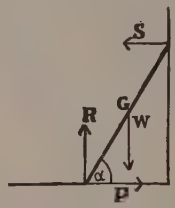


FIG. 15.

of all the parts of the ladder is a single force W applied at the centre of gravity G. Besides this we have to consider the normal reactions R and S. Resolving vertically we find for equilibrium $W-R=0$. Resolving horizontally there must be a force to balance S. Let this be P, applied at the lower end of the ladder. Then $P-S=0$. This does not determine the value of P or S, but we may do this by taking moments about any point in the plane of the figure. If we choose the lower end of the ladder, P and R will have zero moment, and if l is the length of the ladder, α the inclination,

$$Sl \sin \alpha-(Wl \cos \alpha)/2=0, \quad S=\tfrac{1}{2}W\cot \alpha.$$

If the floor is rough, and P the friction, $P=\mu R=\mu W=S=\frac{1}{2}W\cot \alpha$, $\mu=\frac{1}{2}\cot \alpha$, and if α is less than the angle determined by this equation, the ladder will slip down.

4. All the principles of statics are comprised in the Principle of Virtual Work. The conception of work is equally important with that of force. Work is done when the point of application of a force moves, the amount of work being defined as the product of the magnitudes of the force and the distance moved by the cosine of the angle included by them. If F denote the force, D the displacement, the work is $FD \cos (FD)$. This *geometric* or *scalar product* of two vectors (not a vector, since it is not associated with direction, but merely with a number, or scalar) defined as the product of either by the projection on it of the other, is of much importance in our whole subject. The cosine of the angle between two directions is given by the symmetric function of their direction cosines

$$\cos (FD)=\cos (Fx) \cos (Dx)$$
$$+\cos (Fy) \cos (Dy)+\cos (Fz) \cos (Dz).$$

Now if the projections on the axes of co-ordinates of the two vectors are

(10) $$F_x=F \cos (Fx), \quad F_y=F \cos (Fy),$$
$$F_z=F \cos (Fz),$$
$$D_x=D \cos (Dx), \quad D_y=D \cos (Dy),$$
$$D_z=D \cos (Dz),$$

we have

(11) $$FD \cos (FD)=F_xD_x+F_yD_y+F_zD_z$$

as the analytic expression for the scalar product. If one of the vectors is taken as of unit length,

the expression (11) gives us the value of the projection F_s of any vector F on any direction s,

$$(12)\quad F_s = F\cos(Fs) = F_x\cos(sx) + F_y\cos(sy) + F_z\cos(sz).$$

It is easily proved that the work of the resultant of two forces in a displacement is the sum of the works of the components.

In the case of an infinitely small displacement dx, dy, dz, the work is

$$(13)\quad dW = F_x dx + F_y dy + F_z dz,$$

and if the point is moved along a curve the whole work is

$$(14)\quad W = \int (F_x dx + F_y dy + F_z dz),$$

where x, y, z, F_x, F_y, F_z, are supposed given in terms of some parameter, so that the integration along the curve can be performed.

If some of the points of a system are not free, but constrained, a *virtual* displacement is one that is consistent with the constraints. Virtual work is work done in a virtual displacement. The *Principle of Virtual Work* states that in a system of forces in equilibrium the work done in an infinitesimal *arbitrary* virtual displacement vanishes. Let us apply this principle to a number of simple cases. First, two equal weights P hanging from a string over a fixed pulley are in equilibrium. If the system is displaced one weight falls as much as the other rises. For the one that falls the displacement is in the direction of the force, and the work is positive and equal to PD. For the one that rises the displacement is opposite to the direction of the force, and the work is negative and equal to $-PD$. The sum of these two quantities thus vanishes. In the case of a weight hanging from a movable pulley (Fig. 16), if the string on the left is

FIG. 16.

pulled up a distance D, the force T_1 does the positive work T_1D; but from the geometry of the case the weight P rises a distance of $D/2$ and the weight W accordingly does the negative work—$PD/2$. The whole work is zero, if $T=P/2$. But this is the condition of equilibrium as found by resolution, since the tensions T_1 and T_2 are equal and we must have $T_1+T_2-P=0$. Consider a lever (Fig. 17)

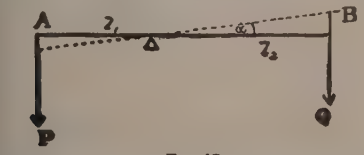


FIG. 17.

carrying the weights P, Q at distances l_1, l_2 from the fulcrum. Then for equilibrium the principle of moments gives $Pl_1=Ql_2$. But if the lever be turned through an infinitesimal angle α, the end A moves a distance downward $D_1=l_1\alpha$ and the weight does the positive work $Pl_1\alpha$, while the end B rises a distance $D_2=l_2\alpha$, and Q does the negative work $-Ql_2\alpha$. The whole work is zero if $Pl_1=Ql_2$, which is the condition for equilibrum. In the case of the inclined plane (Fig. 7), if the particle is displaced a small distance d up the plane, the force F does the work Fd. The weight W does the negative work $-Wd\sin\alpha$, since its direction makes an obtuse angle with the displacement. The reaction does no work, since it is perpendicular to the displacement. The whole work is therefore zero if $F=W\sin\alpha$. But this is the condition of equilibrium. The principle of virtual work is particularly convenient, since it enables us to leave the reactions out of account, since they do no work when the displacements are virtual. As a further example let us consider the equilibrium of a particle whose co-ordinates are x, y, z on a surface $\phi(x, y, z)=0$, under the action of forces whose resultant is X, Y, Z, omitting the reaction. Since the displacement is virtual, we must have $\phi=0$ during the displacement, so that

$$(15)\quad d\phi = \frac{\partial\phi}{\partial x}dx + \frac{\partial\phi}{\partial y}dy + \frac{\partial\phi}{\partial z}dz = 0.$$

The principle of virtual work says that for equilibrium

$$(16)\quad X dx + Y dy + Z dz = 0$$

for any virtual displacement, that is, one in which dx, dy, dz are not independent, but satisfy (15). Multiplying (15) by an undetermined factor λ and adding to (16), we have

$$(17)\quad \left(X+\lambda\frac{\partial\phi}{\partial x}\right)dx + \left(Y+\lambda\frac{\partial\phi}{\partial y}\right)dy + \left(Z+\lambda\frac{\partial\phi}{\partial z}\right)dz = 0.$$

Both conditions are satisfied if we determine λ so that

$$(18)\quad X+\lambda\frac{\partial\phi}{\partial x} = Y+\lambda\frac{\partial\phi}{\partial y} = Z+\lambda\frac{\partial\phi}{\partial z} = 0,$$

or eliminating λ,

$$(19)\quad \frac{X}{\frac{\partial\phi}{\partial x}} = \frac{Y}{\frac{\partial\phi}{\partial y}} = \frac{Z}{\frac{\partial\phi}{\partial z}}.$$

But this is the condition (5) that the resultant is normal to the surface, and in fact only in this way can there be equilibrium, according to the definition of a smooth surface.

For a rigid body, a possible displacement is one in which all the points receive equal and parallel displacements, so that dx, dy, dz are the same for all. We then have

$$(20)\quad \Sigma(X dx + Y dy + Z dz) = dx\Sigma X + dy\Sigma Y + dz\Sigma Z = 0.$$

If this is to be true for arbitrary values of dx, dy, dz we must have

$$\Sigma X = \Sigma Y = \Sigma Z = 0, \tag{21}$$

which are three of the conditions for equilibrium already found. A second possible displacement of a rigid body is one in which it is turned through an angle $d\theta$ about the Z-axis. Let us introduce polar co-ordinates, so that

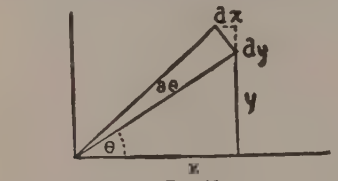


FIG. 18.

$x = r\cos\theta$, $y = r\sin\theta$. Then in the rotation, r being constant,

$$dx = -r\sin\theta\, d\theta = -y\, d\theta,\ dy = r\cos\theta\, d\theta = x\, d\theta,\ dz = 0.$$

Consequently the virtual work is

$$\Sigma(X dx + Y dy + Z dz) = d\theta\,\Sigma(xY - yX). \tag{22}$$

If this is to vanish whatever $d\theta$ we must have

$$\Sigma(xY - yX) = 0. \tag{23}$$

But this is one of the conditions for equilibrium (9) already found, and the two others are similarly found by rotating about the other axes.

Suppose now that we have any number of points $x_1, y_1, z_1, \ldots x_n, y_n, z_n$, acted on by any forces, $X_1, Y_1, Z_1, \ldots X_n, Y_n, Z_n$, and subject to any number of constraints,

$$\begin{aligned} &\phi_1(x_1, y_1, z_1, \ldots x_n, y_n, z_n) = 0, \\ &\phi_2(x_1, y_1, z_1, \ldots x_n, y_n, z_n) = 0, \\ &\quad\ldots\ldots\ldots\ldots\ldots\ldots \\ &\phi_k(x_1, y_1, z_1, \ldots x_n, y_n, z_n) = 0. \end{aligned} \tag{24}$$

Then the equation of virtual work,

$$\sum_{r=1}^{r=n} (X_r dx_r + Y_r dy_r + Z_r dz_r) = 0, \tag{25}$$

must hold for any changes of the co-ordinates which satisfy the conditions,

$$d\phi_1 = \sum_{r=1}^{r=n} \left(\frac{\partial\phi_1}{\partial x_r} dx_r + \frac{\partial\phi_1}{\partial y_r} dy_r + \frac{\partial\phi_1}{\partial z_r} dz_r \right) = 0.$$

$$\ldots\ldots\ldots\ldots \tag{26}$$

$$d\phi_k = \sum_{r=1}^{r=n} \left(\frac{\partial\phi_k}{\partial x_r} dx_r + \frac{\partial\phi_k}{\partial y_r} dy_r + \frac{\partial\phi_k}{\partial z_r} dz_r \right) = 0.$$

Multiplying these equations in turn by multipliers $\lambda_1, \ldots \lambda_k$, and adding to (25),

$$\begin{aligned} \sum_{r=1}^{r=n} \Bigg[&\left(X_r + \sum_{s=1}^{s=k} \lambda_s \frac{\partial\phi_s}{\partial x_r} \right) dx_r \\ &+ \left(Y_r + \sum_{s=1}^{s=k} \lambda_s \frac{\partial\phi_s}{\partial y_r} \right) dy_r \\ &+ \left(Z_r + \sum_{s=1}^{s=k} \lambda_s \frac{\partial\phi_s}{\partial z_r} \right) dz_r \Bigg] = 0, \end{aligned} \tag{27}$$

which is satisfied for all virtual values of $dx_1, \ldots dz_n$, if we take

$$\begin{aligned} X_r + \sum_{s=1}^{s=k} \lambda_s \frac{\partial\phi_s}{\partial x_r} &= 0, \\ Y_r + \sum_{s=1}^{s=k} \lambda_s \frac{\partial\phi_s}{\partial y_r} &= 0, \quad r = 1, 2, \ldots n. \\ Z_r + \sum_{s=1}^{s=k} \lambda_s \frac{\partial\phi_s}{\partial z_r} &= 0. \end{aligned} \tag{28}$$

From these equations, eliminating the k multipliers $\lambda_1, \ldots \lambda_k$, we have $3n - k$ equations of equilibrium.

5. KINEMATICS.— Let us now consider questions of motion. The velocity of a point is defined as the limit of the space Δs described by it to the time of description Δt, when both decrease indefinitely.

$$v = \lim_{\Delta t = 0} \frac{\Delta s}{\Delta t} = \frac{ds}{dt}. \tag{29}$$

Since displacements are compounded as vectors, the resultant of a displacement AB (Fig. 1), and another BD being AD, if the two displacements take place in the same time, the velocities are also proportional to the three lines, so that velocities are vectors, compounded by the parallelogram. Accordingly a velocity may be represented by its components along the co-ordinates axes. Its direction being that of the tangent to the path, its direction cosines are those of the tangent,

$$\frac{dx}{ds}, \quad \frac{dy}{ds}, \quad \frac{dz}{ds}.$$

Consequently, its components are

$$v_x = v\frac{dx}{ds} = \frac{ds}{dt}\frac{dx}{ds} = \frac{dx}{dt}, \tag{30}$$

$$v_y = v\frac{dy}{ds} = \frac{ds}{dt}\frac{dy}{ds} = \frac{dy}{dt}, \quad v_z = v\frac{dz}{ds} = \frac{ds}{dt}\frac{dz}{ds} = \frac{dz}{dt}.$$

Also,

$$\begin{aligned} v^2 &= v_x^2 + v_y^2 + v_z^2 \\ &= \left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2 + \left(\frac{dz}{dt}\right)^2 = \left(\frac{ds}{dt}\right)^2. \end{aligned} \tag{31}$$

Similarly, the projection of a velocity in any direction is the velocity of the projection of the point on a line having that direction.

If a point moves in a plane it may be convenient to introduce polar co-ordinates r, ϕ.

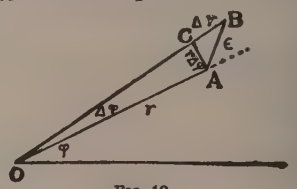


FIG. 19.

If the point moves from A to B (Fig. 19), a distance Δs in the time Δt, dropping a perpendicular AC upon the radius OB, the displace-

ment may be resolved into AC and CD, equal to $r\Delta\phi$ and Δr respectively, and accordingly the velocity may be resolved into the components in those directions.

$$(32) \qquad v_\phi = \lim_{\Delta t=0} \frac{r\Delta\phi}{\Delta t} = r\frac{d\phi}{dt},\ v_r = \lim_{\Delta t=0} \frac{\Delta r}{\Delta t} = \frac{dr}{dt}.$$

Also,

$$(33) \qquad v^2 = v_\phi^2 + v_r^2 = r^2\left(\frac{d\phi}{dt}\right)^2 + \left(\frac{dr}{dt}\right)^2 = \left(\frac{ds}{dt}\right)^2,$$

as may also be seen from the expression for the arc in polar co-ordinates. The components v_r and v_ϕ are called the radial and tangential components of the velocity respectively, while $\frac{d\phi}{dt}$ is called the angular velocity of the radius.

The area of the triangle OAB being $\frac{1}{2}r^2d\phi$, the radius vector sweeps over area at the rate $\frac{dS}{dt} = \frac{1}{2}r^2\frac{d\phi}{dt}$, but since the area is also equal to one-half the product of AB by the perpendicular on it from O, then we find this rate of area description to be equal to one-half the *moment of the velocity* about O. Using the formula (8) for moment of a vector we have

$$(34) \qquad \frac{dS}{dt} = \frac{1}{2}r^2\frac{d\phi}{dt} = \frac{1}{2}(xv_y - yv_x) = \frac{1}{2}\left(x\frac{dy}{dt} - y\frac{dx}{dt}\right),$$

which may be easily verified by passing directly from rectangular to polar co-ordinates.

6. If the velocity of a point varies we define the *acceleration* as the limit of the increment of velocity to the time in which it takes place. We may consider the numerical change,

$$(35) \qquad \lim_{\Delta t=0} \frac{\Delta v}{\Delta t} = \frac{dv}{dt} = \frac{d^2s}{dt^2},$$

or the vector change. If AB (Fig. 20) denote the velocity at a time t, AC the velocity at

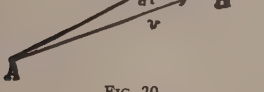


FIG. 20.

the time $t+\Delta t$, the vector increase of velocity is BC, and the acceleration is the limit of the ratio of BC to Δt. Obviously it may be resolved into any components, which are the corresponding components of BC each divided by Δt. In the triangle ABC, since the velocities AB and AC have the directions of the tangents to the path at the respective instants the angle between them is the angle $d\tau$ between the two consecutive tangents. It is obvious that the direction of the infinitesimal side BC may be anything whatever, and that accordingly the direction of the acceleration is totally unrelated to that of the velocity, that is of the tangent to the path. Resolving along the axes, we find for the components of the accelerations

$$(36) \qquad a_x = \frac{dv_x}{dt} = \frac{d^2x}{dt^2},\ a_y = \frac{dv_y}{dt} = \frac{d^2y}{dt^2},$$

$$a_z = \frac{dv_z}{dt} = \frac{d^2z}{dt^2},$$

from which

$$(37) \qquad a^2 = \left(\frac{d^2x}{dt^2}\right)^2 + \left(\frac{d^2y}{dt^2}\right)^2 + \left(\frac{d^2z}{dt^2}\right)^2.$$

Since the direction cosines of the tangent are the same as those of the velocity, v_x/v, v_y/v, v_z/v, we may use the formula (12) to resolve the acceleration along the tangent.

$$(38) \qquad a_\tau = (a_xv_x + a_yv_y + a_zv_z)/v$$

$$= \left(\frac{d^2x}{dt^2}\frac{dx}{dt} + \frac{d^2y}{dt^2}\frac{dy}{dt} + \frac{d^2z}{dt^2}\frac{dz}{dt}\right) \Big/ \frac{ds}{dt}$$

But differentiating equation (31) and comparing with (38), we find

$$(39) \qquad a_\tau = \frac{d^2s}{dt^2}.$$

Thus the rate of increase of the numerical velocity is equal, not to the whole acceleration, but to its tangential component. This we call the tangential acceleration, and it is equal to the limit of DC (Fig. 20), divided by Δt. The normal acceleration is easily obtained from the figure as the limit of BD divided by Δt. But in the figure we have $BD = AB \cdot d\tau = vd\tau$, so that the normal acceleration,

$$(40) \qquad a_\nu = v\frac{d\tau}{dt}.$$

Also, if ρ is the radius of curvature of the path, $ds = \rho d\tau$.

$$(41) \qquad a_\nu = \frac{v}{\rho}\frac{ds}{dt} = \frac{v^2}{\rho}.$$

The normal acceleration is always directed toward the *concave* side of the path, and is called the *centripetal acceleration.*

We will now consider some of the most important cases of acceleration. If the motion is rectilinear, the velocity and the acceleration have always the same direction, but may vary in magnitude and in sign. After uniform motion, in which the velocity is constant and the acceleration zero, so that equal spaces are described in equal times, the simplest case is that of constant acceleration,

$$(42) \qquad \frac{d^2s}{dt^2} = a = \text{const.}$$

Integrating we obtain

$$(43) \qquad \frac{ds}{dt} = at + b,$$

where b is a constant representing the velocity when $t=0$. Integrating again,

$$(44) \qquad s = \tfrac{1}{2}at^2 + bt,$$

where s denotes the space described since $t=0$. Thus if the particle start from rest ($b=0$), it describes spaces proportional to the *squares* of the times of description. It was found by Galileo that bodies fall toward the earth according to such a law, and that in a given locality the value of the acceleration is the same for all bodies. The value of this acceleration of gravity is generally denoted by g. Comparing the velocity attained by a body

falling from rest with the height, we obtain, by (43) and (44),

$$(45) \qquad v = gt,\ h = \tfrac{1}{2}gt^2,\ v^2 = 2gh.$$

Conversely, if a body be thrown upwards with a velocity v, it will reach the height h.

If we consider the motion of a body under gravity, but possessing a horizontal velocity as well as a vertical component, since there is no horizontal acceleration the horizontal velocity v_x is constant. Calling the vertical distance fallen z, the horizontal distance traversed x, we have

$$z = \tfrac{1}{2}gt^2,\ x = v_x t,$$

and eliminating t we have the equation of the path, $z = \frac{1}{2}\frac{gx^2}{v_x^2}$, representing a parabola with the axis vertical. The velocity at any point and its inclination to the horizontal are found from

$$v_z = gt = \sqrt{2gz},\ v^2 = v_x^2 + v_z^2,\ \tan\alpha = v_z/v_x.$$

If, on the other hand, the particle be projected upward with velocity v at an angle α with the horizontal, it will describe the same parabola, rising to the vertex in the time t and falling on the symmetrical half. This problem was also solved by Galileo.

Consider a particle revolving with constant velocity v in a circular path of radius r. Then since $s = vt$, by (39) we find that the tangential component of the acceleration vanishes. The normal component is given by (41) as v^2/r. Thus the acceleration is constant in amount and always directed toward the centre. It is to be observed that although the numerical velocity is constant, the vector velocity is constantly changing its direction, hence the acceleration is not zero, but is perpendicular to the velocity. If we resolve the uniform circular motion into components parallel to given directions, for instance, if P (Fig. 21) is projected into Q and R lying on the axes OX, OY, and if P revolves with constant angular velocity $\omega = \frac{d\phi}{dt}$, we have $\phi = \omega t$, $OQ = r\cos\phi = r\cos\omega t$, $OR = r\sin\phi = r\sin\omega t$. The rectilinear motion of either Q or R is called *simple harmonic motion*, or a *simple vibration*. It is evidently periodic, that is, it repeats after the interval $T = \frac{2\pi}{\omega}$. The number of vibrations in unit of time, or the *frequency*, is $\frac{1}{T} = \frac{\omega}{2\pi}$. Since the acceleration of P is constant in magnitude,

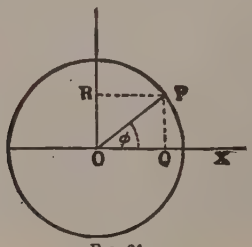


Fig. 21.

and always in the direction PO, its component along OX varies as $\cos\phi$, that is, as the distance OQ. In other words, a point describing a simple harmonic motion has an acceleration proportional to its displacement from the centre of symmetry, and directed toward it. We may also consider harmonic motion analytically. If the acceleration is proportional to the displacement but opposite in direction, we shall have

$$(46) \qquad \frac{d^2s}{dt^2} = -\omega^2 s,$$

where ω is a constant. The integral of this differential equation is

$$(47) \quad s = A\cos\omega t + B\sin\omega t = a\cos(\omega t - \alpha),$$

where A and B are arbitrary constants and $A = a\cos\alpha$, $B = a\sin\alpha$. The constant a is called the *amplitude*, while the angle α, called the *phase*, depends simply upon the instant adopted from which to count the time. By taking for α the values 0° or 90° we obtain either $a\cos\omega t$ or $a\sin\omega t$.

If we compound two simple harmonic motions in lines at right angles to each other, if the amplitudes and periods are the same and the phases differ by a right angle, the previous construction shows that we obtain uniform circular motion. If the amplitudes and phases do not have this relation, we have

$$(48) \qquad \begin{aligned} x &= a\sin(\omega t - \alpha) \\ &= a(\sin\omega t\cos\alpha - \cos\omega t\sin\alpha), \\ y &= b\sin(\omega t - \beta) \\ &= b(\sin\omega t\cos\beta - \cos\omega t\sin\beta). \end{aligned}$$

Solving for $\sin\omega t$ and $\cos\omega t$

$$(49) \quad \sin\omega t = \left(\frac{x}{a}\sin\beta - \frac{y}{b}\sin\alpha\right)\Big/\sin(\beta-\alpha),$$

$$\cos\omega t = \left(\frac{x}{a}\cos\beta - \frac{y}{b}\cos\alpha\right)\Big/\sin(\beta-\alpha).$$

Squaring and adding we eliminate t and obtain the equation of the path,

$$(50) \qquad \frac{x^2}{a^2} + \frac{y^2}{b^2} - 2\frac{x}{a}\frac{y}{b} = \sin^2(\alpha-\beta),$$

which represents an ellipse. The motion is called *elliptic harmonic motion*. The ellipse is evidently inscribed in a rectangle of sides $2a$, $2b$ (Fig. 22), and according to the values of $\alpha-\beta$ may have any shape, reducing to a straight line when $\alpha-\beta$ is zero or 180°. If the two harmonic vibrations are not of the same period, the resulting path belongs to a system of curves associated with the name of Lissajous. They may be easily constructed point by point, but the elimination of t will be possible only if the periods have a common measure.

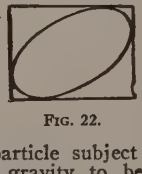


Fig. 22.

Suppose a particle subject to the constant acceleration of gravity to be constrained to

move in a vertical circle of radius l (Fig. 23). The component of the acceleration g in the direction of the tangent is $-g \sin\theta$, while the distance moved from the bottom of the circle

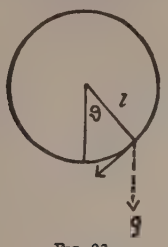


FIG. 23.

is $l\theta$. We thus have the differential equation

$$(51) \qquad \frac{d^2s}{dt^2} = l\frac{d^2\theta}{dt^2} = -g\sin\theta.$$

The solution of this equation requires elliptic functions, but if θ is small enough we may neglect the difference between the angle θ and its sine, so that the equation of motion is

$$(52) \qquad \frac{d^2\theta}{dt^2} = -\frac{g}{l}\theta,$$

which is the same as the equation (46) of harmonic motion with $\omega^2 = g/l$. Accordingly the small vibrations of a pendulum are harmonic, of the period $T = 2\pi\sqrt{\frac{l}{g}}$, which is independent of the amplitude of oscillation. The fact of this *isochronism* of the pendulum, or independence of the period from the amplitude, was discovered by Galileo, while the laws of uniform circular and of harmonic motion, and of the pendulum, were found by Huygens. The latter also used the formula $g = \frac{4\pi^2 l}{T^2}$ to determine the value of g.

Let us now examine the consequences of the celebrated laws discovered by Kepler as governing the motion of the planets about the sun. The first law states that the areas swept over by the radius vector from the sun to a planet in equal times are equal. Calling the area S, $\frac{dS}{dt} = \text{const.}$ But differentiating the value of $\frac{dS}{dt}$ given in (34), we find

$$(53) \qquad 2\frac{d^2S}{dt^2} = x\frac{d^2y}{dt^2} - y\frac{d^2x}{dt^2} = xa_y - ya_x.$$

But this is the *moment* of the acceleration with respect to the origin, and if it vanishes, the acceleration must be directed toward the origin. The kinematical interpretation of the first law is then that the planets are accelerated toward the sun. The second law states that the planets describe ellipses about the sun as a focus. The equation of a conic section referred to its focus is

$$r = \frac{p}{1 + e\cos\phi}, \qquad p = a(1-e^2),$$

where a is the major axis, e the eccentricity. Now to resolve the acceleration along the radius vector, we multiply its components a_x, a_y, respectively, by the direction cosines of the radius vector, which are $\cos\phi$, $\sin\phi$. Differentiating the equations for change of co-ordinates $x = r\cos\phi$, $y = r\sin\phi$, twice, we have

$$a_x = \frac{d^2x}{dt^2} = \frac{d^2r}{dt^2}\cos\phi - 2\sin\phi\frac{d\phi}{dt}\frac{dr}{dt} - r\sin\phi\frac{d^2\phi}{dt^2} - r\cos\phi\left(\frac{d\phi}{dt}\right)^2,$$

$$a_y = \frac{d^2y}{dt^2} = \frac{d^2r}{dt^2}\sin\phi + 2\cos\phi\frac{d\phi}{dt}\frac{dr}{dt} + r\cos\phi\frac{d^2\phi}{dt^2} - r\sin\phi\left(\frac{d\phi}{dt}\right)^2,$$

from which

$$(54) \qquad a_r = a_x\cos\phi + a_y\sin\phi = \frac{d^2r}{dt^2} - r\left(\frac{d\phi}{dt}\right)^2.$$

Now by Kepler's first law,

$$2\frac{dS}{dt} = r^2\frac{d\phi}{dt} = \text{const.} = h, \qquad \frac{d\phi}{dt} = \frac{h}{r^2}.$$

Changing the variable from t to ϕ,

$$\frac{dr}{dt} = \frac{dr}{d\phi}\frac{d\phi}{dt} = \frac{h}{r^2}\frac{dr}{d\phi} = -h\frac{d}{d\phi}\left(\frac{1}{r}\right).$$

Differentiating by t,

$$\frac{d^2r}{dt^2} = -h\frac{d^2}{d\phi^2}\left(\frac{1}{r}\right)\frac{d\phi}{dt} = -\frac{h^2}{r^2}\frac{d^2}{d\phi^2}\left(\frac{1}{r}\right).$$

From the equation of the path we obtain

$$\frac{1}{r} = \frac{1}{p} + \frac{e}{p}\cos\phi, \quad \frac{d^2}{d\phi^2}\left(\frac{1}{r}\right) = -\frac{e}{p}\cos\phi = \frac{1}{p} - \frac{1}{r},$$

from which

$$\frac{d^2r}{dt^2} = -\frac{h^2}{pr^2} + \frac{h^2}{r^3}, \quad a_r = -\frac{h^2}{pr^2}.$$

Thus the fact that the path is a conic section shows that the acceleration is inversely as the square of the distance from the focus. The negative sign shows that it is *toward* the sun.

The third law states that for different planets the squares of the times of description of the orbits are proportional to the cubes of the major axes. Since $2dS/dt = h$, if T is the time of a complete period hT is twice the area of the orbit.

$$hT = 2\pi ab = 2\pi a^2\sqrt{1-e^2}, \quad h^2 = \frac{4\pi^2a^4}{T^2}(1-e^2),$$

$$(55) \qquad a_r = -\frac{h^2}{pr^2} = -\frac{h^2}{a(1-e^2)}\frac{1}{r^2} = \frac{4\pi^2a^3}{T^2}\frac{1}{r^2}.$$

Now since a^3/T^2 is the same for all the planets, we see that the factor of $1/r^2$ in the acceleration is the same for all the planets. These kinematical interpretations of Kepler's laws in terms of acceleration were given by Newton.

6. KINETICS.— The whole of our experience of dynamical phenomena was summed up by Newton in his *Axioms or Laws of Motion*, which are as follows:

I. *Every body persists in its state of rest or of uniform motion in a straight line, except in so far as it is compelled by impressed forces to change that state.*

The property of persistence thus defined is called *Inertia*. The law of inertia was recognized in a less definite way by Galileo, but Newton makes of it a criterion for the existence of force, and in fact implies that if a body is moving in any other way than uniformly in a

straight line, that is, without acceleration, it is acted on by a force. The second law gives a positive definition of force.

II. *Change of motion is proportional to the moving force applied, and takes place in the direction of the straight line in which the force acts.*

In the explanation of this law, and in a corollary appended, Newton makes clear that it is intended to include the independence of effect of two simultaneous forces, and their composition by the parallelogram.

In his introductory definitions, Newton states what he means by quantity of motion, to which force is proportional, namely, the product of velocity by mass, or what is now called *momentum,* but the motion of mass is best introduced by the third law, which is perhaps the most important, as well as original, of the three.

III. *To every action there is always an equal and contrary reaction; or, the mutual actions of any two bodies are always equal and oppositely directed.*

If the force were measured by the acceleration alone, the accelerations of the two interacting bodies would be *equal* and opposite; that is not the case, but they are found to be proportional, with a factor of proportionality which is found to be always the same for two given bodies, no matter how they act on each other. For example, let them be connected by a string, and act on each other through its tension, or by an elastic cord whose length may vary. If for symmetry we write a factor for each acceleration,

$$(56)\quad m_1\frac{d^2x_1}{dt^2}=-m_2\frac{d^2x_2}{dt^2},\quad m_1\frac{d^2y_1}{dt^2}=-m_2\frac{d^2y_2}{dt},$$
$$m_1\frac{d^2z_1}{dt^2}=-m_2\frac{d^2z_2}{dt^2},$$

the factors m_1, m_2 are called the *masses* of the bodies, and their ratio is determined by the ratio of the accelerations. Thus we may compare the mass of any body with that of a given body taken as a unit. The usual unit of mass is the pound or the gram.

By the introduction of the conception of mass and of momentum we pass from kinematics to kinetics, or dynamics proper. As long as we were concerned with one body at a time, like Galileo and Huygens, the notion of acceleration was sufficient, but when we deal with a number of bodies with mutual actions, the notion of force is necessary. The terms on either side of equations (56) represent the forces, and the equations express the third law. The second law may now be stated by saying that force is the rate of change of *momentum.* The forces generally are known in terms of the positions of the bodies, and perhaps of their velocities, and when given by their components X, Y, Z as functions of these quantities, the equations

$$(57)\qquad m\frac{d^2x}{dt^2}=X,\quad m\frac{d^2y}{dt^2}=Y,\quad m\frac{d^2z}{dt^2}=Z$$

are called the differential equations of motion.

Our kinematical examples of the previous section may now be dynamically interpreted. The fact that bodies fall with a common acceleration g shows that the forces with which they are moved toward the earth, or their weights, $W=mg$, are proportional to their masses. The unit of force, namely, that force which produces in a pound an acceleration corresponding to an increase of velocity of one foot per second in each second, has received the name of *poundal.* The weight of each pound is accordingly g poundals. The unit generally used by scientists is the force which produces in a gram the acceleration corresponding to an increase of velocity of one centimeter per second in each second. This force is called a *dyne,* and the weight of a gram is g dynes. These units are called *absolute* units, as they do not depend on accidental circumstances of time or place, but are referred to three fundamental units, of time, length and mass, the latter two of which are preserved in concrete standards, the former is preserved in the rotation of the earth. The more familiar *gravitation unit,* which we have used in the section on statics, and which is the *weight* of the pound or gram, is not absolute, since g varies at different parts of the earth, according to the formula

$$(58)\quad g=980.62-2.6\cos 2\lambda-.000003h,$$

where λ is the latitude, h the height above sea-level, and the units are the centimeter and the second. The weight of a body is accordingly variable, but its mass is invariable. For $\lambda=45°$, at sea-level we have

Weight of pound $=32.17$ *poundals,*
Weight of gram $=980.62$ *dynes.*

The popular usage of the term pound or gram to denote both a mass and a force is unfortunate, and should be avoided.

The fact that the weights of bodies are proportional to their masses was carefully tested by Newton by constructing pendulums of different materials, and finding that the acceleration, as determined by the time of oscillation, was independent of the substance.

The fact that a body moving uniformly in a circle has a centripetal acceleration v^2/r shows that it is acted on by a force toward the centre (centripetal force) equal to mv^2/r. If the body, for instance, be revolved in a horizontal orbit on a whirling machine, and be held in place by a string, this string may be passed over a pulley and support a weight, so that we may thus make a comparison between the absolute dynamical measure of force and the gravitational statical one previously used. By repeating the experiment with another revolving mass, we may compare the masses of two bodies, by the process of comparing both with the same weight. This illustrates the dynamical comparison of masses. The usual statical method of comparison by a balance is actually a comparison of *weights,* and gives a correct comparison of masses because the value of g is the same at each pan. If we used a balance-beam so long that g differed sensibly at its two ends, equality of weights would not mean equality of masses.

Another simple illustration of the dynamical method of comparison of masses is furnished by Atwood's machine, by which the laws of falling bodies may be studied. Two masses, m_1, m_2, Fig. 24, are hung from a string passage over a frictionless pulley. Since the distance moved up by one mass is equal to that moved down by the other, the velocities and accelerations of the two are equal and opposite. Each

mass is acted upon by two forces, the tension of the string upwards and its own weight downwards. The tension is the same for both. Con-

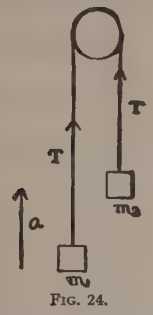


FIG. 24.

sequently we have for the acceleration a,

$$m_1a_1 = \quad m_1a = T - m_1g,$$
$$m_2a_2 = -m_2a = T - m_2g,$$

from which we obtain

$$a = \frac{m_2 - m_1}{m_2 + m_1}g;$$

that is, the acceleration is to that of a body falling freely as the difference to the sum of the masses. Thus by observing the acceleration the masses may be compared. In the usual use of Atwood's machine that difference of masses is produced by an extra weight, which is taken off at a certain height by a fixed ring, after which the two remaining equal masses travel with uniform velocity, and by the velocity generated the acceleration is determined.

The properties of harmonic motion show that a body acted upon by a force proportional to its displacement from a fixed point will execute a harmonic vibration. When a point has a position of equilibrium and is displaced therefrom, forces will in general be brought into play tending to restore it to its position, and these forces will depend upon the displacement. If the displacement be small enough, the forces will be approximately proportional to the displacement, hence the frequency of harmonic vibrations in nature. The vibration of the pendulum or of a tuning-fork are examples.

From the generalization that all the planets are accelerated toward the sun with an acceleration $a = c/r^2$, where c is constant for all, Newton, putting the force equal to cm/r^2, and seeing that the masses of the two interacting bodies, the sun and planet, must enter symmetrically, was led to assume $F = \gamma Mm/r^2$, and from the law of reaction this would also be the force urging the sun toward the earth. Thus he was led to the generalization of universal gravitation, namely, the statement that every mass in the universe attracts every other with a force proportional to the product of both their masses, and inversely to the square of the distance apart. (The number γ is the same for all, depending only on the units used).

Newton tested this by comparing the acceleration of the moon due to the earth's attraction with the acceleration of a body at the earth's surface. Supposing the moon's orbit to be circular, of radius r and period T, its acceleration will be by (55) $a_m = 4\pi^2 r/T^2$. If the acceleration varies inversely as the square of the distance, at the surface of the earth, it will be

$$a_s = a_m\frac{r^2}{R^2} = \frac{4\pi^2 r^3}{R^2T^2},$$

where R is the earth's radius.

Now we have

$T = 27d\cdot 43$ m. $= 39{,}343$ m., $2\pi R = 4 \times 10^7$ meters, $r = 60R$,

from which

$$a_s = \frac{2\pi\cdot 60^3\cdot 4\cdot 10^7 \text{ meters}}{(39{,}343\cdot 60 \text{ sec})^2}$$

$$= 9{\cdot}74\ \frac{\text{meters}}{\text{sec}^2} = 974\ \frac{\text{cm.}}{\text{sec}^2}.$$

This agrees well with the value of g from terrestrial observations, while more exact calculations give a still better agreement.

The value of the Newtonian constant, γ, or the number of dynes of attraction of two masses each of one gram, one centimeter apart, is $\gamma = 6.6576.10^{-8}$.

A highly important contribution was made by d'Alembert, who made it possible to reduce every problem of dynamics to one of statics. If a system of particles be not free, they cannot move under the influence of given applied forces as they would if not constrained, but the reactions will cause them to move otherwise, as in the case of the masses in Atwood's machine. For another instance, consider two bullets fastened together by a string and thrown at random into the air. If free each would describe plane curves, namely, vertical parabolas. Under the influence of the tensions of the string which causes the constraint, they describe looped or tortuous paths. If we knew the actual paths and motions, we could find forces which would produce the same motions if the particles were free. These d'Alembert calls the effective forces and they are given by

$$X' = m\frac{d^2x}{dt^2},\quad Y' = m\frac{d^2y}{dt^2},\quad Z' = m\frac{d^2z}{dt^2}.$$

D'Alembert's principle states that the actual applied forces, together with the *reversed* effective sources, would form a system in equilibrium. If we express the equilibrium by means of the equation of virtual work, (25), we obtain

$$\sum_r \{(X_r - X'_r)\delta x_r + (Y_r - Y'_r)\delta y_r + (Z_r - Z_r')\delta z_r = 0$$

or

$$(58)\quad \sum_r \left\{\left(m_r\frac{d^2x_r}{dt^2} - X_r\right)\delta x_r + \left(m_r\frac{d^2y_r}{dt^2} - Y_r\right)\delta y_r + \left(m_r\frac{d^2z_r}{dt^2} - Z_r\right)\delta z_r\right\} = 0.$$

This equation, given by Lagrange, was made by him the basis of all dynamics. Since the reactions would of themselves form a system of forces in equilibrium, they may be left out of the equation (58) of d'Alembert's Principle.

From the equation (58) we can deduce all the principles of dynamics. Suppose every particle is free, then all the virtual displacements, δx_r, δy_r, δz_r, are independent, and in

order that the equation may hold for arbitrary displacements, we must have

$$(59)\qquad m_r\frac{d^2x_r}{dt^2}=X_r,\quad m_r\frac{d^2y_r}{dt^2}=Y_r,\quad m_r\frac{d^2z_r}{dt^2}=Z_r$$

for every r. But these are Newton's equations of motion.

If the particles be free or form a rigid system, a virtual displacement will be given when δx_r, δy_r, δz_r, have the same values for all the particles. We may then remove these factors from the summation.

$$(60)\qquad \delta x\left(\sum_r m_r\frac{d^2x_r}{dt^2}-\sum_r X_r\right)+\delta y\left(\sum_r m_r\frac{d^2y_r}{dt^2}-\sum_r Y_r\right)+\delta z\left(\sum_r m_r\frac{d^2z_r}{dt^2}-\sum_r Z_r\right)=0,$$

and if δx, δy, δz, are arbitrary, this requires

$$(61)\qquad \sum_r m_r\frac{d^2x_r}{dt^2}=\sum_r X_r,\ \sum_r m_r\frac{d^2y_r}{dt^2}=\sum_r Y_r,\ \sum_r m_r\frac{d^2z_r}{dt^2}=\sum_r Z_r.$$

Now we have

$$(62)\qquad \sum_r m_r\frac{d^2x_r}{dt^2}=\frac{d^2}{dt^2}\sum_r m_rx_r=\left(\sum_r m_r\right)\frac{d^2\bar{x}}{dt^2},$$
$$\sum_r m_r\frac{d^2y_r}{dt^2}=\frac{d^2}{dt^2}\sum_r m_ry_r=\left(\sum_r m_r\right)\frac{d^2\bar{y}}{dt^2},$$
$$\sum_r m_r\frac{d^2z_r}{dt^2}=\frac{d^2}{dt^2}\sum_r m_rz_r=\left(\sum_r m_r\right)\frac{d^2\bar{z}}{dt^2},$$

where $\bar{x}$, $\bar{y}$, $\bar{z}$ are the co-ordinates of the centre of mass, which obviously coincides with what in the treatment of statics has been called the centre of gravity. We thus find that the centre of mass of a free system, or of a rigid body, moves as if all the forces of the system were applied at that point and all the mass were concentrated there. In particular if the system is exposed to no external forces, but only to its mutual actions, since these are equal and opposite in pairs, they destroy each other. Consequently the centre of mass of such a system moves uniformly in a straight line. This applies to the solar system.

Under the same conditions, a rotation about an axis is a virtual displacement. Putting as in (22) $\delta x=-y\delta\theta$, $\delta y=x\delta\theta$, $\delta z=0$, and dividing out $\delta\theta$ we have

$$(63)\qquad \sum_r m_r\left(x_r\frac{d^2y}{dt^2}-y_r\frac{d^2x}{dt^2}\right)=\sum_r(x_rY_r-y_rX_r).$$

The quantity on the right is the z-component of the resultant moment of all the impressed forces, as in (9), (23), which will be denoted by the components L, M, N.

The quantity on the left may be written

$$\frac{d}{dt}\sum_r m_r\left(x_r\frac{dy_r}{dt}-y_r\frac{dx_r}{dt}\right).$$

The quantity whose derivative appears,

$$(64)\qquad H_z=\sum_r\left(x_rm_r\frac{dy}{dt}-y_rm_r\frac{dx_r}{dt}\right)=\sum_r(x_rm_rv_{yr}-y_rm_rv_{xr}),$$

is evidently the z-component of the resultant *moment of momentum* of all of the particles of which the system is composed. We thus have the principle that if we construct a vector H having the components H_x, H_y, H_z, where

$$H_x=\sum_r(y_rm_rv_{zr}-z_rm_rv_{yr}),$$
$$H_y=\sum_r(z_rm_rv_{xr}-x_rm_rv_{zr}),$$
$$H_z=\sum_r(x_rm_rv_{yr}-y_rm_rv_{xr}),$$

in virtue of the equations

$$(65)\qquad \frac{dH_x}{dt}=L,\quad \frac{dH_y}{dt}=M,\quad \frac{dH_z}{dt}=N,$$

the velocity of the extremity of the vector H, representing the moment of momentum of the system, is equal and parallel to the resultant moment of the impressed forces about the same point. This principle, with that of equations (61), suffices for the treatment of the motion of a rigid body. By putting all velocities equal to zero we obtain the conditions of equilibrium as in (9).

If in equation (58) we put for δx_r, δy_r, δz_r, the distance actually traversed by the various points in the actual motion in the interval dt,

$$\delta x_r=\frac{dx_r}{dt}dt,\quad \delta y_r=\frac{dy_r}{dt}dt,\quad \delta z_r=\frac{dz_r}{dt}dt,$$

we obtain

$$(66)\qquad \sum_r m_r\left(\frac{d^2x_r}{dt^2}\frac{dx_r}{dt}+\frac{d^2y_r}{dt^2}\frac{dy_r}{dt}+\frac{d^2z_r}{dt^2}\frac{dz_r}{dt}\right)dt-\sum_r\left(X_r\frac{dx_r}{dt}+Y_r\frac{dy_r}{dt}+Z_r\frac{dz_r}{dt}\right)dt=0,$$

and we may write the sum of terms containing the accelerations as an exact derivative,

$$\frac{d}{dt}\frac{1}{2}\sum_r m_r\left[\left(\frac{dx_r}{dt}\right)^2+\left(\frac{dy_r}{dt}\right)^2+\left(\frac{dz_r}{dt}\right)^2\right]=\frac{dT}{dt}.$$

The quantity T whose derivative appears, which is one-half the sum of the products of the mass of each particle by the square of its velocity, is the very important quantity called the *kinetic energy*. Integrating equation (66) between the limits t_0 and t_1,

$$(67)\qquad T_1-T_0=\sum_r\int_{t_0}^{t_1}(X_rdx_r+Y_rdy_r+Z_rdz_r),$$

where T_0 and T_1 denote the values of T at the respective instants t_0 and t_1.

The integral on the right is the work (14) done by all the applied forces during the motion. We thus obtain the principle that *the increase of kinetic energy of a system is equal to the work done by the forces.* Suppose now that the system be taken from one given configuration, where all the co-ordinates have given values, to a second, where they have other given values, the particles describing given paths, and they then be taken from the same initial configuration to the same terminal one, but by other paths. Two cases are to be considered. Either the work done by the forces depends upon the paths, or it is independent of the paths, depending only on the terminal configurations. If the integral

$$\int_{t_0}^{t_1}(X_rdx_r+Y_rdy_r+Z_rdz_r)$$

does not depend upon the path, it can be shown

that every component of every force is the partial derivative of a single function $-W$ of all the co-ordinates, by the corresponding co-ordinates.

$$(68) \qquad X_r = -\frac{\partial W}{\partial x_r}, \quad Y_r = -\frac{\partial W}{\partial y_r}, \quad Z_r = -\frac{\partial W}{\partial z_r}.$$

We then have

$$\sum_r \int_{h_0}^{h} (X_r dx_r + Y_r dy_r + Z_r dz_r) = W_0 - W_1,$$

and the equation (67) becomes

$$T_1 - T_0 = W_0 - W_1,$$

or

$$(69) \qquad T_1 + W_1 = T_0 + W_0.$$

The sum of the two functions $T + W$ is then constant during the motion. As T is called the kinetic, W is called the *potenial energy* of the system. Such systems are called *conservative systems,* and the above principle is called the principle of the *Conservation of Energy.* The motion of energy is of the greatest importance in dynamics. The principle was first used by Huygens and was generally stated by John and Daniel Bernoulli.

As an example of a conservative force we may take gravity. For a single particle we have $W = mgz$ (z being measured upward), so that the equation of energy is

$$\tfrac{1}{2}mv^2 + mgz = \text{const.} = \tfrac{1}{2}mv_0^2 + mgz_0,$$
$$v^2 - v_0^2 = 2g(z_0 - z) = 2gh.$$

Accordingly the velocity attained by a falling particle does not depend on the form of the path, but only on the height fallen. This was known to Galileo, for bodies falling along the inclined plane or the arc of a circle. All forces acting according to the Newtonian law are also conservative.

We have now stated in summary fashion the principal theorems of *Mechanics.* The scope of this article does not permit us to enter into the details of the various methods which arise for treating the more complicated problems, say of the motion of a rigid body. By means of the equations (65), however, we may form an idea of some of the properties of such motions. We have seen that the centre of mass moves as if the whole body were concentrated and all the forces applied there. To find the motion of rotation we have to investigate the moment of momentum of a rigid body. If the body rotate about an axis with angular velocity $d\theta$, we obtain the velocity of a point at a distance r from the axis by differentiating the equations $x = r\cos\theta$, $y = r\sin\theta$,

$$v_x = -r\sin\theta\frac{d\theta}{dt} = -y\frac{d\theta}{dt}, \qquad v_y = r\cos\theta\frac{d\theta}{dt} = x\frac{d\theta}{dt},$$

and the moment of momentum is

$$H_z = \sum_r m_r(x_r v_{yr} - y_r v_{xr}) = \frac{d\theta}{dt}\sum_r m_r(x_r^2 + y_r^2).$$

The quantity $K = \Sigma_r m_r(x_r^2 + y_r^2) = \Sigma_r m_r r_r^2$ is called the *moment of inertia* of the body with respect to the axis. Suppose the axis is horizontal, and the body influenced only by gravity. The resultant of the weights of all the particles of the body is a force $W = Mg$ applied at the centre of mass, which is, say, at a distance h from the axis, the plane through it and the axis making an angle θ with the vertical. Then the moment of all these forces about the axis is $N = Mgh\sin\theta$, and we have the equation of motion

$$(70) \qquad \frac{dH_z}{dt} = K\frac{d^2\theta}{dt^2} = -Mgh\sin\theta.$$

This is the same as that of a simple pendulum of length $l = K/Mh$, which is called the length of the equivalent simple pendulum. A point at a distance l from the axis and in line with it and the centre of mass is called the *centre of oscillation.* This problem of the so-called compound pendulum was solved by Huygens, who also showed that if the body be suspended from a parallel axis through the centre of oscillation the period would be the same.

If a rigid body move in any manner with one point fixed, it may be shown that its motion at any instant may be described as a rotation with a certain angular velocity about a certain axis. All the particles of the body are then moving in various directions tangent to circles with planes parallel to each other, but owing to lack of symmetry the direction of the resultant moment of momentum has no simple relation to the direction of the axis.

FIG. 25.

As the motion goes on the direction of the axis changes in the body, and so does the direction of the moment of momentum. Thus the phenomenon is a complicated one, and can be dealt with only by lengthy analysis. If, however, the axis of rotation is an axis of symmetry, as in the case of the axis of a symmetrical top, Fig. 25, it is evident that the particles may be grouped in symmetrical pairs, m_1, m_2, Fig. 26, so that the moments of momentum H_1, H_2 about the fixed point O will be symmetrical with respect to the axis, and the resultant moment will be in the direction of the axis. If then we apply to the axis a force F (Fig. 25),

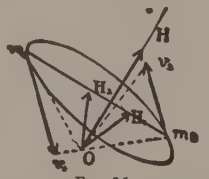


FIG. 26.

it will have a moment M (Fig. 27), perpendicular to the plane of F and the fixed point, and according to equations (65) this will be the direction in which the vector H will move toward H'. The end of the axis will, therefore, move at right angles to the direction in which it is pulled. This is the basis of the explanation of the curious phenomena of all tops and gyroscopes. In the ordinary top, the weight

acting downwards at the centre of mass produces a horizontal moment; the point of the top accordingly begins to move horizontally, causing a movement of *precession*. When the precession begins, the rotation is no longer

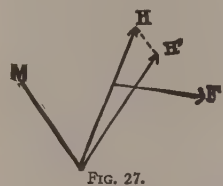


FIG. 27.

about the axis of symmetry, and the vector H no longer coincides with the geometrical axis of the top, but the end of the vector H always travels in a horizontal plane, and the axis of the top moves about it in a motion of so-called nutation. The rotary motions of the planets are explained in a similar manner. It has recently been demonstrated by Einstein that the classical, Newtonian mechanics presented here is only a first approximation to the facts. The discrepancies between the Newtonian and the Einsteinian mechanics are due to the fact that time and space, as ordinarily conceived, are not independent dimensions of being. See RELATIVITY, PRINCIPLE OF.

Bibliography.— The following treatises may be consulted for a more detailed treatment. For the whole subject: Love, 'Theoretical Mechanics'; Thomson and Tait, 'Treatise on Natural Philosophy'; Webster, 'Dynamics'; Ziwet, 'Theoretical Mechanics'; Minchin, 'Treatise on Statics'; Kent, R. W., 'Fundamental Mechanical and Electrical Laws' (1921); Prescott, J., 'Mechanics of Particles and Rigid Bodies' (2d ed. 1923); Bird, G. W., 'Mechanics for Engineering Students' (3d ed. 1938): Boyd, J. E., 'Mechanics' (1930); Millikan, R. A., and others, 'Mechanics, Popular Molecular Physics, Heat and Sound' (Boston 1937).

ARTHUR GORDON WEBSTER,

MECHANICS OF DEVELOPMENT OR EVOLUTION. A term applied by German embryologists and biologists to the changes coincident with the reproduction, fertilization and later growth of organisms. In the organic world, living bodies are constantly undergoing changes of state, these changes being most conspicuous during the period of embryonic development. The changes in the conditions of life together with heredity and selection have caused the evolution of the world of plants and animals. These changes have been complex, and yet in every way have been made with exactness, order and regularity, and the larger knowledge of development mechanics has in a great measure been due to the researches of Pander, Lotz, Born, Wilson, Loew, Ryder, Wyman, Driesch and others. Probably the most noteworthy treatments, though of opposing schools, are those of Von Wilhelm Roux, 'Programm und Forschungsmethoden der Entwichlungsmechanik der Organismen leichverständlich dargestellt' (Leipzig 1897), and of Dr. Oscar Hertwig, 'Zeit- und Streitfragen der Biologie: Mechanik und Biologie' (Jena 1897). Nature does for man in the organic what he has to effect in the inorganic world, and it is only necessary that he observe these changes to be able to state a series of relations of antecedent and consequent. See LIFE; GROWTH; KINETOGENESIS.

MECHANICS' INSTITUTES. The establishment of mechanics' institutes marks the struggle of the artisan to provide for his own education. Denied a technical education, unable to take advantage of college and university education because of financial and economic stress, the artisan nevertheless demands for himself such educational opportunities as he can use during his free hours. His needs are peculiar. His range of interests is prescribed by his trade or vocation, his time is limited, his preparation is likewise limited and variable. His demands cannot be satisfied, therefore, by conventional methods and equipments. A special organization must be set up. Mechanics' institutes are a distinctive product of England, no other country having developed an equal number of such organizations. Nor are such institutions characteristic of any other national educational scheme. The reason for this is the conservatism of English universities and higher educational institutions generally. The artisan was not provided with a systematic training beyond the fundamentals of his trade as given by a more or less definite apprentice system. Industrial education and manual training were not made a part of public education until late in the 19th century. Hence the necessity for the artisan to devise a scheme for educational extension into his adult years, an education that would meet his specific needs. Birmingham and Glasgow were the pioneers in developing educational opportunities for mechanics. In Birmingham Sunday lectures in mechanics and in the physical sciences were given as early as 1789. An "Artisan Library" was maintained. Glasgow organized its Mechanics' Institute in 1823. This is probably the first use of the term. The London Mechanics' Institution was founded in the same year and was under the leadership of Dr. Birkbeck, who had been instrumental in the maintenance of the work in Birmingham. Liverpool followed with its Mechanics' and Apprentices' Library in 1825. Other cities followed and in 1839 a Metropolitan Association of Mechanic's Institutions were formed; in 1848 a similar association known as the Yorkshire Union was formed with 86 institutions as members.

The range of work became wider as the movement grew. The Manchester Mechanics' Institute announced its purpose to be "to enable artisans of whatever trade to become acquainted with such branches of science and art as are of practical application in their trade." The subjects offered either by lecture or class instruction were as follows: natural philosophy, science, natural history, literature, writing, grammar, composition, algebra, geometry, drawing, music, French, German, Latin. This is indicative of the scope of the work attempted.

The aim of the mechanics' institutes was to bring education within reach of the middle and lower classes in England. The programs show that it was an effort to give as much of the traditional content of education as these classes could assimilate. It was education given to mechanics, but much of it was not about mechanics nor yet about industry or closely re-

lated matters. Herein lies the explanation for the decline of the movement. The institutes failed to hold their clientèle as the artisans lacked the necessary educational background. But out of and on these foundations have grown the highly efficient technical schools which are in successful operation today.

Mechanics' institutes were also established in the United States, notably in Boston, Philadelphia, New York and Rochester, N. Y. A few are still in successful operation. It is notable that they are taking an important part in the development of vocational and industrial education in the United States. With free public schools, especially free state colleges and state universities, giving extensive courses in the mechanic arts and in the sciences, there is less demand for these private institutions with their special appeal to the mechanics' interests. Their function has been that of the pioneer. They have blazed the way for engineering and technical schools and for vocational and trade schools. See also EDUCATION, INDUSTRIAL; EDUCATION, TECHNICAL; MANUAL TRAINING; COOPER UNION; VOCATIONAL EDUCATION.

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MECHANICS' LIENS, *in statute law,* a lien or claim upon real estate to secure payment for work or labor performed on, or materials furnished for, buildings or other improvements thereon; which labor or material has been furnished at the request or with the consent, express or implied, of the owner of such real estate or other property. In early English law lands were charged with liens by express agreement of the owner and were generally covered by mortgages. Courts of equity also recognized mortgage agreements. By statute other liens were created, including judgment liens and liens for taxes and assessments.

In the United States the increasing number of independent contractors who constructed buildings on contract, and of dealers in building material, resulted in the enactment of numerous mechanic lien laws. Such laws have also been enacted in Canada, but not in Great Britain. The statutes hold that the value of real estate is increased by the addition of improvements and that the property should accordingly be held subject to such claims. Mechanics' liens are valid prior liens over all other claims, such as mortgages, judgments or taxes, and the term covers all claims for labor, whether skilled or unskilled, and for all building materials furnished. But liens are held against the property and not personally against the owner. The lien only attaches to the very property upon which the work was done, and has no effect on other pieces of real estate of the owner.

In most states the law provides that the work to which the owner is entitled under a contract must be entirely performed before the contractor can file a lien, but where owners' payments are made in instalments, some codes permit the filing of a lien when the owner defaults in the payment of an instalment. Liens usually take precedence according to the time of their filing in the county clerk's office. In some states subcontractors, who have not had direct dealings with the owner, may nevertheless file liens against the property for the work performed by them. The statutes of mechanics' liens vary in the different states in the manner of details, time of filing, method of procedure, etc., and state statutes should be consulted.

MECHANICSBURG, mê-kăn'ĭks-bûrg, borough, Pennsylvania, in Cumberland County; altitude 430 feet; 9 miles southwest of Harrisburg; on the Pennsylvania Railroad. It is located within a farming area raising fruits, field crops, and hay, and there are clay pits nearby. Industrial products are shirts, pajamas, silks, automobile wheels, flavoring extracts, and structural steel.

The place was settled in 1790, and was called Drytown (from the scarcity of water) until 1828, when it was incorporated and renamed, the new name alluding to the number of mechanics employed in its machine shops. Pop. (1940) 5,709; (1950) 6,786.

MECHANICSVILLE, Battle of (also called BATTLE OF BEAVER DAM CREEK). After the Battle of Oak Grove, June 25, 1862, the Army of the Potomac was thrown upon the defensive by the sudden appearance of "Stonewall" Jackson on its right. North of the Chickahominy, George McClellan had but one corps in position, that of Fitz-John Porter, temporarily strengthened by a division of Pennsylvania reserves. The reserves held the extreme right of the line at Mechanicsville and Beaver Dam Creek, with three brigades and five batteries of 26 guns. His main position was along the east bank of the creek, a tributary of the Chickahominy, and was very strong, his left resting on the Chickahominy, his right and advance extending to a body of woods near and overlooking Mechanicsville, held by a regiment and a battery. Rifle-pits had been constructed for the infantry, epaulments had been thrown up to cover the guns and a strong picket-line was in front from Mechanicsville Bridge to Meadow Bridge along the Chickahominy. A. P. Hill's Confederate division and Thomas Cobb's Legion were in plain view from the left, intrenched on the opposite side of the Chickahominy.

About noon of the 26th Hill's men were seen in motion. At 12.30 the Union pickets at Meadow Bridge were driven in; John Reynolds' brigade on the right, covering the crossing of the road from Mechanicsville to Bethesda Church; Truman Seymour on the left, covering at Ellerson's Mill the crossing of the road from Mechanicsville to Gaines' Mill; and Meade's brigade, with two batteries, in reserve. A. B. Hill had 14,000 men in his division, which he had concentrated near Meadow Bridge, under orders from Gen. Robert Lee to cooperate with Jackson, who was marching from Ashland to turn McClellan's right. Hill sent Lawrence Branch's brigade and a battery to cross the Chickahominy seven miles above Meadow Bridge and communicate with Jackson's advance, and when Jackson had crossed the Virginia Central Railroad, Branch was to cross the Chickahominy, push down the river and uncover Meadow Bridge, which Hill was to cross at once and then sweep down to Mechanicsville, uncovering in turn the Mechanicsville Bridge, which James Longstreet's and D. H. Hill's divisions were to cross, when all were to push down the left bank of the Chickahominy and cut off McClellan's communications with his base at White House on the Pamunkey, and thus force him to abandon his operations against Richmond and retreat down the Peninsula. Jackson was late,

and it was 10 o'clock before Branch opened communications with him. As time passed and nothing was heard from Branch or Jackson, Hill grew impatient, and at 3 P.M. put his five brigades and six batteries in motion. Charles William Field's brigade seized Meadow Bridge and crossed it, closely followed by the brigades of Joseph Reid Anderson and James J. Archer. The brigades of Maxcy Gregg and William Dorsey Pender then crossed the bridge and marched across the country to support the right wing of the attacking column. Field was met by severe artillery fire, but, forming his troops in a line, he forced the Union advance of a regiment and battery from Mechanicsville back to the main line beyond Beaver Dam Creek.

It had not been Lee's intention to attack McCall in position, but to have Jackson turn it. Since Jackson was not up in time and McClellan would doubtless learn Lee's plan and make a counterattack against Richmond, Lee ordered A. P. Hill to attack. The brigades of Field, Archer, and Anderson were ordered to advance on the Mechanicsville road against Reynolds. They were met by heavy artillery fire and were bloodily repulsed, although one of Anderson's regiments on the left wing succeeded in making a temporary stand beyond the creek. Parts of Porter's corps now came up and strengthened Reynolds' right. Following the repulse on the left, Pender's brigade and Roswell Sabine Ripley's brigade of D. H. Hill's division made a determined attack on Seymour at Ellerson's Mill. A millrace, swampy ground, and other obstacles were in their way, however, and Seymour's direct fire and Reynolds' flank fire checked them and then repulsed them with heavy losses.

The attack was renewed, but it resulted in even greater losses, some regiments losing all their field officers and half of their men. It was now sunset, and no further effort was made to assault the position, but the firing was continued until 9 P.M. On the following morning, McCall was ordered to fall back on Gaines' Mill (see GAINES' MILL, BATTLE OF).

Union casualties at the Battle of Mechanicsville totaled 49 killed, 207 wounded, and 105 missing. Confederate losses, including both killed and wounded, were over 1,500 (Longstreet's estimate of 3,000 to 4,000 killed, wounded, and missing is probably excessive). In his account of the battle, General Longstreet said: "Next to Malvern Hill, the [Confederate] sacrifice at Beaver Dam was unequaled in demoralization during the entire summer."

Consult Webb, A. S., *Campaigns of the Civil War:* Vol. 3, *The Peninsula* (New York 1881); Alexander, E. P., *Military Memoirs of a Confederate* (New York 1907); Ropes, J. C., *Story of the Civil War* (New York 1907); Steele, M. F., *American Campaigns,* 2 vols. (Washington 1909); Freeman, D. S., *R. E. Lee,* vol. 2 (New York 1934); id., *Lee's Lieutenants:* Vol. 1, *Manassas to Malvern Hill* (New York 1942).

MECHANICVILLE, city, New York, situated in Saratoga County, at an altitude of 105 feet, on the Hudson River and the New York State Barge Canal system, 19 miles by rail north of Albany. It is served by the Boston and Maine and the Delaware and Hudson railroads, both of which have repair shops in the city. Mechanicville processes dairy products from the surrounding agricultural area, and manufactures pulp and paper products, knit goods, women's dresses, and bricks. The city has a public library and a high school.

There is a monument to Elmer Ephraim Ellsworth (q.v.), colonel of a Zouave regiment, killed at the outbreak of the Civil War.

Settled before 1700, Mechanicville was incorporated as a village in 1859 and as a city in 1915. Government is of the commission type, and the city owns its water supply system. Pop. (1950) 7,385.

MECHANISM or **MECHANICAL THEORY.** In its most general meaning, mechanism is the relation of a limited number of invariable substances to each other in such a way that they vary in their relations according to invariable laws. More specifically, it means the explanation of phenomena by the universal laws of matter in motion. Mechanism is closely connected with the attempt to resolve bodies into their simplest elements and to explain their qualities as due to uniform laws of connection and interaction among these elements.

The mechanical theory has usually been held in connection with some form of atomism. Since the aim of this kind of explanation is to reduce qualitative determinations to quantitative and mechanical relations of elements, these elements have usually been conceived to possess only such qualities as are necessary to explain the empirical qualities, the ideal being to find a single, homogeneous element possessing only the characteristics essential to corporeity. The term "mechanical" is also used in a looser sense, though still within the limits of the general definition given above, to describe any explanation which regards all the qualities of a body as due to the mere summation of the qualities of its parts—that is, a mechanical theory of society.

Mechanism as a Theory of the World.— As a philosophical theory, mechanism is the attempt to regard the entire universe as a closed system of causes and effects in which every change is ultimately reducible to a change of motion. In this sense, therefore, it is practically synonymous with materialism (q.v.).

Mechanism as a Method of Explanation.— After the Middle Ages the development of the new science, at the hands of Nicolaus Copernicus, Johannes Kepler, Galileo Galilei (qq.v.), and many of their contemporaries, depended very largely on the application to nature of the method of mechanical explanation. Francis Bacon (q.v.), by his opposition to the use of teleology in scientific explanation, did much to bring about the acceptance of mechanism, and it was firmly established as the true scientific method of dealing with nature by René Descartes (q.v.), who, though not an atomist, still denied to matter all but quantitative characteristics and defined the method of science as strictly mechanical. Even the physical phenomena of living bodies (everything in the world, in fact, except the *res cogitans* in man) he regarded as capable of a purely mechanical explanation. From the 17th century on mechanism became the recognized method for natural science, and consequently it soon became an urgent philosophical problem to discover a satisfactory way of reconciling the mechanical conception of nature with a teleological and idealistic conception of the universe. Thus Gottfried Wilhelm von Leibnitz (q.v.), while admitting the necessity of reducing all natural phenomena to motion, held that ultimate reality consists of an infinity of centers of force (monads), conceived as in some sense analogous to minds. Accord-

ingly, metaphysical explanation must be in terms of teleology, though mechanism is the sole valid explanation of the phenomenal manifestation of reality in nature. A similar conception, having its historical origin in Leibniz, was held in the 19th century by Lotze (1817–81) (q.v.), who proclaims the purpose of his philosophy to be «to show how absolutely universal is the range of mechanism, and at the same time how completely subordinate the significance of the function which it has to fulfil in the structure of the world» ('Microcosmus,' Introduction). Kant also regards the mechanical categories as the sole valid means of scientific explanation. The causal category is, for him, rigorously constitutive of our experience and hence is determinant of our conception of all objects in the world of experience; teleology, on the other hand, though a necessary means of regulating our investigations of organized matter, remains a merely subjective principle which can give no insight into the origin of any being. When we deal with objects which «cannot be thought by us, as regards their possibility, according to the principle of mechanism,» we may treat them «as if» they were teleologically ordered; but «nothing is gained for the theory of nature or the mechanical explanation of its phenomena by means of its effective causes, by considering them as connected according to the relation of purposes.» The phenomena of the moral life, according to Kant, lie outside the realm of scientific experience and hence are not subject to mechanical explanation. Since Kant's time, many thinkers, perhaps the majority, have followed him in regarding mechanism as the ultimate principle of explanation for science; thus Helmholtz, F. A. Lange, Dubois-Reymond, Clausius, Thomson, Maxwell, etc. Wundt attempts to find for it a logical justification as the only theory which can afford an adequate conception of natural causality. On the other hand, more recent writers, especially among physicists, have taken the opposite view. According to them, the pre-eminence of mechanical explanation is merely a dogma based on its successful use in science. E. Mach, Stallo, Helm and H. Cornelius take this position. These thinkers maintain that the purpose of scientific explanation is to condense into a single compact statement (e.g., a mathematical formula) a large mass of empirical data. A scientific law is merely a short-hand statement of the facts, and its value is purely economic. So long as the mechanical theory affords useful analogues for the formulation of other phenomena, it is a valid scientific method. Whenever this ceases to be the case, mechanism must be superseded by a more economical theory. Kant's conception of mechanism as a mode of dealing with experience has been developed by contemporary English idealism. The general problem of all rational knowledge is conceived to be the construction and maintenance of a coherent and systematic experience. In all thought, therefore, there is implied a totality which constitutes the truth. But this totality manifests itself in different categories of thought and in varying degrees of perfection. Matter and motion are the abstractions in which the sensuous world is reduced to homogeneity in order to be susceptible of quantitative treatment, and in this treatment they are able to a large extent to represent genuine and actual relations of that world» (Bosanquet, 'Logic,' Vol. I, p. 200). Mechanical explanation, therefore, is one form in which the unity of thought may be manifested; it is «that form of identity and difference in which an identity is regarded as the sum of the difference in which it is presented» (ib., p. 201). Its value for knowledge is therefore said to be instrumental or methodological, because it is a method which thought uses in its effort to construct a rational experience. It possesses ultimate truth just in proportion to the degree of rational unity which it achieves in experience as a whole.

In psychology the term mechanism is sometimes used to describe a theory which seeks to explain mental phenomena as due to the combination or interaction of simply psychic elements. This usage is an analogy with the atomic theory of matter. The classical example is Herbart (q.v.), who gave the term currency. According to his theory every representation has a constant quality and a variable force. These forces stand in relations of greater or less opposition and the whole state of consciousness is conceived as a resultant of all the forces involved in it. Consult Th. Ribot's 'German Psychology of To-day' (Eng. trans. by J. M. Baldwin, pp. 24 ff.). For mechanism in biology see MECHANISM AND VITALISM.

Bibliography.— Lange, F. A., 'History of Materialism' (Eng. trans., London 1879–81, 3 vols.); Kurt, Lasswitz, 'Geschichte der Atomistik vom Mittelalter bis Newton' (Hamburg 1890, 2 vols.); Lotze, 'Metaphysic,' Book II (Eng. trans., Oxford 1887, 2 vols.); Sigwart, C., 'Logic, § 100 (Eng. trans., London 1895, 2 vols.); Ward, James, 'Naturalism and Agnosticism,' Part I (2d ed., London 1903, 2 vols.); Gates, G. and A. W., 'Mechanism and Meaning of Life'; Wilkinson, G., 'Mechanism of the Cochlea' (1925).

GEORGE H. SABINE.

MECHANISM AND VITALISM. The Newtonian mechanics has long constituted an ideal for all the natural sciences on account of the elegance of its form and the clearness of its definitions. There has consequently been a tendency to reduce biology as well as chemistry, astronomy, optics, etc., to a mechanical basis and to explain all biological phenomena in terms of motions of particles. This tendency is known as *mechanism*, and those who follow it are called *mechanists*. Now, a living oganism, even from the purely mechanical side, is of the greatest complexity and intricacy of structure. Practically all organic tissues are colloidal in nature, and the physics and chemistry of even a simple colloid are as yet very imperfectly understood. Furthermore, the most minute observable portion of living tissue is far from being a simple colloid, but manifests a distinct and highly complicated structure. As a consequence, all mechanical explanations of living processes are bound to be of an extremely sketchy nature. Now, the actions of animals and plants are subject to fairly simple descriptions in terms derived from our own consciousness. When a spider catches a fly, we seem to render that fact intelligible to ourselves by saying that it wants to eat the fly. As a consequence, our biology as it exists is permeated through and through by anthropomorphic con-

cepts, such as purpose, desire, sensation, etc. While the mechanists claim that, as far as the scientist is concerned, all the facts ordinarily described through the mediation of these concepts are susceptible to a correlation in a fashion which, though purely mechanical, is too complicated for our own human faculties to grasp, there are others, the so-called *vitalists,* who deny this possibility.

The vitalists may either discover a peculiar purposive, anthropomorphic force active in biological matters alone, as does Driesch, or they may, like Bergson, regard the purposive account of the world as everywhere prior to the mechanical account. They draw their arguments from certain processes which, like the regeneration of lost parts, or the adaptation of the individual to the environment by mutation, appear peculiarly fitted for purposive explanations involving some prevision of the future. These processes they regard as not merely non-mechanical, but counter to the current of mechanism, involving either indeterminism, or determination through factors which have no mechanical correlates.

The paucity of the fruits of purely mechanical research in biology is obvious; on the other hand, the methods of the vitalist are generally so crude and his definitions so vague that there is no great body of biological knowledge which has been gained from the vitalistic standpoint. The terminology of vitalism abounds in such expressions as *élan vital,* or "entelechny," which are only defined *per ignotius.* In short, whether a complete mechanization of biology be possible or not, biological investigation has been fertile precisely in so far as it has subjected itself to the norms, if not to the concepts, of physical science. It would consequently seem that mechanism is methodologically correct, even if it be metaphysically wrong. See also MATERIALISM; MECHANISM.

Consult Bergson, Henri, 'Creative Evolution' (New York 1911); Driesch, Hans, 'The History and Theory of Vitalism' (London 1914); Mack, Ernst, 'Popular Scientific Lectures' (Eng. trans., Chicago 1895).

NORBERT WIENER.

MECHANISMS, Mental, are modes of thought obtaining both in the unconscious and in conscious mental activity, the most important of which are identification, compensation, projection, introjection and rationalization. In earliest infancy the average individual gradually makes a distinction between self and external reality, tending to regard as *himself* those parts of his experience which give him pleasure and as *external* those parts which give him pain. He thus very early unconsciously identifies himself with certain portions of his environment. This unconscious habit of thought continues throughout life. All persons constantly identify themselves with persons and things surrounding them or which come within their mental purview. This has the very important result of making them regard those external persons or things as having an influence over themselves and their acts and their emotions. Thus a man who defended the actions of a celebrated physician who was condemned and executed for murdering his wife was giving, in his defense, an illustration of identification of himself with the murderer, as was shown later to some extent by his confession that he lived very unhappily with his wife and sympathized with the criminal who had succeeded in getting rid of his partner in that way. Two varieties of identification are distinguished, namely, the subjective form or introjection, and the objective or projection. In introjection the subject accepts an idea which really has an external origin, and identifies it with some portion of his own mind, as for instance when one reads a description of some disease and infers that one has that disease oneself. This is a characteristic of impressionable and hypersensitive natures who feel an excessive sympathy for other people. It leads to various forms of introversion in which the individual tends more and more to live a life within himself and to become more and more unable to achieve objective success in the world. Projection, on the other hand, is that objective form of identification which takes an idea which has had actually an internal origin and believes that it has an external origin. Examples of this mechanism in an excessive degree are found in the mental malady known as paranoia (q.v.), in which the suspicions of the individual, having a purely subjective origin, are projected upon the external social environment. The paranoiac believes that he is a great man, taking his belief from the grandiose thoughts which occur to him as a compensation [see below] for an unconscious feeling of *inferiority,* and he views external reality more and more as conspiring against him to prevent the realization of his wishes for superiority. It is true that all individuals give evidence in thought and act of both introjection and projection, but it is only when these mechanisms are unduly developed that the discrepancy between the unconscious wish and the actuality become such as to render the individual obnoxious. All healthy adults identify themselves with parts of their environment to some extent, as with their possessions and with the members of their family and of their social milieu, but such identification is productive of good both in action and in thought. It should not, however, be allowed to go too far, and a rigorous critique should be exercised by comparison with real things in order to prevent excess.

Compensation is that mechanism of the unconscious which secures an activity sometimes quite the opposite from that found to be the goal of the unconscious wish. For example when a person shows an extraordinary interest in antivivisectionism or the prevention of cruelty to children or to animals, it is frequently discovered upon analysis that this form of activity is a compensation for an unconscious sadism or desire to inflict cruelty. Lynching, which ostensibly aims at the punishment of an offender, is in reality mediated through an unconscious desire to inflict cruelty or to see it inflicted. Much of the action of extravagant chivalry is also an illustration of an unconscious desire to indulge in acts of cruelty. This is an apparent contradiction, but numerous analyses have shown the truth of this statement. The fact that a conscious and an opposing unconscious wish are satisfied both at the same time makes the compensation all the more ambiguous. That is, the individual consciously believes that he is satisfying only the wish to *right* a wrong, not being conscious of the fact

that in taking especial pleasure in righting a wrong, he is unconsciously satisfying a wish to occupy his mind with the *wrong* itself. It is not known to the militant suffragette that her conscious desire to arrogate to herself the privileges of *men* is a compensation for an unconscious desire to be dominated by a *man.* Compensation is a physiological mechanism, too, by virtue of which the function of one organ, say the kidneys, is taken over at times by that of another, for instance the skin, in excreting certain waste products. An aim is sought by nature and failing in attaining this aim through one avenue, she tries another. Similarly in the mental processes, the psyche is aiming constantly at the satisfaction of desire, and if it fails to get it consciously, it will get it unconsciously by compensation, that is, the desire of which the individual is not aware, though it may be fundamental in his psyche, will nevertheless gain its satisfaction in some substitutive form, through something which symbolizes in conscious life the object of the unconscious craving. A very infantile partial trend of the libido, (q.v.), namely, the child's desire to be looked at, is gratified by the actor in a domestic performance where he may be utterly unconscious of the fact that his primary desire is to exhibit his body but unconscious only of the fact that he wishes to represent a character for the edification of the public.

Rationalization is the constant tendency on the part of all people to give an *ex post facto* reason for their thoughts or acts. This is why "a man convinced against his will is of the same opinion still." The term rationalization was introduced into analytic psychology by Dr. Ernest Jones. If a person is hypnotized and during the hypnotic sleep is told by the hypnotizer to do something when he wakes up, such for instance as putting a chair on a table, he will do so, and when he is asked to give a reason for this act, he will fabricate a wrong one, because he does not know the right cause. The cause of his act was the hypnotic suggestion, and is perfectly well known to the hypnotizer. But to the hypnotized subject the cause is unknown as it is contained in his unconscious, and, having been given to him in his unconscious state, it does not emerge into consciousness. This is paralleled by almost every instance in which a reason is given for doing anything. The entire cause in the case of some persons is, as with the hypnotized person, in the unconscious, while with the majority of people a large proportion of the causes of all their actions is in their unconscious and is unknown to them. The reasons which people then give for their actions are termed rationalizations and the tendency of all persons to feel that they have to give reasons when they are asked for them is what is meant by rationalization. See also SYMBOLISM. Consult Hendrick, I., 'Facts and Theories of Psychoanalysis' (1939); Jelliffe, Smith Ely, 'Sketches in Psychosomatic Medicine' (1939).

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MECHANIZED WARFARE. See ADVANCE GUARDS; ANTIAIRCRAFT GUNS; ARMORED CARS; ARMS; ARTILLERY; COAST DEFENSE; MACHINE GUN; MILITARY AERONAUTICS; MILITARY ENGINEERING; MILITARY SCIENCE; MILITARY TRANSPORTATION; NAVAL AVIATION; OUTPOSTS, MILITARY; STRATEGY; TACTICS; TANK; SECOND WORLD WAR.

MECHANOTHERAPY, treatment of disease by mechanical means or exercise. See MASSAGE.

MECHITARISTS, mĕk-ĭ-tăr'ĭsts, a sect of Armenian Christians acknowledging the authority of the Pope, but retaining their own ritual. The name originated from Mechitar Da Petro (1676–1749), who in 1701 founded a religious society at Constantinople for disseminating a knowledge of Armenian literature. They soon removed to the Morea, whence in 1715 they went to Venice, and later to the island of San Lazzaro. There are branches of the sect in Vienna and elsewhere. At Venice its printing presses have turned out the best works in Armenian literature, and a periodical which has a large circulation. Consult Boré, *Le couvent de Saint Lazare à Venise, etc.* (Paris 1837).

MECHLIN (Dutch: Mechelen; French: Malines), the Catholic archiepiscopal see of Belgium, a city in the Antwerp Province. The origin of the town goes back to 870 when it was first mentioned in the Treaty of Meersen. It owes its existence to an abbey and small inland port. In the Middle Ages, it acquired several trade monopolies for a large region: salt, fish, and wheat had to be stored and sold there. Drapery was a prosperous industry. Under the rule of Charles V and Philip II, it became the seat of government, and an art center developed under the impulse of the rulers. Several great architects of international renown in the 15th and 16th centuries came from Mechlin.

In 1949, its main industries were tapestry weaving and the manufacture of hand-carved furniture. It is also the seat of an unique institution, the only school for carillonneurs in the world, founded by Jef Denijn. Its outstanding monument is the Cathedral of St. Rombaut (13th century) which contains an excellent carillon and the tomb of Cardinal Mercier, famous defender of Belgian liberties in World War I.

Among the most famous artists the town produced are the painter Frans Hals, the sculptors Luc Faid'herbe, Théodore Verhaeghen, and Ernest Wijnants. The cathedral choir is exceptionally well conducted by the scholarly Canon Van Nuffelen.

Mechlin suffered a disastrous air attack during World War II. Pop. (est. 1949) 61,994.

MECKLENBURG, mĕk'lĕn-boorg, Germany, a territory on the Baltic Sea, a former Saxon province, now divided into the republics of MECKLENBURG-SCHWERIN and MECKLENBURG-STRELITZ.

(1) Mecklenburg-Schwerin, bounded on the north by the Baltic Sea, elsewhere chiefly by Prussia and Mecklenburg-Strelitz, has an area of 5,066 square miles. The capital is Schwerin. Mecklenburg-Schwerin is watered by several rivers, most important of which are the Elbe and its tributaries, the New Elde and the Sude, on the southern border, the Warnow, the Recknitz and the Stepenitz, which flow toward the Baltic. There are many lakes and ponds, the largest of which are the Müritz See (51 square miles), the Schweriner See (23 square miles), the Kölpiner and the Plauer See. The country is generally flat, though here and there intersected by low ranges of hills, and its surface is extensively covered with wood. Near the sea

are large tracts of sand and morass. The climate, though raw, is mild and healthful; the average temperature throughout the year is 46° and the precipitation is 21 inches.

The principal industries are agriculture, dairying and stock-raising. About 50 per cent of the population are tillers of the soil. The landholders were formerly hereditary tenants of the peasant class, title being vested in the upper classes, as the emperor or the aristocracy. The chief crops are wheat, rye, oats, barley, corn, pease, beans, beets, turnips and potatoes, and tobacco is cultivated to some extent. The principal manufacturing industries are foundries, machine shops, brick yards, tanneries, paper mills, sugar refineries, breweries, distilleries, tobacco factories, etc. There is considerable commerce through Warnemünde (Rostock) and Wismar. The railway mileage is 1,094 miles. The predominating form of religion is the Lutheran. Besides the university at Rostock there are several gymnasia and numerous burgher, parochial and other schools. Under the Empire the two Mecklenburg duchies had a common assembly or Landesunion, consisting of the representatives of the landed aristocracy or Ritterschaft and the burgomasters of 49 towns, the tenants of the royal domains had no representation. The assembly met once a year, alternately at Malchin and Sternberg. The executive authority in Mecklenburg-Schwerin was vested in a cabinet of four ministers; there were also a permanent committee consisting of nine members at Rostock, who represented the two estates when the assembly was not in session, and deputation and convocation diets, which might be assembled upon special occasions and for special purposes. Mecklenburg-Schwerin had two votes in the federal council and six representatives in the Reichstag, the only elective offices. Each duchy had a separate system of lower courts but they had a Supreme Court at Rostock in common. There was no general financial budget for Mecklenburg-Schwerin; there were three entirely distinct systems of finance. The budget of the first system was called the administration of the sovereign; the second, the states administration and the third, the ordinary budget of the common administration. The Constitution of the Republic is dated 17 May 1920. Technical education is well advanced and higher education is provided for by the University of Rostock. Pop. (1925) 674,411.

(2) Mecklenburg-Strelitz, divided by Mecklenburg-Schwerin into two large districts, the province, under the empire, of Stargard, and the province of Ratzeburg, both on the east, and on the west in several smaller districts, existing in separate patches, has an area of 1,131 square miles. Pop. 110,371, capital Neustrelitz. The country is flat and similar in physical characteristics to Schwerin. Under the Empire Strelitz had one joint representative chamber with Schwerin, but Ratzeburg was not included in these estates and was governed directly by the grand duke. The grand duke gave Ratzeburg a representative constitution 1869. Mecklenburg-Strelitz had one vote in the federal council of the empire and one representative in the Diet. Consult Raabe, W., 'Mecklenburgische Vaterlandskunde' (3 vols., Wismar 1896).

MECKLENBURG (měk'lĕn-bĕrg) **DECLARATION,** in American history, a series of rebellious resolutions adopted 20 May 1775, at Charlotte, Mecklenburg County, N. C., by a convention held at midnight and representing each militia company in the county. The resolutions declared that the people of Mecklenburg County were free and independent of the British Crown, and not only was the general tenor that of the Declaration of Independence, but many phrases in the resolutions are word for word as they appear in that document. The minutes of the midnight meeting are said to have been destroyed by fire in 1800. Whether the Declaration of Independence followed the words of the Mecklenburg Declaration, or whether the latter, having probably been replaced from memory, was tinctured with the former, is a disputed question. In 1831, the day of 20 May was made a legal holiday in North Carolina. Consult Cooke, 'Revolutionary History of North Carolina' (1853); Draper, 'The Mecklenburg Declaration' (1874); Graham, G. W., 'The Mecklenburg Declaration of Independence, May 20 1775,' and 'Lives of its Signers' (New York 1905); Hoyt, W. M., 'The Mecklenburg Declaration of Independence' (ib., 1907); Moore, J. H., 'Defense of the Mecklenburg Declaration of Independence' (Raleigh 1908).

MECONIC ACID, an organic acid occurring in opium and having the formula $C_5HO_3(OH)(COOH)_2$. In preparing it, the opium is exhausted with water at 100° F., the infusion is neutralized with calcium carbonate and evaporated to a syrup, and calcium meconate is precipitated by adding a concentrated solution of calcium chloride. Two crystallizations from hot dilute hydrochloric acid follow, and the free acid is then deposited in the form of small scales, containing three molecules of water. Upon heating to 212° F. the hydrated crystals lose their water, and become white. Meconic acid is readily soluble in alcohol, but only slightly so in ether and in cold water. It has a sour taste and a pronounced acid reaction, and its solutions are turned red by ferric chloride, $FeCl_3$. Meconic acid forms numerous salts («meconates»), as well as various organic derivatives; but none of these is of importance in the arts.

MEDAL, a piece of metal in the form of a coin, cross, or star, stamped with the portrait of an eminent person or with an inscription commemorating a famous action or event, and not to be circulated as money. Medals belong to two periods, ancient and modern, separated by a wide interval. Early Greek and Roman medals were struck for prizes in athletic games, or in commemoration of great events. The Roman series of medals or medallions is very extensive in gold, silver and brass or copper. The gold medals begin with Constantine and continue to the fall of the empire; the silver begin under Gallienus and continue as long; the copper from Augustus to Alexander Severus.

In more modern times the art of medal-making has been brought to great perfection, and most of the principal nations have adopted the plan of preserving their history by these durable monuments. The French series is deserving of special mention as the most perfect and complete in the world. It commences under Louis XI and continues to the present date, illustrat-

ing every important event in the history of France. The English series commences under Henry VIII, but as works of art the medals have not high rank. The British battle medals, however, form an admirable series.. The Italian and German medals of modern date are very fine. The mediæval are interesting and bold in design, but rude in execution. The papal series, commencing with Paul II, are worthy of attention.

One of the earliest American medals is that presented to Gen. John Armstrong for his successful attack in 1756 on the Indians at Kittanning. Most of those struck during the Revolution were made in France. The next American medal of which there appears to be any record is that which was presented to General Gates after the surrender of Burgoyne, 17 Oct. 1777. On 25 March 1776, when news of the British evacuation of Boston reached Congress, that body resolved that its thanks be presented to the Commander-in-Chief, and that a gold medal be struck in commemoration of the event. This medal was nearly two and three-quarters inches in diameter. On one side was a profile head of Washington, with the legend in Latin: "The American Congress to George Washington, the Commander-in-Chief of its armies, the asserter of freedom." On the reverse the device showed troops advancing toward a town, others marching toward the water, ships in view, General Washington in front, mounted, with his staff, whose attention he is directing to the embarking enemy. The legend is: "The enemy for the first time put to flight." Then, too, at the time of his death, among minor honors paid to the great general's memory, was the publishing of a silver commemorative medal.

There is the record of one medal only granted by Congress in commemoration of any naval victory during the War of the Revolution, and that was a gold one presented to Paul Jones for his defeat of the British frigate *Serapis* when commanding the *Bonhomme Richard*, 23 Sept. 1779. Other gold medals were those presented to Commodore Perry and Lieutenant Jesse D. Elliot for the part which they took in the battle of Lake Erie, 8 Oct. 1812; to Captain Lawrence, who, in command of the *Hornet*, 24 Feb. 1813, captured the British brig *Peacock*; to Captain Warrington of the *Peacock*—then under the Stars and Stripes—for the capture of the *Epervier*, 20 April 1814; to Capt. Thomas Macdonough, who commanded the American squadron in Plattsburg Bay, August 1814; to Captain Decatur, who, in command of the *United States*, captured the British frigate *Macedonian*, 25 Oct. 1812; and to Captain Jones and Captain Blakely, who, when commanding the *Wasp*—the one, 12 Oct. 1812, and the other 28 June 1814—captured respectively the *Frolic* and the *Reindeer* from the British navy.

The giving of medals went out of fashion after the second war with Great Britain, and but little was done by the government during the War of the Rebellion. Maj. Robert Anderson received two medals for his gallant defense of Fort Sumter, but one was presented by the citizens of New York and the second by the Chamber of Commerce of the same city. After the successful operations by Grant in East Tennessee and at Chattanooga, Congress voted him thanks and a gold medal with suitable emblems, devices and inscriptions. It is worthy of remark that no less than 189 medals were struck in honor of Abraham Lincoln, and later medals have been issued in memory of Garfield and McKinley, and in honor of Sampson, Schley, Dewey and others in the Spanish-American War. (See also COINAGE; NUMISMATICS; TOKEN MONEY). Consult Hawkins, 'Medallic Illustration of the History of Great Britain and Ireland' (London 1885); Loubat, J. F., 'Medallic History of the United States' (New York 1878); Leduc, 'Histoire des décorations en France' (Le Mans 1890); Hill, G. F., 'Portrait Medals of Italian Artists of the Renaissance' (New York 1912).

MEDAL OF HONOR, United States Military, an honor bestowed upon army and navy officers and men for specific services; regarded as a higher token of the war hero than the Victoria Cross of England, the medal of the Legion of Honor of France, or the Iron Cross of Germany. It is given not for the sheer performance of duty, no matter how hazardous that duty may be, but for some voluntary act of valor, beyond the bounds of mere obedience to orders. Out of the millions of men who have battled for the United States in the different wars this country has had, the vast majority, as history shows, performed their duty. Of these, however, have been about 2,000 men who have done more, who have braved dangers when they were not expected to brave them, overcome difficulties that were regarded by the rest as insurmountable, and faced death when it seemed it meant the sacrifice of their own lives. Many are the ways these medals have been won. By the Act of 12 July 1862 the United States government authorized the striking of 2,000 medals to be given to non-commissioned officers and privates for gallantry in action and soldier-like qualities. On 3 March 1863 the sum of $20,000 was appropriated for making the medals, and officers were made eligible to receive them. Medals were also authorized by Congress in recognition of acts of bravery performed during the World War and the war with Spain in 1898 (in the naval battles of Manila and Santiago, the Manila medals bearing the portrait of Admiral Dewey, and the Santiago medals a portrait of Rear-Admiral Sampson). The medal is a bronze five-pointed star within a circle suspended from a cross bar inscribed with the word "Valor" and surmounted by an eagle, united by a ribbon of 13 stripes of red, white and blue. Consult Rodenbough, 'Uncle Sam's Medal of Honor' (New York 1886), and 'United States Army Regulations' (latest issue).

MEDAL OF HONOR LEGION, an association of officers and enlisted men of the United States army, who were awarded medals of honor for special acts of bravery and devotion. At first limited to participants in the Civil War, it was subsequently extended to all medal holders. The association has altogether about 400 members among the army veterans and among naval veterans. The meetings are held annually.

MEDALLION, mē-dăl'yŏn. (1) The term medallion in numismatics is applied to those productions of the mint of ancient Rome, or struck in the provinces under the empire, which, if gold, exceed the *aureus* in size; if silver, the *denarius;* and if copper, the first or large brass. Medallions are not numerous. Those struck in

the Greek provinces are more common than the Roman, but of inferior workmanship. A beautiful and famous gold medallion exists of Augustus, and one of Domitian, but few, in any metal, are found prior to the reigns of Hadrian and Antoninus; those in brass are the largest, many of them being several inches in diameter, and for the most part of admirable workmanship. (See MEDAL).

(2) In architecture, an oval panel carved in bas-relief, usually carrying a head or figure. The same term is used for a color design.

MEDANO, mā-dä'nō, the Spanish name for peculiar moving sand-hills in Peru. They are seen on the plain of Islay near Arequipa, and are crescent-shaped bodies of white sand, which move across the desert in the direction of the winds which blow from sunrise to sunset. The sand composing the *medano* seems different from the desert sands over which the moving mass is blown or carried.

MEDARY, Samuel, American editor and politician: b. Montgomery Square, Montgomery County, Pa., 25 Feb. 1801; d. Columbus, Ohio, 7 Nov. 1864. In 1825 he settled at Batavia, Clermont County, Ohio, and in 1828 established the *Ohio Sun* in support of Jackson's candidacy for the presidency. He sat for Clermont County in the State house of representatives in 1834–35 and was a member of the State senate in 1835–37. In 1837 he purchased at Columbus the *Western Hemisphere,* later the *Ohio Statesman,* which he edited until 1857. In 1857–58 he was governor of Minnesota Territory and in 1858–59 of Kansas Territory. He was named Minister to Chile in 1853 but declined. He established the *Crisis* at Columbus in 1860, and was its editor until his death. He gave active aid to Morse in the promotion of the electric telegraph, was a firm supporter of the measures of Jackson and Douglas; is said to have originated the battle-cry "Fifty-four forty, or fight!" in connection with the Oregon boundary dispute, and was often called the "old wheel-horse of Democracy." There is a monument to his memory at Columbus, Ohio.

MEDEA, mę-dē'ą, a powerful sorceress of the Greek heroic age, daughter of Æetes, king of Colchis. By some her mother is said to have been Idyia, daughter of Oceanus; by others Hecate or Neæra. By her profound knowledge of the magical virtues of plants she practised witchcraft. She became the wife of Jason (q.v.), the leader of the Argonauts. For 10 years she lived with him after having supported him in every danger, till the charms of Glauce, or Creusa, the daughter of King Creon, kindled a new passion in him, and he discarded Medea, who brooded on revenge. With this purpose she sent the bride, as a wedding gift, a poisoned garment, also a poisoned crown of gold, which Glauce put on and died in agony. The sorceress reduced Creon's palace to ashes by a shower of fire, murdered her two children by Jason and then mounted her dragon chariot and escaped. Some say that she went to Hercules, others to Athens, to King Ægeus, by whom she had Medus. From Athens also she was banished as a sorceress. She finally returned to her home, where her son Medus reinstated her father, who had been dethroned by his brother Perses, after which she died. The story of Medea has often been a subject of tragic poetry ancient and modern. The tragedies of this name, by Æschylus and Ennius, have perished, as well as the Colchides of Sophocles. The Medeas of Euripides and Seneca are alone extant. The story has also been dramatized by Corneille and Grillparzer. Cherubini made this myth the subject of an opera. Consult Lübker, F., 'Reallexikon des plassischen Altertums' (8th ed., Leipzig 1914), and Mallinger, Léon, 'Médée étude sur la litterature comparée' (Paris 1898).

MEDEA, The, a play of jealousy and revenge, in which the interest is sustained from the beginning to the very end, and is artistically almost without a flaw, was brought out by Euripides in 431 B.C. Few tragedies of ancient or modern times are more dramatic. None exhibit the working of a fiercer and more intense passion. With the 'Hippolytus' it forms the double summit of the poet's works, and probably no Greek tragedy has been more famous in the modern world. The great enchantress, who fell in love with Jason when he came to Colchis in quest of the Golden Fleece, escapes with Jason to Greece, and lives happily with him for many years. Later Jason and his barbarian princess are obliged to flee to Corinth. In this city the scene of our play is laid. The old nurse speaks the prologue: Jason has deserted his wife for the daughter of Creon, king of Corinth. Dishonored, forsaken, the hapless woman sits brooding. The pædagogus enters and reports a conversation he has just overheard: Creon proposes to banish Medea. Medea is heard bemoaning her fate: oh, that she had never listened to the smoothing words of the deceitful Greek. Embittered, she imprecates curses on Jason and her children and prays that the whole house may be blasted to naught. Then she comes out and explains her position to the Corinthian women, who form the chorus. Creon enters and orders Medea to get her gone. She dissembles: the king is mistaken in believing that she is dangerous — she is simply hot with hate against Jason. "Let me remain — I shall yield to the stronger hand and hold my peace." The king reluctantly consents for her to remain one day. A great change comes over the woman scorned after Creon's departure: "I would not have groveled so before him except to get revenge. I shall bide my time, find first a safe refuge, then compass their destruction in secrecy by craft. Till then, my soul, sit still. By the Queen of Night that habits my hearth's dark shrine, no one shall ever vex my soul with impunity."

The chorus sing: "the old order is upturned; piety and fear, religion, justice, truth, loyalty all decline to their contraries, and naught but confusion lives." Jason appears and upbraids his wife for her froward spirit; she may rail at him, but not against the king. He had tried to appease the incensed ruler, but she persisted in her folly. But he will not desert her even in this dire extremity. "O most pernicious and perfidious man! You front me, you, the most hateful, insolent wretch on earth? But I am glad you came, for I shall tell you what you are, that you may chafe and wince.— I saved you, slaying the dragon and delivering you from death. I abandoned my home and followed you. Yet now you forsake me, the mother of your children. A loyal

spouse I have in you! I, a poor lorn woman, with her two babes, a fine reproach for our newly wedded prince!" Jason feels that he must be a skilful pilot to run before the wind of her loud words; but he declares that she received more than she gave, for she lives in a good Greek land, where law and justice reign — she is no longer an obscure barbarian. He had her welfare at heart when he contracted the new alliance. Women are so unreasoning that they know not where their fortunes lie. Jason withdraws and the chorus sing a song on the power of love. King Ægeus of Athens enters. He promises to protect Medea, if she comes to his city seeking refuge. Then she sends for Jason and asks his forgiveness for the rash words spoken in angry mood: "Ho, children, come forth and welcome your father with me." But the thought of their impending death, when she beholds her babes, is too much even for Medea's iron courage. The tears force themselves to her pitying eyes. In explanation of her weakness she tells Jason that she is a woman, naturally born to tears, prone to weep, subject to fears: her heart melted at the thought of reconciliation. Jason has naught but praise for her altered mood; may his children grow to manhood triumphant o'er his foes. Medea weeps. Jason asks her why she turns her face away and hears not with joy his benisons. "'Tis nothing—I bore them, bred them, loved them, and when you prayed that they might live, I wondered whether this would come to pass." She begs Jason to intercede for her children and allow them to remain in Corinth — she will send his bride royal gifts. The children carry the presents in a casket to the palace. The chorus sing an ode and the pædagogus enters to inform Medea that the children may remain. "Be of good comfort, thy children will yet bring thee back home." "Nay, I shall first send others home. Alas! O children, you have a home, but I go to another land, just when I begin to feel that I am blest in you. Out upon my daring! 'Twas all for naught I toiled for you, my children. Ah, the fond hopes that your dear hands would minister to my wants and when I die put the shroud around me. Oh, why do you look at me thus? My heart is unequal to the task. My babes' bright morning faces unnerve my arm. I *cannot* do it. I will take my children with me. Why, to wring their father's heart, give my own a double pain? But am I to be mocked? Shall I let my foes go unpunished? I *must* do it. Out upon my cowardice! Go in, children. Nay, my heart, let them live; spare the tender babes, my unblown flowers, my life, my joy, my all the world. No, by the avenging deities, I will not give up my children to my foes. But I must see them before I go. O my darlings! O sweet mouth and form and face, sweet kiss, sweet embrace! O balmy breath and tender touch of your delicate cheeks! Go in, go in. I can look no longer, I faint." The chorus sing an ode on the comparative benefits of having children and having no children. A messenger enters: "when your children entered the palace we were all glad. The rumor spread that you were reconciled." One kissed the hands of the children, the other their golden hair. The princess sat with fond look on Jason; but when she espied the pair, she pulled down her veil and turned away in scorn. Jason entreated her to allay her wrath: "Accept these gifts and ask your father to remit the doom of exile, for my sake." And when she saw the splendid gifts, she granted her lord's desire. Then she took up the robe — after they had gone — and tried it on. The golden crown she placed upon her head and arranged her hair before a mirror. Then she rose and walked about the room, stepping lightly with delicate foot and glancing oft toward the lowest folds around her ankle. Suddenly a ghastly spectacle presented itself. A pallor spread o'er her face. Back she tottered all a-tremble, and barely reached her couch before she fell, frothing foam around her lips, her eyeballs rolling wildly. One servant darted to her father's chamber, another flew to call the bridegroom. The hapless girl lay full a minute speechless. Then she roused and gave forth a scream, for a double agony had charged upon her: from the inclusive verge of golden metal around her brow a marvelous stream of fire shot forth, while the robes began to eat her delicate flesh. Up she started and sped across the room, a pillar of fire, shaking hair and head in vain endeavor to cast off the crown. But firm it held. Whene'er she shook her locks the flames started up twice as high and fierce. O'erwhelmed she sank upon the floor, past recognition save to a parent's eye: the clear calm look was gone, the comely features marred, drops of intermingling fire and blood dripped from her head, while gobbets and flakes of flesh dropped from her bones, like tears of resin from the pine, as those unseen jaws of the poisonous drug fed on her form. All feared to touch the corpse. Suddenly her father entered. He knelt and clasped her in his arms: "Oh, my poor child, what god brought thee to this cruel death?" At last he stayed his tears and tried to raise his old bent form, but the robes did cling to him as the ivy to the laurel. He writhed upon his knees and tried to wrench himself away, but only pulled the flesh from off his bones. At last the ill-starred sire gave up the ghost. Now their corpses lie side by side, a spectacle to draw tears of pity from the eye. Medea informs the chorus that she must slay her children and hasten away: "Now, my heart, put on thy armor for the deed. Shrink not. Think not on the happy days agone. For this one brief day forget thy children — e'en if thou dost slay them, they are most dear, and I the most unhappy woman in the world." Medea enters the house and soon the screams of the children are heard within. Jason enters and asks for Medea; he feels anxious for his children — the king's relatives may do them hurt. "Wretched man, your children are dead, slain by their mother's hand." Jason is overwhelmed. He orders the gates to be unbarred. Medea appears aloft in a chariot. Jason asks for the bodies; but she refuses to give them up: she will take them and bury them herself, that her foes may not demolish the grave. She intends to go to the land of Erechtheus to live with Ægeus. She prophesies that Jason will die most miserably, struck on the head by a piece of fallen timber from the Argo. She soars away, and Jason calls on Zeus to witness the treatment he has received at the hands of the tigress. Thus the play, in which we see the perfection of Euripides' art.

ends. The fury of her vengeance is as the love of Phaedra in the *Hippolytus;* but instead of overwhelming her soul, it excites to action, arms it against the deepest instincts of mother-love and makes it triumph over everything in a kind of grandiose and savage egoism. The more impetuous the fury, the more pathetic the struggle of feminine instincts. In no other play is there anything more characteristically Euripidean than Medea's celebrated monologue. Next to the human passions it is the natural affections, the tenderness of parents for their children, the love of brothers and sisters, of husband and wife, that Euripides portrays best.

JOSEPH E. HARRY,
Author of "The Greek Tragic Poets."

MEDELLIN, mā-thâ-yēn′, city, Colombia, the capital of the Department of Antioquia, and an episcopal see, picturesquely situated in a mountain valley 4,850 feet above sea level on the Porce, an affluent of the Canca, 150 miles northwest of Bogotá. From it radiate several highways and airlines.

It was founded in 1674 and has a cathedral, college, seminary, technical school, mint, hospital and other public buildings. The development of the gold and silver mines in the region has contributed largely to its modern progress.

It has manufactures of pharmaceuticals, chemicals, electric appliances, foodstuffs, pottery, porcelain ware, cloth, candies, cigarettes, clocks, shoes, paper, and jewelry and has a considerable trade, exporting gold, silver, coffee, and hides. Pop. (1938) 143,952.

MEDFIELD, town, Massachusetts, in Norfolk County; altitude 179 feet; 19 miles southwest of Boston; on the New York, New Haven and Hartford Railroad. It is a residential suburb. The public library houses historical relics. Medfield was settled and incorporated in 1651. Pop. (1950) 4,549.

MEDFORD, city, Massachusetts, in Middlesex County; altitude 12 feet; on the navigable Mystic River; 5 miles northwest of Boston; terminus of a branch of the Boston and Maine Railroad from Boston; and, through West Medford, on the Lowell division of the same railroad. A residential suburb of Boston, it has important manufacturing interests. Among its products are machinery for cutting shoe soles; wax and polishes; waterproofed textiles, and valves.

Medford's public library has a collection of autographed letters of George Washington. The city's educational facilities include a standard public school system and Tufts College (q.v.), which has, in cooperation with Harvard University, the Fletcher School of Law and Diplomacy, training students for government service and participation in the management of international relations. Lawrence Observatory, which rises to a height of 310 feet above sea level, affords a view of the surrounding country. In its early days Medford was famous for rum and ships.

Shipbuilding began here in the first years of the nineteenth century, and prospered until the early 1870's. The distilling of rum at Medford ceased very soon after 1900. In the pre-Revolutionary War years Medford was a source of supplies for New Hampshire and Vermont. It was a city of merchants. Medford-built ships engaged in the China trade, and made fast voyages around the Cape to California.

Medford first known as Meadford, was settled in the 1630's; incorporated as a town in 1684, and made a city in 1892. Its government is administered by mayor and council. Pop. (1940) 63,083; (1950) 59,714.

MEDFORD, city, Oregon, and Jackson County seat; altitude 1,377 feet; on the Southern Pacific Railroad; 206 miles south of Eugene; has an airport with airline service. Situated in the Rogue River Valley, it is the center of a fruit growing, dairy farming, lumbering, and mining region. It is also a summer resort. Near by is Rogue River National Forest, and the city is connected by highway with Crater Lake National Park. From 1900 to 1910, as the fruit industry developed, Medford grew from a town of less than 2,000 to a city of more than 8,000. It has mayor and council, and city-owned water system. Pop. (1940) 11,281.

MEDFORD, city, Wisconsin, and Taylor County seat, altitude 1,414 feet, on the Black River and the Minneapolis, St. Paul and Sault Ste. Marie Railroad, 79 miles northeast of Eau Claire. Principal occupations are dairying, mill-working hardwoods, and canning. The city has a mayor and council, and owns its water supply. Pop. (1950) 2,799.

MEDHURST, mĕd′hĕrst, **Walter Henry,** English oriental scholar and missionary: b. London, 1796; d. there, Jan. 24, 1857. He was educated for the ministry and in 1816 made a missionary tour through India and Malacca, establishing himself in 1822 in the island of Java, where he remained eight years. During this interval and for several years afterward he pursued his missionary labors there, in Borneo and on the coasts of China. In 1843 he settled in Shanghai and subsequently passed six years in the interior of China. He was an accomplished student of the languages and literatures of eastern Asia, being well versed in the Chinese, Japanese, Javanese and other dialects, besides Dutch, French and English, in all of which he wrote. Besides a Chinese version of the Bible, he published *English and Japanese Vocabulary* (1830); *Dictionary of the Hokkien Dialect* (1832–1839); *Translation of a Comparative Vocabulary of the Languages of China, Corea and Japan* (1835); *China in its State and Prospects* (1838); *Chinese Repository,* 20 vols. (1838–1851); *Notes on Chinese Grammar* (1842); *Chinese Dialogues* (1844); *Dissertation on the Theology of the Chinese* (1847); *English and Chinese Dictionary* (1847–1848).

MEDIA, mē′dĭ-ȧ, Asia, an ancient kingdom and country of considerable extent, now comprised in the provinces of northwest Iran. It was originally inhabited by a Turanian race, who are called Medes by ancient writers; but this name properly belongs to an Aryan race, who had spread themselves widely in the high regions of Western Asia and ultimately established their ascendency in Media. They have been traced both by Persian and Indian traditions to the countries beyond the Indus. The history of Media is involved in considerable obscurity, but careful modern investigations have made the main outlines fairly clear. The Medes are first mentioned

in connection with some of the kings of Assyria from the 9th century B.C. The Assyrian conqueror Shalmaneser II in 836 B.C. received tribute from those of the Zagrus area. In 713 the great King Sargon II (722–705 B.C.) conquered the country and made the Median princes tributary to the Assyrian monarchy. According to the Assyrian inscriptions, one of the Median rulers named Dayukku (Dajaukku) was carried off as a prisoner in 715 B.C.; this Dayukku is the same as the Deioces who, according to Herodotus, founded the Median kingdom on an independent basis and fixed his capital at Ecbatana (now Hamadan). Deioces was followed by three kings in succession, bearing the names (in Greek) of Phraortes (647?–?625 B.C.), Cyaxares (625–585 B.C.) and Astyages (584–550 B.C.).

Phraortes, to whom the Greek historian assigns a reign of 22 years, began the extension of the Median empire by the subjugation of the mountainous region of Persis, to the southeast of Media. He then conquered other parts of Asia, and at length ventured to take the aggressive against the Assyrians and attack Nineveh. In this attempt he failed and lost his life.

Cyaxares succeeded him on the Median throne, and during a reign of 40 years raised his kingdom to the greatest power and importance it was destined to achieve. He thoroughly reorganized the army and advanced against Nineveh. He gained several successes, but before he could take the Assyrian capital he had to return to defend his kingdom against the inroads of Scythians. At first the Scythians carried all before them and became virtually masters of Media, but Cyaxares temporarily secured his position by negotiating with them, and finally slew all their chiefs when they were overpowered by wine at a feast. Thus rid of Scythian authority, Cyaxares again advanced against the Assyrians. In conjunction with Nabopolassar, founder of the Neo-Babylonian empire, he captured Nineveh about the year 606 B.C. After this event the Assyrian dominions were partitioned between the two conquerors, the northern parts falling to Media and the southern portions to Nabopolassar. Nebuchadnezzar, son and successor of Nabopolassar, married a daughter of Cyaxares. Cyaxares carried his arms into Asia Minor and waged war for five years against Alyattes, king of Lydia. On May 28, 585, the Median and Lydian forces were engaged in battle when a total eclipse of the sun took place and struck terror into the soldiers on both sides. This event disposed both sides to enter into peace negotiations, which were successfully carried through by the agency of Nebuchadnezzar and Syennesis, prince of Cilicia. Cyaxares probably died very shortly after this event, and left to his successor a greatly extended empire.

Astyages was the last independent king of Media, and from 550 B.C., when he was conquered by Cyrus the Persian, Media formed part of the Persian empire. See PERSIA-IRAN—*History*.

Consult Delattre, A. L., *Le peuple et l'empire des Mèdes jusqu'à la fin du règne de Cyaxare* (Brussels 1883); Oppert, Jules, *Le peuple et la langue des Mèdes* (Paris 1879); Ragozin, Z. A., *Media, Babylon and Persia* (New York 1888); Cameron, G., *History of Early Iran* (Chicago 1936).

MEDIA, borough, Pennsylvania, county seat of Delaware County; on the Philadelphia, Baltimore and Washington Railroad, about 15 miles west of Philadelphia. It is a well-built, well-kept residential suburb of Philadelphia, and is situated in a fertile agricultural region. It is the headquarters for the Delaware County Institute of Science, established in 1833. The Institute has a library of about 5,500 volumes, and the borough library has about 3,500 volumes. The street-lighting plant and the waterworks are owned and operated by the borough. The borough was incorporated in 1850; its government is vested in a burgess and council. Pop. (1940) 5,351; (1950) 5,733.

MEDIAL MORAINE. See MORAINE.

MEDIATION, *in international law,* is the friendly intercession of a third power or powers with a view to bringing about the settlement of a controversy between two or more states, to avert threatened hostilities between them or to bring to a close a war in which they are engaged. Most writers on international law make a distinction between "good offices" and "mediation." The employment of good offices by a third power consists in the tendering of friendly advice or the offering of suggestions to the disputing parties with a view to bringing about the settlement of a dispute or the conclusion of peace, if they are engaged in war. A government which tenders its good offices is understood to be willing to suggest a compromise as a common basis of agreement between the contending parties, to arrange preliminaries for the negotiation of a treaty of peace and to do anything else that may serve the parties in settling their controversy or in ending their hostilities.

Mediation, on the other hand, has more of the character of friendly intervention. A mediator assumes the rôle not merely of adviser or conciliator but takes the part of a middleman,—usually the leading part,—in the conduct of the negotiations between the disputants. He is not, however, a judge, for mediation is not arbitration, nor is he an advocate for either side but, to use the language of Sir James Mackintosh, he is "a common friend, who counsels both parties with a weight proportioned to their belief in his integrity and their respect for his power." With a view to encouraging a more frequent recourse to mediation as a means of settling international controversies and in order to define the rôle of the mediator the Hague Peace Conferences of 1899 and 1907 adopted the following rules which were embodied in a convention which was ratified by practically all the powers of the world.

"In case of serious disagreement or dispute, before an appeal to arms, the Contracting Powers agree to have recourse, as far as circumstances allow, to the good offices or mediation of one or more friendly Powers (Art. 2).

"Independently of this recourse, the Contracting Powers deem it expedient *and desirable* (the italicized words were added in 1907) that one or more Powers, strangers to the dispute, should, on their own initiative and as far as circumstances may allow, offer their good offices or mediation to the States at variance.

"Powers, strangers to the dispute, have the right to offer good offices or mediation, even during the course of hostilities.

"The exercise of this right can never be regarded by either of the parties at variance as an unfriendly act (Art. 3).

"The part of the mediator consists in reconciling the opposing claims and appeasing the feelings of resentment which may have arisen between the States at variance (Art. 4).

"The duties of the mediator are at an end when once it is declared, either by one of the contending parties, or by the mediator himself, that the means of reconciliation proposed by him are not accepted (Art. 5).

"Good offices and mediation, undertaken at the request of the contending parties or on the initiative of Powers strangers to the dispute, have exclusively the character of advice, and never have binding force (Art. 6).

"The acceptance of mediation cannot, in default of agreement to the contrary, have the effect of interrupting, delaying or hindering mobilization or other measures of preparation for war.

"If mediation takes place after the commencement of hostilities, the military operations in progress are not interrupted, in default of agreement to the contrary (Art. 7)."

It will be seen that the tender of good offices or mediation by third powers prior to or during hostilities is declared to be a legal right, though not an obligation. The Convention, however, imposes on the disputants an obligation to have recourse to this mode of settling their controversies *so far as circumstances allow.* Each disputant is therefore the judge as to whether the circumstances in a particular case create an obligation to accept the offer tendered. At the outbreak of the European War the President of the United States made known his willingness to serve as a mediator whenever he should receive assurances that an offer would be acceptable by the warring powers. Again in 1916 when war between the United States and Mexico seemed imminent the governments of several of the Latin American republics made known their willingness to offer their good offices in bringing about a settlement of the dispute but the American government declared that the circumstances were not such as to make recourse to this form of sentiment expedient. The express declaration of The Hague Convention that the exercise of the right of mediation by third powers shall never be regarded by either of the disputing parties as an unfriendly act was designed to remove all possibility that an offer of mediation might be construed as an act of gratuitous interference rather than the act of a disinterested friend of both parties. The rôle of the mediator is defined in article 4 as that of reconciliation and article 5 lays down the circumstances when his mission is terminated. Article 6 which declared that mediation has no binding effect on the parties but is entirely advisory in character removes the possibility of further misunderstanding concerning its purpose and effect.

The historical instances of recourse to good offices and mediation are numerous. A few of these may be mentioned as illustrations. During the war of 1812 between Great Britain and the United States, the Tsar of Russia offered to act as a mediator with a view to bringing about a termination of hostilities. The offer was accepted by the government of the United States and to avoid delays plenipotentiaries were at once appointed by the President to conclude a treaty of peace but the offer was refused by the British government and nothing further came of the Russian proposal.

Early in 1861 several Latin American republics tendered their good offices to avert the civil war then imminent; after the outbreak of hostilities the British and French governments through their ministers at Washington expressed a willingness "to undertake the kindly duty of mediation" if the President should desire it. President Lincoln expressed appreciation for "this generous and friendly demonstration" but stated "that we cannot solicit or accept mediation from any, even the most friendly quarter." On various occasions during wars in South and Central America the President of the United States tendered his good offices to bring about the adjustment of difficulties or to terminate hostilities already existing. One of the most remarkable of such examples of mediation on the part of the United States was that which was begun in 1866 and concluded in 1872 for the purpose of terminating the war between Spain on the one hand, and the allied republics of Peru, Chili, Bolivia and Ecuador on the other. During the Franco-German War of 1870–71 France requested the United States "to join other powers" in an effort to bring about peace. President Grant replied that he anxiously desired to see the war ended and peace restored and that he would be glad to use his efforts in bringing about peace if Germany also desired the employment of his good offices. At the same time the French government was informed that it was the uniform policy of the United States not to act jointly with European powers in interference in European questions. During the Chino-Japanese War of 1894 the government of the United States made known to both belligerents its willingness "to contribute its kindly offices toward the restoration of peace" but when an inquiry was made asking whether the United States would be willing to join England, Germany, France and Russia in an intervention between China and Japan the President replied that the United States could not join the powers mentioned in such an intervention. During the Boer War of 1899–1902 the government of the United States alone of all the governments approached by the South African republics tendered its good offices but the offer was not acceptable to the government of Great Britain.

A remarkable recent example of the employment of good offices by the President of the United States to bring about the termination of war was the intervention of President Roosevelt in 1905 which resulted in the conclusion of peace between Japan and Russia. On 8 June 1905 the President caused identical notes to be sent to the governments of both belligerents expressing his wish that "the terrible and lamentable conflict now being waged" might be brought to an end and urging them "not only for their own sakes but in the interest of the whole civilized world to open direct negotiations with one another." He also expressed his entire willingness to do what he properly could if the two powers felt that his services would be of any aid in arranging the preliminaries as to the time and place of meeting of the plenipotentiaries which they might appoint. The suggestion of the President was promptly acted upon and plenipotentiaries were appointed to negotiate

a treaty of peace. They met at Portsmouth, New Hampshire, and a treaty of peace was signed on 23 Sept. 1905.

A still more recent example of successful mediation was that of 1914, which resulted in the temporary termination of an existing conflict between the United States and Mexico. On 25 April, the diplomatic representatives of Brazil, Argentina and Chile addressed a communication to the Secretary of State tendering the good offices of their governments for «the peaceful and friendly settlement» of the controversy. The offer was promptly accepted both by the President of the United States and General Huerta, President of Mexico, and both parties agreed to a mutual suspension of hostilities at the request of the mediators.

At the suggestion of the mediators commissioners representing both parties were appointed and they met at Niagara Falls, Ontario, in May 1914. The mediating plenipotentiaries in turn presided over the conferences. On 24 June a protocol embodying the terms of agreement was signed and it was duly ratified by both governments. See also ARBITRATION, INTERNATIONAL.

Bibliography.—In addition to the general treatises on International Law (bibliography q.v.) see especially Hershey, 'Essentials of International Public Law' (pp. 322–324; excellent bibliography on p. 342; New York 1912); Holls, 'The Peace Conference at The Hague' (pp. 176–203; New York 1900); Higgins, 'The Two Hague Peace Conferences' (pp. 167 ff; Cambridge 1909); Hull, 'The Two Hague Conferences' (pp. 267–276; Boston 1908); Moore, 'Digest of International Law' (Vol. VII, Secs. 1065–1068; Washington 1906).

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MEDICAGO, genus of leguminous plants common throughout the greater part of the globe and including such forage plants as alfalfa, medic and bur and mail clovers. Some species are annual, others perennial. In all here are about 50 species, of which about six are native to the United States. These include *M. sativa, M. lupulina, M. denticulata, M. Arabica.* In general the perennial species have violet flowers, the annuals small bright yellow flowers. The pods are single-seeded, curved and spineless in some, while in others it is spirally twisted, has spines on the edges and contains several seeds. Medicago sativa is the most important species, since it includes the valuable alfalfa and lucerne.

MEDICAL ASSOCIATION, American. See AMERICAN MEDICAL ASSOCIATION.

MEDICAL ASSOCIATIONS. Organizations of this general designation are very numerous and find their *raison d'être* in the desire of their members or founders to exchange information on professional subjects and to advance the status of the medical profession generally. In colonial America the early medical associations were organized as follows: Boston, 1735; New York, 1749; Philadelphia, 1765; New York, 1769; and others including New Jersey, 1766; Massachusetts, 1781; South Carolina, 1789; Delaware, 1789; New Hampshire, 1791; Connecticut, 1792. The leading association of this type, the American Medical Association (q.v.) was founded in 1847 for the advancement of medical science and the improvement of the public health. Medical specialist associations include the American College of Physicians, founded in 1915, the American College of Radiology, founded in 1924, and the American College of Surgeons, founded in 1913, the American Ophthalmological Association, the Congress of Physical Therapy, the American Gynecological Association, the American Heart Association, the American Laryngological Association, the American Laryngological, Rhinological and Otological Society, the American Psychiatric Association, the American Proctological Society, the American Psychoanalytical Association, the American Psychopathological Association, the American Public Health Association, the American Radium Society, the American Roentgen Ray Society, the American Society for Clinical Investigation, the American Society for Experimental Pathology, the American Society for the Control of Cancer, the American Society of Clinical Pathologists, the American Society of Tropical Medicine, the American Surgical Association, the American Therapeutic Society, the American Urological Association, the Association for Research in Nervous and Mental Diseases, the American Association for the Study of Allergy, the American Association for the Study of Internal Secretions, the Association of American Medical Colleges, the Association of American Physicians, the Association of American Teachers of the Diseases of Children, the Association of Military Surgeons of the United States, the American Association for the Study of Goiter, the American Society of Oral and Plastic Surgeons, the American Association of Obstetricians, Gynecologists, and Abdominal Surgeons, the American Association of Pathologists and Bacteriologists, the American Association of Industrial Physicians and Surgeons, the American Association of Railway Surgeons, and the American Association of Anatomists.

There are in addition several national associations which promote the interests of the medical profession in co-operation with the public. One of the best known of these is the Child Health Association. There are also state associations, county and municipal medical associations.

MEDICAL CODE, a set of regulations adopted by a medical association outlining the conduct of members of the profession. The various codes prohibit advertising in public prints, as well as the endorsement of proprietary or secret remedies. The ethics of both «regular» and homœopathic schools define the relations of patient and physician and of attending and consulting physician, and provide that a physician shall attend the immediate family of a brother physician without charge, except when unusual labor, expense or exposure is involved. The medical code in this country was founded on the English code of medical ethics prepared by Thomas Percival in 1803. In 1847 the American Medical Association adopted a general code which superseded codes existing in several States, and which was unopposed till 1882. In the latter year a majority of the members of the New York County Medical Society voted to disobey the provisions of the code which forbade them to consult with any but «regular» physicians, claiming the right to consult with any physicians that the legislature of each State decided to be

legally qualified. Similar action was taken by a majority of the members of the New York Academy of Medicine. This antagonism affected the whole profession in this country, and the immediate result was the formation of New York County and State associations, whose delegates were received by the American Medical Association, to the exclusion of those from the old societies. In 1903 steps were taken to heal their differences and unite the rivals into one body, with the code so modified in effect as to allow individual liberty in the matter of consultation. Consult Flint, 'Medical Ethics and Etiquette' (New York 1883) and 'Principles of Medical Ethics' (Chicago 1912), the official work of the American Medical Association.

MEDICAL COLLEGES FOR WOMEN. See EDUCATION, PROFESSIONAL; MEDICAL EDUCATION IN THE UNITED STATES.

MEDICAL CORPS, UNITED STATES ARMY. See MEDICAL ORGANIZATION IN THE UNITED STATES ARMY.

MEDICAL CORPS, UNITED STATES NAVY. See NAVAL MEDICAL CORPS, UNITED STATES.

MEDICAL EDUCATION, Colleges and Schools, Legal Supervision, etc. Before the establishment of medical schools in this country medical students either went abroad to study or served an apprenticeship with some practising physician. As a rule the apprentice had little opportunity for study, but was forced to depend on what he could absorb by contact with his preceptor. The physicians of the 17th and 18th centuries who had studied abroad were usually classical students. The first public lectures on anatomy before a class of students in this country are said to have been delivered by Dr. William Hunter of Newport, R. I., in 1752. It seems, however, that Dr. Giles Firmin as early as 1647 delivered readings on human osteology in New England; that Dr. Thomas Cadwallader of Philadelphia gave instruction to students in anatomy between 1745 and 1751; and that Drs. John Bard and Peter Middleton dissected the human body in New York City in 1750 for purposes of medical instruction. In 1762 Dr. William Shippen of Philadelphia gave a course of lectures on anatomy, illustrated by actual dissections. These lectures were continued till the organization of the Medical College of Philadelphia (now the medical department of the University of Pennsylvania) in 1765. Dissections were rarely performed prior to 1760 and even autopsies were seldom permitted. At the time of the American Revolution, with a population of 3,000,000, there were probably about 3,500 physicians in the colonies, of whom it is estimated that not more than 400 had received medical degrees. In New England the clergyman was often the only available physician. Two medical schools were organized in the colonies, the Medical College of Philadelphia (now a department of the University of Pennsylvania) in 1765, and the medical department of King's (now Columbia) College, in 1768. The first medical degree conferred in this country, that of bachelor of medicine, was granted to 10 men by the Medical College of Philadelphia in 1768. The degree of doctor of medicine was first conferred in 1770 by the medical school of King's College on two students who had taken the bachelor's degree in 1769. Fifty-one medical degrees had been conferred by these institutions before 1776, when operations were suspended by the war. In the colonial period two medical societies (the State Medical Society of New Jersey, in 1766, and the Delaware State Medical Society, in 1776) and one permanent general hospital were organized. Harvard University Medical School was organized in 1782, Dartmouth Medical College in 1797, the School of Medicine of the University of Maryland and the College of Physicians and Surgeons of New York in 1807. In 1813 the medical department of Columbia College was finally discontinued; the College of Physicians and Surgeons took its place in 1860. Of the 76 medical schools now existing in the United States (less than half the number of schools in operation in 1906), three were established between 1765 and 1800, 12 between 1801 and 1825, 19 between 1826 and 1850, 29 between 1851 and 1875, 80 between 1876 and 1900, 5 between 1901 and 1904.

At the time of the organization of the early medical schools the practice of obstetrics was relegated as a rule to ignorant midwives; physiology, histology, organic chemistry, pathology, and surgery, as now recognized, were hardly known. The schools at first conferred the degree of bachelor of medicine on those who had studied two years with a preceptor and attended one course of lectures, the degree of doctor of medicine after three years of study and two courses of lectures. The bachelor's degree was abandoned in 1813. At first the Medical College of Philadelphia required for admission some knowledge of Greek and Latin, physics, natural history and botany, but the requirement was abandoned about the time of the reorganization of the University of Pennsylvania in 1792. For a century there were as a rule practically no requirements in preliminary general education for admission to medical schools, and even to-day this is their greatest defect.

In 1839 the New York State Medical Society resolved that teaching and licensing ought to be separated as far as possible. Further discussion of this question led to a convention of delegates from all medical schools and societies in the United States, held in New York in 1846; from it sprang the American Medical Association. This national organization, thoroughly representative in character, gave a new impetus to medical societies. The following societies have exercised an important influence in promoting higher standards: Association of American Medical Colleges (1890); American Institute of Homœopathy (1844); National Confederation of Eclectic Medical Colleges (1871); Southern Medical College Association (1892). These prescribe for admission to medical schools a preliminary general education equivalent to one year in a high school. All prescribe four courses of lectures in different years as a condition for an M.D. degree, though they give an allowance of one year to graduates of reputable literary colleges and of other professional schools. All tend to improve facilities for teaching, dissections and clinics. The schools registered by these societies are 72, 19, 7 and 13 respectively.

In 1859 the Chicago Medical College, now the medical department of Northwestern University, was established to test the practicability of a thorough graded system of instruction. Students were divided into three classes, and each class was examined at the close of the

year. Each of the three courses was six months in duration. Attendance on hospital clinical instruction and practical work in the chemical, anatomic and microscopic, or histologic laboratories were required for graduation. In 1871 the Harvard Medical School adopted a similar plan. The Syracuse Medical School followed, and to-day the graded system of consecutive lectures is the rule. In 1896 President Eliot wrote substantially as follows: Within 25 years the whole method of teaching medicine has been revolutionized throughout the United States. The old medical teaching was largely exposition; it gave information at long range about things and processes which were not within reach or sight at the moment. The main means of instruction were lectures, surgical exhibitions in large rooms, appropriately called theatres, rude dissecting rooms with scanty supervision, and clinical visits in large groups. The lectures were repeated year after year with little change, and no graded course was laid down. There was little opportunity for laboratory work. The new medical education aims at imparting manual and ocular skill, and cultivating the mental powers of close attention through prolonged investigations at close quarters with the facts and of just reasoning on the evidence. The subjects of instruction are arranged, as at the Harvard Medical School, in a carefully graded course, which carries the student forward in an orderly and logical way from year to year. Laboratory work in anatomy, medical chemistry, physiology, histology, embryology, pathology and bacteriology demands a large part of the student's attention. In clinical teaching, also, the change is great. Formerly a large group of students accompanied a visiting physician on his rounds, and saw what they could under very disadvantageous conditions. Now instruction has become, in many clinical departments, absolutely individual, the instructor dealing with one student at a time, and personally showing him how to see, hear and touch for himself in all sorts of difficult observation and manipulation. Much instruction is given to small groups of students, three or four at a time — no more than can actually see and touch for themselves.

In 1918 there were, excluding graduate schools, 95 medical schools in the United States with 13,630 students. The growth in medical students in 32 years up to 1910 was 333 per cent. In the last 30 years, however, there has been a radical change in medical education in the United States which has had the effect, as will be shown in the following table, of improving the quality of the education, while at the same time reducing the number of those granted medical degrees. Acting upon the recommendation of the American Medical Association, a committee has made a division of medical schools into three classes, A, B and C, the first containing those medical schools which fulfilled the highest requirements. Here are the results following the reconstruction:

Year	Colleges	Students	Women	Graduates	Women
1904.....	160	28,142	1,129	5,747	.....
1914.....	102	16,502	631	3,594	.....
1915.....	96	14,891	592	3,536	.....
1916.....	95	14,022	566	3,578	134
1918.....	95	13,630	581	2,807	106
1926.....	79	18,840	935	3,962	212
1930.....	76	21,597	955	4,565	204

While the actual number of physicians graduated is very much less than that of the year 1904 the reports of 1930 showed the largest enrolment since 1911. The diminution in number of medical students was not affected by the European War nor was the actual number of medical students and teachers affected by the selective draft, for the Medical Officers' Reserve Corps and the Enlisted Medical Reserve Corps provided against that contingency.

Class A colleges require a four-year high school course and two years of work in a college of arts and sciences approved by the council on education of the American Medical Association. The council also specifies what is required in the studies both in high school and college, and also what is to be expected of the medical schools themselves, both in supervision, equipment, teachers, clinical facilities [including, for instance, daily dispensary cases, at least six maternity cases for each senior student and 30 necropsies for each senior class of 100 students or less], medical library, museum, dissect material, etc. In 1918 there were 69 medical colleges of Class A in the United States and two in Canada.

Medical schools of Class B are those which under the present organization give promise of being made acceptable by general improvements. Of these there are 14 in the United States and six in Canada. Class C contains those which require complete reorganization, do not keep satisfactory records, or enforce entrance requirements or give a major portion of their instruction after 4 P.M., or are privately owned and conducted for profit. Of these there are 12 in the United States.

The comparative value of the work done now and 25 years ago is realized when it is known that in 1904 only 2.5 per cent of medical schools required college work as an entrance requirement, while in 1918 92.2 per cent did, and that in 1904 only 6.2 per cent of the medical students of the country were in the high grade medical schools, while in 1918 there were 95.3 per cent in the better schools, and that in 1904 but 6.4 per cent of the graduates in medicine came from the high grade colleges, while in 1918 the latter graduated 90.3 per cent.

In 1915 a national board of medical examiners was inaugurated with funds from the Carnegie Foundation. The board consists of six representatives from the government [two from the army, two from the navy and two from the public health service], three members of State licensing boards and seven other physicians appointed at large. The three medical schools which make a lower tuition charge for women than for men are the universities of Michigan, Pennsylvania and Vermont.

About 1903 a rapid improvement in medical education began in the United States, resulting in a very great decrease in the number of medical colleges and it was thought that a dearth of physicians would follow. Fears were also expressed that the medical education, the cost of which was thus greatly increased, would be the privilege of the rich, and that it would undemocratically exclude the poor boy, a fear which has not been justified. Apprehensions were also felt that the raising of the standard of medical education would have the effect of decreasing the supply of physicians for

rural communities. This, however, has been obviated by the improvement of facilities in communication — automobiles, better roads, etc.

Out of 76 medical schools about 70 are coeducational, although a few of the medical colleges admitting women have no women students. The State of New York has 9 medical colleges, the largest number in any State.

More attention should be paid in the United States to instruction in hygiene and state medicine. In Great Britain no one can be appointed a medical officer unless he has a special diploma in public health. In this country little opportunity is afforded for general or special sanitary work on broad lines. This subject is now under discussion and doubtless progressive States will soon provide places where medical officers of health or other persons engaged in sanitary work can obtain practical and scientific training. The scientific investigations which would be made in the laboratories of such schools would be of great value to the public.

The earliest law relating exclusively to physicians was passed by Virginia in 1639, but like the later act of 1736 it was designed mainly to regulate their fees. The act of 1736 made concessions to physicians who held university degrees. In only two of the 13 colonies were well-considered laws enacted to define the qualifications of physicians. The general assembly of New York in 1760 decreed that no person should practise as physician or surgeon in the city of New York till examined in physic and surgery and admitted by one of his majesty's council, the judges of the supreme court, the king's attorney-general and the mayor of the city of New York. Such candidates as were approved received certificates conferring the right to practise throughout the whole province, and a penalty of £5 was prescribed for all violations of this law. A similar act was passed by the general assembly of New Jersey in 1772. In 1840 laws had been enacted by the legislatures of nearly all the States to protect citizens from the impositions of quacks. Between 1840 and 1850, however, most of these laws were either repealed or not enforced as a result of the cry that restrictions against unlicensed practitioners were designed only to create a monopoly.

State Supervision.— Careful attention needs to be given to the difference between a license and a degree; the one carrying with it the right to assume a title which is evidence of scholastic ability, the other the right to enter on the practice of a profession or a pursuit, both emanating from the same authority, the State, either directly or through intervening mediums. As foreigners are often puzzled to account for the diversity in our legislation, the fact is again emphasized that all matters of internal police control are left exclusively to the several States, and that national laws regulating professional practice cannot be enacted. Hence the laws of the United States will be silent concerning licenses and degrees except in so far as they may apply to the District of Columbia and certain recent political dependencies.

Licensing.— The requirements for admission to practise a profession in the 54 political divisions of the United States vary as greatly in the various professions as the political divisions differ in area, extent, population and importance. However, two general items appear in full or in part in the various statutory requirements for licensing; namely, (1) the general preliminary education requirements; (2) the professional preparation. The general preliminary are given uniformly under the synopsis of requirements.

Supervision.— In medicine all political divisions except Alaska now have examining and licensing boards. In some States the stringent laws against non-medical practitioners are enforced; in others quackery receives such legal protection that any person may treat "the sick or suffering by mental or spiritual means without the use of any drug or material remedy." This is due largely to the fact that so many statutes lack specific definitions as to what constitutes the practice of medicine, and without these definitions the conviction of such practitioners cannot be secured through the courts. There is much misunderstanding in this country regarding the duty of the State in relation to the health of the people. It does not consist in discriminating between schools or systems of medicine, but in requiring without prejudice or partiality of all who seek a license to practise for gain on the lives of fellow beings a minimum preliminary and professional training.

Medical Sects.—As commonly understood, regular physicians have no distinctive theory or practice; homœopaths treat diseases with drugs that excite in healthy persons symptoms similar to the morbid condition treated; eclectics make use of what they regard as specific remedies, chiefly botanic; physiomedicalists use only botanical remedies, discarding those which are poisonous. In practice these distinctions are not always observed. The following political divisions specify homœopaths, eclectics or osteopaths as constituting part of their examining boards or have other than regulars on them. Arizona, Arkansas, California, Colorado, Georgia, Hawaii, Idaho, Illinois, Indian Territory, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, Nevada, New Jersey, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, Wyoming.

Midwifery.—Special fees for certificates of registration as midwives are required in California, Illinois, Iowa and Texas. In the following political divisions the provisions of the medical practice acts do not apply to women engaged in the practice of midwifery: Arkansas, Colorado, Florida, Georgia, Idaho, Kentucky, Louisiana, Maryland, Mississippi, Montana, New Mexico, North Carolina, South Carolina, Tennessee, Washington. In other political divisions, though there are some special provisions for certain localities, the general acts regulating the practice of medicine make no reference whatever to the practice of midwifery by women. It would seem, therefore, that these laws restrict the practice of midwifery to licensed physicians. Practically the conditions in political divisions where the laws seem to restrict the practice of midwifery to licensed physicians are little better than in political divisions where the practice of midwifery by women without a license is authorized. There will probably be little change for the better till the practice of midwifery is regulated by definite statutory provisions.

MEDICAL EDUCATION IN THE UNITED STATES AND CANADA. Prior to 1765 students from America necessarily went abroad for their medical education, mainly to the medical schools of Edinburgh, London and Paris. Others secured their training by serving an apprenticeship with a practicing physician. The latter custom was common in view of the expense incident to work abroad. As a rule, the apprentice had little opportunity for study, but was forced to depend on what he could absorb by contact with his preceptor. The physicians of the 17th and 18th centuries who had studied abroad were usually classical students. Among the American Edinburgh graduates was John Morgan who had received his bachelor's degree from the College of Philadelphia in 1757. He had studied medicine under such men as William Hunter, Cullen and the Monros, and later visited Europe in search of additional training. While in Edinburgh he conceived the notion of founding a medical school in Philadelphia, the same to be an integral part of the College of Philadelphia. In this project he enlisted the wholehearted co-operation of William Shippen, Jr., a graduate of the College of New Jersey (Princeton). Shippen had studied in London and graduated from Edinburgh in 1762. This idea took concrete form in 1765 when Morgan, Shippen, and later, Rush gathered around them in the city of Philadelphia a group of students for instruction in the essentials of medicine, surgery and midwifery. This was the first medical school in this country—The Medical College of Philadelphia—now a department of the University of Pennsylvania.

During the next half a century other schools followed, some of which were inspired by Louis and Laennec and showed clearly the influence of French medicine.

The first medical degree conferred in this country, that of Bachelor of Medicine, was granted to 10 men by the Medical College of Philadelphia in 1768.

At the time of the American Revolution, with a population of 3,000,000, there were probably about 3,500 physicians in the colonies, of whom it is estimated that not more than 400 had received medical degrees. Although the medical apprenticeship did not entirely disappear, the lecture became more and more widely accepted as the routine method of instruction, and partly in consequence of this tendency an extraordinary number of medical schools were established during the latter half of the 19th century. Some were short-lived, but others soon appeared to replace them. Unhappily, in these efforts to broaden and systematize the content of the medical curriculum, the importance of clinical experience was gradually lost from view, in a short time resulting in the anomaly of students attempting to learn medicine from books, having little or no contact with patients. Sir William Osler is credited with transplanting in this country the British custom of using medical students as clinical clerks in hospital wards, thus introducing a new appreciation of the importance of practical experience in clinical teaching which has influenced in greater or less degree all of our medical schools.

Near the end of the 19th century Germany was the Mecca for those who wished to devote themselves to the newly established and rapidly growing sciences of physiology, pathology and bacteriology. Pupils of Ludwig, Cohnheim and Koch brought back with them not only new knowledge which had to be incorporated in the curriculum, but also a clearer understanding of the need for a satisfactory foundation of general education on which to build. The Association of American Medical Colleges, organized in 1890, recommended a minimum standard of high school graduation as a prerequisite for medicine. Johns Hopkins University in 1893 made a bachelor's degree a prerequisite for admission to the medical school. This action served to call attention to the necessity for at least some required standard of preliminary education.

State control of medical practice during the first half of the 19th century came to be exercised through local medical societies, membership in which was accepted as a sufficient qualification. Later, the diploma of a medical school was accorded the same recognition. The failure of the schools to keep abreast of scientific progress led to the establishment, during the last years of the 19th and the early part of the 20th centuries, of State medical boards with power to examine all candidates and to license those who were successful in meeting the standards of the board. Representing as they do a great improvement over the previous indiscriminating acceptance of school credentials, the State boards have, nevertheless, been handicapped by lack of funds and by political control.

The American Medical Association, organized in 1847, included in its constitution a declaration of purpose, in these words: «cultivating and advancing medical knowledge; elevating the standard of medical education; promoting the usefulness, honor, and interests of the medical profession; enlightening and directing public opinion in regard to the duties, responsibilities and requirements of medical men; for exciting and encouraging emulation and concert of action in the profession and facilitating and fostering friendly intercourse between those engaged in it.» The most significant event in the life of the association was the reorganization in 1901 which brought all local and State societies into an organic union as constituent parts of the American Medical Association. There followed at once an inquiry into the standards and methods of medical schools. Data were collected from State boards showing the relative success or failure of the graduates of the various schools. The need for more comprehensive investigation of the problems of medical education led in 1904 to the establishment by the American Medical Association of a Council on Medical Education. Personal inspections, beginning in 1907, by representatives of the council called attention to the prevailing lack of standards, the meager resources and untrained personnel in many of the proprietary schools. The Carnegie Foundation for the Advancement of Teaching, by invitation of the American Medical Association and accompanied by the Secretary of the Council on Medical Education, visited all schools in the United States and Canada, and the results of their investigation, published in 1910, aroused the public to a recognition of the fact that medical education in this country lagged far behind that in Europe. By repeated visitation and by annual publication of a classified list of schools, the council was able to bring about a most remarkable improvement in the standards of medical education. Many of the weaker

schools closed; others gained strength through consolidation or university affiliation; nearly all were able to secure either private endowment or State support. By 1914 certain principles regarding medical education had become generally established although not by any means fully translated into appropriate action in every institution. These principles were, first, that a definite minimum standard of preliminary education must precede admission to the medical school; second, that in the medical sciences, such as anatomy and physiology, there must be experienced teachers, trained in their respective subjects, rather than practicing physicians who could devote only a few hours a week to the discharge of their academic responsibilities; third, that medicine must be learned neither from books alone nor from lectures only, but chiefly, from the observation of the sick; that hospitals and dispensaries, therefore, were just as necessary to a medical school as a chemical laboratory or a dissecting room; and fourth, to secure public confidence and support and to maintain high academic standards, it was regarded as necessary that medical schools should be integrated with the rest of the system of higher education; that they should become parts of, or at least affiliated with, universities, and that the proprietary interest of the faculty should cease.

State boards were led to adopt rules or secure legislation excluding from the licensing examination graduates of low grade schools. This, in turn, caused the closing or merger of most of those schools which could not reach an acceptable standard, and the surviving schools were enabled to develop better educational programs.

In the development here outlined America borrowed from Europe many of the best features of the Scottish, French, English and German schools, at the same time integrating them with our own system of education and fitting them into our own university structure.

In 1918 there were, excluding graduate schools, 95 medical schools in the United States with 13,630 students. In 1905 there were 160 schools and 26,147 students. The radical change in medical education which has taken place since 1910 has had the effect, as will be shown in the accompanying table, of improving the quality of the education, while at the same time reducing the number of those granted medical degrees. Medical schools were divided into three classes, A, B and C, the first containing those medical schools which fulfilled the highest requirements based on «Essentials» formulated by the Council on Medical Education and Hospitals of the American Medical Association and ratified by the association's House of Delegates. In 1929, medical schools had either attained an A rating or were deemed unworthy of any recognition and thereafter medical schools were listed as approved or unapproved.

The number of medical schools, students and graduates for five-year periods beginning with 1905 is as follows:

Year	Schools	Students	Graduates
1905	160	26,147	5,606
1910	131	21,526	4,440
1915	96	14,891	3,536
1920	85	13,798	3,047
1925	80	18,200	3,974
1930	76	21,597	4,565
1935	77	22,888	5,101
1939	77	21,302	5,089

While the actual number of physicians graduated was very much less than the number graduated in the year 1905, the reports for 1935 showed the largest enrolment since 1905. The classes entering during the World War period were the lowest on record.

During the World War period there was little opportunity for advance in medical education, but in the decade and a half which followed, some schools were able to make remarkable progress toward the attainment of their objectives. Magnificent buildings, extensive equipment, generous support for research, good facilities, liberal budgets based on large endowments, placed not a few of our institutions in a position second to none. This development, apart from its purely financial aspect, has concerned itself largely with clinical teaching and the necessary clinical facilities.

There has also been a steady increase in the amount of preliminary education possessed by students entering upon the study of medicine. Although many schools have additional requirements, the following indicates the preliminary education acceptable to the council:

The minimum requirement for admission to approved medical schools is two years of college training which include English, theoretical and practical courses in physics, biology and general and organic chemistry. Three years or more in college is, however, recommended.

Since it cannot be assumed that all who have satisfied these requirements merely in terms of hourly credits are fitted for the study of medicine, it is desirable that qualitative standards for admission should be imposed.

As a rule candidates should have received their preliminary education in institutions approved by accrediting agencies acceptable to the council. Exceptions to this rule may be made in the case of applicants who have demonstrated superior ability. For the convenience of admitting officers, the council has prepared a list of colleges approved by national and regional educational associations.

Admission to approved medical schools may also be by examination under the following conditions:

(a) Candidates who have completed two years of collegiate instruction and present evidence of general scholarship of high order, but who lack credits in not more than two of the required subjects may be admitted on passing examinations in these subjects.

(b) Candidates who have completed three years of collegiate instruction and present evidence of having accomplished work of distinction in one or more fields of learning, but who lack credit in any or all of the required subjects, may be admitted on passing examinations in these subjects.

While the minimum requirement of the council for approved schools is two years, for the session 1939–40, 66 of the 77 medical schools in the United States, including 10 schools of the basic medical sciences, had a premedical prerequisite in excess of the minimum. Actually only 223, or 3.8 per cent, of the freshman class of 1938–39 were admitted with less than three years. For this session, 21 schools had a requirement of two years. Similar figures computed on the basis of the freshman class of 1936–37 placed 12 per cent in this class, or 716 students.

The requirements for admission to practice a profession in the United States vary as greatly

in the various professions as the political divisions differ in area, extent, population and importance. However, two general items appear in full or in part in the various statutory requirements for licensing; namely, (1) the general preliminary education requirements; (2) the professional preparation. Reciprocity or endorsement policies exist between the States. Further, in 1915 a National Board of Medical Examiners was organized, and at present its certificate is acceptable for medical licensure without examination in 42 States.

The medical course in the United States in general covers four academic years of approximately 32 weeks each. Fifty-one schools offer such a course. The medical schools of Northwestern and Duke Universities and those of the Universities of Minnesota and Tennessee operate on the quarter system, permitting a student by utilizing the summer months to decrease the length of time necessary to obtain his degree. A considerable number of the students of these schools do not elect to study during the summer months. The medical schools of the University of Chicago are operated on a plan of individual promotion permitting a student to advance as rapidly as he desires, but the great majority complete the course in 12 quarters. Fifty-five schools require a four-year course, while 12 require four years of systematic instruction followed by a fifth year spent as an intern or in research work. Ten schools offer only a two-year course. For the most part the latter are located in smaller communities where clinical material is so scarce that satisfactory teaching of clinical medicine would be utterly impossible. In many instances, facilities do not exist for the satisfactory teaching of such subjects as physical diagnosis and gross pathology, which involve the use of clinical material. The same is true of the introductory courses in medicine and surgery, which commonly form a part of the second year schedule. These schools since 1 July 1939 have been listed as recognized schools of the basic medical sciences.

The standard curriculum recognized by the Council on Medical Education and Hospitals consists of from 3,600 to 4,400 hours, distributed as from 900 to 1,100 hours a year, and grouped as set forth in the following schedule, each group to be allotted approximately the percentage of hours of the whole number of hours in the courses as stated:

		Per Cent	
1. Anatomy, including embryology and histology	14	....	18.5
2. Physiology	4.5	....	6
3. Biochemistry	3.5	....	4.5
4. Pathology, bacteriology and immunology	10	....	13
5. Pharmacology	4	....	5
6. Hygiene and sanitation	3	....	4
7. General medicine	20	....	26.5
Neurology and psychiatry			
Pediatrics			
Dermatology and syphilology			
8. General surgery	13	....	17.5
Orthopedic surgery			
Urology			
Ophthalmology			
Otolaryngology			
Roentgenology			
9. Obstetrics and gynecology	4	....	5
Totals	76	....	100
Electives	24	....	0

When the teaching conditions demand it, a subject may be transferred from one division to another.

In the published lists of the Council on Medical Education and Hospitals, 67 medical schools in the United States and nine in Canada are listed, and 10 schools of the basic medical sciences in the United States and one in Canada, are also listed. All but three of these schools at the present time enjoy the approval of the council, the three being on probation. In 85 schools, 6,364 freshmen students, 5,733 sophomores, 5,506 juniors, 5,447 seniors, 398 fifth year and 247 sixth year students were enrolled during the session 1938–39. In the two medical schools of the University of Chicago, 520 students were enrolled, making a total of 24,215 in the 87 schools. There were, therefore, in the medical schools of the United States, 5,754 freshmen, 5,160 sophomores, 4,947 juniors, 4,921 seniors, plus the 520 students of the University of Chicago, making a total of 21,302. The enrolment in the schools of the basic medical sciences in the United States for the session 1938–39 numbered 569, of which 330 were freshmen and 239 sophomores. The enrolment in the 10 Canadian schools was, first year, 610; second year, 573; third year, 559, fourth year, 526; fifth year, 398, and sixth year, 247, a total of 2,913. In the one school of the basic medical sciences in Canada there were 47 students—24 freshmen and 23 sophomores.

The 24,215 medical students enrolled exclude 1,152 fifth year students in the United States interning or engaged in research, and 121 in Canada interning as a requirement for the degree of Doctor of Medicine.

There are 10 medical schools in Canada which offer a complete medical course and one which offers courses in the medical sciences covering two years only. All of these schools enjoy the approval of the Council on Medical Education and Hospitals. These schools vary in their preliminary requirement. For the session 1939–40 one required a degree for admission to a five-year course. Of the nine other schools, four have a six-year medical course preceded by senior matriculation which is equivalent to the work of the first year in a college of arts; one requires one year for entrance to a five-year medical course; three, including one school offering courses in the basic medical sciences, require two years and one has a three-year prerequisite.

It cannot be too strongly urged that those who wish to enter the medical profession should secure their training in an institution which is recognized by all State licensing boards. Otherwise they may find that their time and money have been wasted. There are schools in existence which do not measure up to accepted standards and therefore cannot be approved by licensing bodies. Students should most carefully consider the difficulties of future practice before entering one of these institutions.

It is not possible to estimate accurately the cost of a medical education. Living costs vary in different parts of the country, and personal expenditures vary still more. There is also a difference in the charges made by medical schools for tuition. For the session 1938–39, three schools charged fees of less than $100 a year. These were State universities which make an additional charge for nonresidents. State universities, generally speaking, do not accept students from outside the State. In 15 colleges fees were over $500. Thirty schools made an additional charge for nonresidents ranging from $37.50 to $400. These amounts include annual

tuition fees and minor charges, such as for matriculation, breakage and graduation. Though the fees in some instances seem large they do not by any means cover the cost of instruction. No medical school at the present time can maintain extensive laboratories, pay the essential salaries to teachers and properly teach modern medicine without an income larger than that derived from students' fees. Medical schools, along with other institutions of the higher learning, have been affected by the economic situation. Almost without exception income has been reduced, and in order to balance the budget, fees have been increased.

It is extremely difficult for a student to earn money while at the same time he is carrying on his medical studies. The medical curriculum is so exacting that all available time should be spent in study. Many a student, in an effort to be self-supporting, has ruined his health or his scholarship. Once a student has been dropped, it is extraordinarily difficult to obtain admission elsewhere. The reason for this is that every school has many more applicants than it can receive, and in face of such active competition a student who has once tried and failed can scarcely hope to be given another chance to the exclusion of some other applicant whose record is unblemished. Therefore, unless a student has some very unusual ability which enables him to earn enough to support himself in a couple of hours a day, he should not expect to earn his way through medical school. It would be better for him to work until he accumulates the required reserves and then go to school. The physician has heavy responsibilities, and to discharge these obligations conscientiously he needs the best training that is obtainable. To warrant his sacrifice of time and money he must be sure to get during his college years an adequate foundation for his professional career.

Provision is made in some schools for scholarships and loan funds for deserving students. In some instances the award is made solely on scholarship, but ordinarily the needs of the student are also given due consideration. The scholarship may consist of the remission of the annual tuition fee or there may be a definite money payment to the recipient. In some instances scholarships are limited to residents of the State.

Women are admitted to all medical schools of the United States and Canada except the following schools: Emory, Harvard, St. Louis, Dartmouth, Hahnemann, Jefferson, and Queen's University in Canada.

In the United States the licensing of physicians is a function of the States. Each State has its own board of medical examiners or department of registration. The medical practice acts of the various States differ, and information regarding the regulations for practice should be obtained directly from the officers within a State.

In September 1933 the Council on Medical Education and Hospitals voted to undertake a resurvey of all medical schools in the United States and Canada. During the academic years 1934–35 and 1935–36, Dr. Herman G. Weiskotten, dean of Syracuse University College of Medicine, visited all schools in company with a representative of the council, the Association of American Medical Colleges or the Federation of State Medical Boards of the United States. A confidential report in graphic form by which the schools were grouped in tenths of a rank order of excellence for each one of several criteria was sent to the schools visited. A committee of the council late in 1939 finished its final report which presents a comprehensive review of medical education in this country from 1934 to 1939. Schools of osteopathy and a few unapproved medical schools refused to permit an inspection or to furnish official reports. When the survey of medical schools was undertaken in the fall of 1934, the number of medical students admitted to the first year classes in 76 schools in the United States was 6,537. The corresponding figure for 1939 was 5,768, a decrease of 769. On the other hand, the size of upper classes has not been reduced to the same extent. More careful selection of the students accepted will doubtless tend to diminish the number who drop out because of scholastic failure, so that the number of graduates may show a smaller decline than the number of matriculants. During the four years, 1935 to 1938 inclusive, the number of persons licensed annually to practice medicine increased from 5,509 to 6,252, showing that the reduction in the number of medical students had not diminished the number of physicians added each year to the medical profession. The excess of physicians licensed annually over the number of medical graduates is attributable to the licensing of graduates of schools outside of the United States. At the time the schools were visited, the number of teachers with professorial rank in the basic medical science departments of the 66 four-year schools was 1,084; the number of students in the first two years was 11,434. The teacher-student ratio, therefore, for men in the higher ranks was 1:11. For 1939, the corresponding figure was 1,247 professors and 10,551 students, with a teacher-student ratio of 1:8.

Since the completion of the survey, in a group of 28 of the less progressive schools, preclinical facilities have been improved in 17 at a cost of from $29,000 to $500,000 with an average of $89,941. The total amount contributed for this purpose was in excess of $1,500,000. Facilities for clinical teaching in 20 have been improved at costs ranging from $10,000 to $2,500,000. Total expenditure for this purpose has been in excess of $10,500,000 with an average of $545,795. Twenty-four of these 28 schools have increased their annual budgets by amounts varying from $10,347 to $87,816, with an average of more than $47,000 and an aggregate of over $1,100,000. Such increasing expenditures during the depression years surely indicates a determination on the part of the public and the profession that there shall be no falling off in the standards of medical education or the quality of medical service. The policy of the council during this survey was different from what it was in 1905–10 for the reason that the whole picture of medical education is radically different from what it was at that time. Even the weakest of the medical schools at the time of this survey was a stable institution as compared with the numerous proprietary schools and diploma mills in existence at the time that the council was created.

In 1937 the medical schools of Canada were approached regarding the survey of Canadian medical schools made during 1934–36 as to the policy to be adopted in the future—that is, whether the American Medical Association should continue the grading of medical schools in Canada or whether they would prefer that

the medical schools themselves or some other body take over this task. The problem was referred to the Canadian Medical Association which in June 1938 brought in a report to the effect that in the event of the Council on Medical Education and Hospitals of the American Medical Association publishing a list of approved schools, those Canadian schools wishing their inspection and approval could request this inspection. This leaves each school free to deal directly with the council. In May 1939, the council voted that after 1 Jan. 1945 the Canadian medical schools would be included in the council's classification only at their own request.

American medicine is assuming more and more a position of leadership and distinction in the world. A decline in the quality of medical education in many European countries has increased the responsibility of our medical schools to keep medical education abreast of the rapid advances in the knowledge applicable to medicine. It is important to realize that the survey above discussed is part of a continuous process. The relationships of the Council on Medical Education and Hospitals to the medical schools and hospitals are on a day to day basis. The accrediting activities of the council, which were the first in professional education and which have been supported from the beginning by the medical profession, make it possible to keep not only the personnel of the medical schools and hospitals but also the general medical profession in touch with developments in medical education. The physician realizes, as no one else can, the disasters, personal or communal, that flow from ignorance and improper or incomplete preparation, and these can be prevented only by insistence upon high standards of medical education. There are now sufficient medical schools for the instruction of physicians to meet the needs, so far as can be ascertained, of the public. It is true that a number of students every year fail to obtain admission to existing institutions, but these are for the most part border-line students and those least likely to render useful service in the practice of medicine. Widespread publicity and generally diffused knowledge of the council's activities have had a most salutary influence on the selection by men and women of medical schools qualified to prepare them for the ever increasing complexity of the actual requirements for the care of the sick and the prevention of disease.

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MEDICAL FIELD SERVICE. See AMBULANCE COMPANIES; HOSPITALS, MILITARY; MEDICAL ORGANIZATION IN THE UNITED STATES ARMY.

MEDICAL JOURNALISM. One of the earliest newspapers on record, the *Gazette de France,* was issued by a physician, Renaudot (Paris 1631). He established the *Gazette* to bring employers and employees together. It was a quarto sheet, printed in four columns on one side. Medical matters were not treated directly in the *Gazette,* but its purpose was the prevention of disease and suffering by lessening poverty. With the origin of scientific societies in Italy at the time of the Renaissance, these published journals which sometimes contained articles of medical interest. The first journal paying considerable attention to medicine was *Le Journal des Scavans.* This was published every Monday for three months at Paris, at the beginning of 1665, the next year it continued longer, and then every two weeks rather regularly. It lasted some 10 years, and altogether some 700 pages were printed. Early issues, contained reviews of Willis' 'Cerebri Anatome,' and Steno's 'De Musculis et Glandulis,' and other medical reviews of current interest. The German Society of Naturalist Physicians (Gesellschaft Naturforschender Aerzte), founded in 1652, began to publish in 1670, after coming under Imperial protection, its 'Transactions' monthly under the name *Ephemeridæ.* A more purely medical periodical was the *Acta Medica Hafiensia,* edited by Thomas Bartholin at Copenhagen in 1671. The Royal Society chartered by Charles II began to publish its well-known philosophical 'Transactions' in 1665. Included among its publications were the works of Malpighi and Leeuwenhoek in the 17th century and those of Galvani in the 18th.

All these were in Latin. The first medical periodical in the vernacular was the *Nouvelles Découvertes sur toutes les Parties de la Médecine,* issued monthly (Paris 1679–81). It was published by Nicholas de Blagny, a somewhat irregular medical practitioner of the time who realized the value of publicity. He met with decided opposition from the medical profession, who deprecated not only his methods but above all the publication of medical matters in the language of the people. He waked the French medical profession, however, to the value of a medical publication and not long after, a *Journal de Médecine* was published by the Abbé de la Roque and continued by Claude Brunet, who established a monthly, *Progrès de la Médecine* (1695–1709). French medical journalism then went to sleep, to use the expressive phrase of Südhoff, for some 50 years. Formal German medical journalism began with the *Acta Medicorum Berolinensium,* founded in 1717. This appeared twice a year at first, and then annually until 1730. In 1717, there began at Leipzig a quarterly publication called the *Collection of Natural History and Medical Information.* This continued for many years. The second half of the 18th century saw a thorough waking up to the advantage of medical journalism. At Hamburg in 1759 the weekly, *Der Artz,* began. In various German cities, a series of medical Bibliotheks, that is, regularly issued reviews of medical books, made their appearance. In 1767, the German medical journal, *Neue Arzneien* (New Remedies) was founded. Most of these journals lasted only a few years until their founder became occupied with other things or his enthusiasm evaporated.

Eighteenth century medical journalism or its equivalent, at the time, consisted to a great extent of the transactions of various medical societies. A number of very important contributions to medicine were published originally in these and they have a distinct bibliographic value. Südhoff suggests that the material for the cultural history of medicine in this century lies buried in the files of its forgotten medical periodicals. These were very numerous and Garrison has given a check list in chronological order of some hundred of them.

Toward the end of the 18th century, the special journals of the scientific departments of medicine began to make their appearance. Probably the most important of these was

Reil's *Archiv für die Physiologie* (1795), which was the incentive for the foundation of Johannes Müller's *Archiv für Anatomie, Physiologie und wissenschaftliche médicin* (Berlin and Leipzig, 1834–57), continued by Reichert and Du Bois Reymond and still published at the present time. Siebold's *Lucina* (Leipzig 1802–11), Langenbeck's *Bibliothek für die Chirurgie* (Göttingen 1805–13), Grafe's and Walther's *Journal der Chirurgie und Augen-Heilkunde* (Berlin 1820–50), Magendie's *Journal de physiologie expérimentale* (Paris 1821–31), Malgaigne's *Journal de Chirurgie* (Paris 1843–46), *Bulletin de la Société anatomique de Paris* (founded in 1826 and still current), and the *Mémoires* and *Bulletin de l'Académie de medecine* are typical examples.

About the middle of the 19th century, yearbooks began to be regularly published. About the same time Virchow's *Archiv für Pathologische Anatomie* and the *Comptes rendus* of the *Société de Biologie* of Paris began publication. There are now literally hundreds of such journals published in the various countries and languages. The tendency to extreme specialization in medical journalism became marked in the last quarter of the century when special journals for narrow interests were published. *Mind* (1876), *Brain* (1879), and *La Cellule* (1884), are typical examples. Garrison notes that the contribution of the 20th century to medical journalism is the large number of recent periodicals devoted to the psychological and sociological aspects of the sexual instinct.

In Italy medical journalism developed rather slowly, Italian professors being inclined rather to write books than the shorter articles. Certain special subjects like electrotherapeutics, because of Galvani's and Volta's discoveries, were covered early. *Il Galvani*, with the subtitle *Giornale di Elettro-Idro-ed Aero-Terapia*, was published at Milan at the beginning of the 19th century. All medical therapeutics was reduced to electrical terms by it. Since then the Italians have the habit of calling their medical journals after their great physicians, and have had journals named for Cesalpino, Malpighi, Spallanzani and a number of other distinguished medical discoverers.

A very early attempt at the publication of a medical journal in America was made through a translation of the French *Journal of the Military Hospitals*, under the title of *A Journal of the Practice of Medicine, Surgery and Pharmacy in the Military Hospitals of France* (Vol. I, No. 1, New York 1790). This contained some 120 pages but is the only number that has come down to us.

The first medical journal published in America was the *Medical Repository*, a quarterly, under the editorship of Samuel L. Mitchill, Edward Miller and Elihu Smith. It was founded in 1797, and the interest which it aroused can be best appreciated from the fact that of volumes I and II, a second edition was printed in 1800 and exhausted, and a third edition issued in 1804. This is the only time in the history of American medical journalism that this has happened. The *Medical Repository* continued publication until 1824. Its success led after a few years to the almost simultaneous foundation at Philadelphia of two medical journals, *The Medical Museum* (1804–11) and the *Philadelphia Medical and Physical Journal* (1804–07). Though neither of these lasted long, the establishment of other medical journals went apace. In Boston, the *Medical and Agricultural Register* was published for two years (1806–07), the *Baltimore Medical and Physical Recorder* for a similar period (1808–09). An effort was made to attract additional readers in these journals by including subjects of cognate interest. This was also the case with regard to the *American Medical and Philosophical Register* (New York), which lasted, however, only some five years (1810–14). *The New England Journal of Medicine and Surgery* had a happier fate, enduring some 15 years (Boston 1812–28). Philadelphia had by this time, owing to professional jealousies and politics and the mismanagement of medical schools in New York, come to be the centre of medical education in the United States and the medical journalism of the country focussed there. The *American Medical Recorder* (1813) lasted more than 10 years and was followed by the *Philadelphia Journal of the Medical and Physical Sciences*, founded in 1820 by Nathaniel Chapman. In 1825, the title of this journal became the *American Journal of the Medical Sciences*, still with us. Under the editorship of Dr. Isaac Hays and his son, this came to be the representative American medical journal long known as *Hays' Journal*. The oldest American medical weekly in existence is the *Boston Medical and Surgical Journal*, founded in 1828, whose editors have been some of the most distinguished physicians of Boston. The *Medical News*, founded in Philadelphia by the younger Dr. Hays in 1843, was transferred to New York (1896) and combined with the *New York Medical Journal* (1905). This latter was founded in 1865, followed almost immediately by the *Medical Record* (1866), both still in existence.

The first medical journal issued west of the Alleghanies was the quarterly *Reporter of Medicine, Surgery and Natural Sciences*, issued at Cincinnati, 1822. The first Canadian medical periodical was the *Journal de Médecine de Quebec*, issued in 1826.

The founder of medical journalism in its modern sense, as not only a carrier of news and information for physicians but also as a force for the uplift of the profession, the regulation of the practice of medicine, the direction of medical legislation, and the exposure of abuses, was Thomas Wakley, an Englishman, who in 1823 founded *The Lancet* in London. When this appeared there were a great many abuses, especially in hospital practice and medical education needing correction. Hospital posts and even sometimes medical professorships had become family matters, subjects of inheritance. Hospital instruction was so given that it reached but a very limited number. Wakley began by publishing the hospital lectures of professors for the benefit of the profession. When Abernethy, the distinguished London surgeon of the time, applied for an injunction against the publication of his lectures without his permission, Lord Eldon decided that lectures delivered in hospitals were public property. The trial proved a good advertisement for Wakley and his work, and after a time he was elected to Parliament and he became the most important factor in England for the correction of social abuses by legislation. *The*

Lancet has always continued the work of its founder in this regard, and has been noted for its crusades against food and drug adulterations, its campaigns for the correction of medical abuses, and its leadership of the medical profession of England generally for the amelioration of medical social conditions. The work of *The Lancet* was not only supplemented but extended in England, when the *British Medical Journal,* representing the British Medical Association, was founded in 1857. The association, organized in 1832, published yearly 'Transactions' until 1853, and then the *Association Medical Journal,* which was succeeded by the *British Medical Journal* after some five years. The *British Medical Journal* has come to be a most powerful factor for the correction of medical abuses and the exposition of impositions of various kinds upon the profession as well as the public. The American Medical Association, founded in 1847, did not establish its journal until 1883. This was scarcely more than a weekly 'Transactions' until under the management of Dr. George Simmons, at the beginning of the present century, it began to be thoroughly representative of the best interests of the medical profession in America and of the genuine medical interests of the public, taking its place worthily beside the *British Medical Journal.* The *Journal A. M. A.* initiated the reform of medical education by securing four-year courses and full-time professorships in the medical schools, and thus has secured a noteworthy reduction in the number of schools of medicine in the country, decidedly to the advantage of medical teaching generally. It was enabled to do this through its reorganization of the American Medical Association which strengthened State and county medical organizations and brought a reform of their medical journals. The advertising abuses of medical journals were emphatically pointed out and an initiation of reform secured. The *Journal A. M. A.* has done extremely valuable work for the medical profession and the public in the exposure of quacks, the regulation of physicians' registration and, above all, the analysis and exposure of so-called patent medicines, many of which selling in very large quantities, at expensive prices and bought particularly by the poor, were shown to contain either such harmful materials as alcohol or cocaine as their chief ingredient, or else to be made up of absolutely inert materials like salt or sugar and water, slightly colored.

The success of the London *Lancet* led to the foundation of the *Lancette Française* in 1828, which followed the plan of reporting hospital lectures and afterward became the *Gazette des Hopitaux,* which still continues. The *Gazette Médicale de Paris* was founded in 1830. Other French journals in large numbers were founded in the second half of the 19th century and the weekly newspapers were supplemented by the *Progrès Médicale,* paying attention particularly to current medical items, Paris, 1873. In the last quarter of the 19th century a whole series of such weekly journals meant to carry medical news and represent the medical profession as well as organize the correction of abuses, were founded in various parts of the world. The *Deutsche Medizin, Wochenschrift* in 1875, *Vrach* in Saint Petersburg in 1880, and Geneva, Munich, Prague, Rome, Vienna and many other cities came to be represented in this way.

At the beginning of the European War, there were some 1,700 medical journals published in the various languages. Their distribution was as follows: the United States had 630; Germany, that is, the German-speaking countries, 451; the French, 268; the British, 152; the Italian, 75; the Spanish, 29. This was entirely too many for the maintenance of such proper standards as would make them seriously valuable and prevent abuses. Many of them were published almost entirely as a means of propagating information for business purposes with regard to various drugs and preparations, the journals being established for this purpose, or the proprietors allowing their columns to be used for such exploitation because of the money paid for advertising. The more medical journals the lower the standards. The war, with its scarcity of paper, etc., brought an end to a great many of the proprietory medical journals and undoubtedly it has done very much to purify the field of medical journalism.

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JAMES J. WALSH, M.D.

MEDICAL JURISPRUDENCE, the science of applying medical knowledge to the purposes of legal investigation; the application of the principles and practice of various branches of medicine in judicial proceedings requiring the explanation of doubtful questions, such as those relating to conception and birth, time and cause of death, physical and mental diseases, etc. Medical jurisprudence is often spoken of as forensic medicine, that is, the medicine of the forum. It embraces subjects both purely medical and purely legal, and covers a very wide range. These questions have usually been considered under five divisions: (1) Such as arise out of the relation of sex, including impotency, pregnancy, legitimacy and rape; (2) injuries to persons, as wounds, death from violence, poisoning and abortion; (3) disqualification by different forms of mental diseases; (4) feigned disability or disease; (5) questions as to age, identity and life insurance. The major part of what is known as medical jurisprudence relates to evidence given in courts, even if the whole subject is not properly embraced within the subject of judicial evidence. As medical books can be used only in a very restricted sense in judicial proceedings, the testimony of medical experts has become very important. Our laws do not give recognized preference to any particular class or school of medical practitioners as qualified for expert witnesses. Knowledge is the test of qualification to give such evidence. The presiding judge passes, as a preliminary, upon the question of qualification and determines whether the witness shall be permitted to testify. The opinion of a medical expert is never conclusive but is simply to be regarded by the judge or jury in the same manner as other evidence given to assist in establishing a fact. The medical expert is fre-

quently called upon to state facts, as well as to give his opinion based upon facts shown by other testimony to exist. He may testify as to the health of a patient whom he had treated, of his habits and mental traits. He may testify that he found poison in the stomach of a person found dead and give an opinion as to whether the poison caused death. He may give an opinion as to how long a person has been dead, from the condition of the body when found; whether a certain wound would produce death; and his opinion as to the instrument used to inflict the wound.

In all of these subjects of investigation the evidence of a medical expert is almost indispensable. In matters of life insurance, where the insured dies shortly after a policy has been issued to him, medical expert examination and evidence are often of great importance, bearing upon the condition of the insured at the time of insurance and upon the question of representations. In suits for injuries to persons through the fault of others the question of the extent and probable continuance of disability are to be investigated with the aid of expert evidence. Many questions of supposed crime could not be properly determined without the knowledge and skill of the physician, applied as science directs. In cases involving sanity and mental capacity medical jurisprudence reaches the zenith of its importance. The untrained non-scientific mind cannot measure the status and capacity of other minds. If it is difficult, sometimes nearly impossible, for the best informed to determine accurately the physical condition of a person, none but those eminent for knowledge of and experience in matters of the mind ought to judge of its condition and hazard opinions as to its peculiarities and capacity. Insanity is a disease of the mind which assumes many forms —almost as many as there are different phases in the human mind. Many definitions are given of insanity, one of which is that it is a physical disease located in the brain, which deranges the mental and moral faculties to a greater or less degree. This definition is not quoted in preference to any other for the purpose of approval, but because it differs so radically from others, and to show the difficulty of comprehending the nature of this dread malady. The general term insanity comprehends all shades of mental diseases, from the slightest abnormal condition to that of the wildest maniac. The expert alienist is called upon to testify as to a person's ability to make a will, a contract or to transact any kind of business. He is asked to decide whether a person is bereft of his normal reason to the extent that prudence requires his confinement; and when he has been confined, whether it would be safe or prudent to let him have his liberty. The questions upon which the expert's opinion with regard to the insane, or those supposed to be insane, are asked, can hardly be enumerated. The importance of the subject cannot be overestimated, and new and earnest efforts are being constantly exerted by the medical profession to render its information upon this difficult subject as full and complete as possible. Many works upon medical jurisprudence have been published and in all of them insanity, in its various forms, has had a prominent place, while quite a number of authors have produced commendable works devoted entirely to the subject of the medical jurisprudence of insanity. Consult Scheffel, Carl, *Medical Jurisprudence* (Philadelphia 1931); and Smith, S. A., *Forensic Medicine* (8th ed., London 1943).

MEDICAL ORGANIZATION, United States Army. The separation of the War Department into a Department of the Army and a Department of the Air Force by the National Security Act of 1947 required certain changes in medical organization which were not immediately worked out. While the historical part of the present article will deal with the medical organization of the War Department, the statement of present medical organization and functions will deal, except in a few instances, with those of the Department of the Army.

History.—The history of the United States Army Medical Department began in the Colony of Massachusetts Bay on May 8, 1775, when the Provincial Congress ordered that a committee of physicians, appointed by the Congress, examine as to professional qualifications all persons recommended for appointment as surgeons to the several regiments by their commanding officers. Prior to this date, medical aid had been voluntarily rendered by private physicians, who later sent in bills for services rendered. These physicians had no military status or authority. At this time the inchoate medical establishment of the army was termed "The Hospital." On July 19, 1775, the Colonial Congress in Philadelphia appointed a committee to consider ways and means of establishing the hospital, a project strongly recommended by Gen. George Washington. The Colonial Congress, on July 27, 1775, created "An Hospital," with Dr. Benjamin Church (q.v.) as director general and chief physician, at four dollars per diem. Three months later Church was tried by a council of war for treasonable correspondence with the enemy, and imprisoned. Dr. John Morgan (q.v.) was appointed to succeed him. Morgan, who had been instrumental in organizing the medical department of the University of Pennsylvania (1765), rendered most valuable services up to his dismissal from the army, Jan. 9, 1777. On April 11, Dr. William Shippen (q.v.) was appointed to succeed Morgan, who later (1779) received a handsome exoneration at the hands of Congress. Morgan's dismissal was due, in part, to the increasing sickness among the troops and to the difficulty in supplying them with medical supplies, but principally to the fact that the medical service was very loosely organized. As there was no strong central government and no War Department, it necessarily followed that there could not be an organized medical service under central direction. At this time the Prussian and British plan of medical administration was in vogue, with physicians, surgeons, and deputy directors general, and a fourth staff officer dubbed "Physician and Surgeon General of the Army" in each of the Middle, Eastern, and Northern departments. These four "generals" were of vague status and their office was apparently established at the same time as that of the director of "The Hospital." All this led to further contretemps, such as the court-martial and acquittal of Shippen (1780). The congressional resolution of Sept. 30, 1780 resulted in the election of Shippen as director general and the appointment of John Cochran as chief physician and surgeon. By the end of the war, con-

gressional acts assigned a director and deputy director of the Hospital Department. General Washington manifested the keenest interest in the welfare of the medical establishment, as evidenced particularly in his instructions to Morgan for the removal of the hospital to New York (April 3, 1776), his letters to John Hancock on the doubtful and jealous character of the regimental surgeons and their intrigues against the hospital (1776–1777), and his letter of approval of Shippen's and Cochran's plan for reorganization (Feb. 14, 1777). The first hospital regulations, drafted by Morgan after conference with Washington and the regimental surgeons, were published in July 1776. The first army regulations, drafted by Friedrich Wilhelm von Steuben (q.v.) in the winter of 1778–1779, contained a section on "treatment of the sick."

While the results achieved by the medical service during the Revolutionary War seem open to criticism, it must be remembered that the high mortality among the troops enrolled, not dissimilar to that of other armies of that time, was due chiefly to respiratory and gastrointestinal diseases in epidemic forms, and to septic conditions following battle wounds. As might be expected, regimental hospitals were collections of sick men huddled together without organization, regulation, sufficient clothing, or rudimentary comforts. Many fatal infections at that time were caused by the common practice of variolating with human unattenuated smallpox virus through purchase of scabs in the open market. This practice, although forbidden by Gen. Horatio Gates, continued until swept away by Jennerian vaccination in 1796–1798. The earliest examples of the Medical Department's contribution to medicine are found, however, during this period, in the publication of the first American pharmacopeia in 1778 and the publication of a treatise on wounds and fractures in 1776 by Dr. John Jones (q.v.). The latter was not only the first American book on surgery but also, by reason of the appendix on camp and military hospitals, the first American book on military medicine. During the Revolutionary War, 1,400 medical men of the colonies volunteered their services. Many of them achieved eminence, not only in the field of medicine but also in actual command of troops, and in the legislative halls of Congress.

Following Yorktown (Oct. 19, 1781), Congress rapidly demobilized the army in 1782–1783 and the Hospital Department was all but disbanded. In 1792 the army was reorganized as a "legion" (5,120 men), with Richard Allison as surgeon of the legion (1792–1796). In 1798, war being imminent with France, Congress authorized an army of 10,000, with James Craik (q.v.) as physician general (1798–1800). In 1800, when war did not eventuate, these forces were disbanded. The strength of the army at the outbreak of the War of 1812 was 6,742. The Medical Department was reorganized, but without a strong, centralized head. It encountered the same difficulties as were encountered in the revolution. Mortality, morbidity, and noneffectiveness due to communicable diseases constituted a far greater drain upon manpower than battle casualties. Military authorities now agree that the ravages of smallpox and other communicable diseases were the chief causes of the failure of various campaigns in the war.

In 1813, James Tilton was appointed physician and surgeon general. In 1814 regulations of the Medical Department were issued, defining for the first time the duties of a medical officer. Tilton initiated a fundamental policy when he abolished the distinction between a physician and a surgeon. Medical officers of the army since that time have been known as surgeons, but the duties required of them are in nowise limited to surgery as a specialty in the field of medical practice.

After the War of 1812, the army was again disbanded, the physician and surgeon general was discharged, (1815), and there was no Medical Department until 1818 when Joseph Lovell was appointed surgeon general. From the time of his appointment to the present, the history of the department is unbroken; it has always had a surgeon general, always remained a corps organization.

Lovell effected a central organization, required allegiance on the part of post, departmental, and territorial surgeons, revised the regulations for the administration of the Medical Department, and made the first annual report of the department to the secretary of war. He also initiated at all military stations a system of observations and reports of weather by the medical officers stationed there. This constituted the only weather service of the country for many years. During his incumbency (1818–1836) the practice of requiring professional examinations of candidates for the Medical Corps, continued since 1775, was regularized by an act of Congress, and medical officers were given the pay and relative rank of other officers of the army. Serving under Lovell, Assistant Surgeon William Beaumont (q.v.), in 1833, published his work on digestion which won him recognition as the pioneer physiologist of the United States. In 1836, Surgeon General Lovell established the library of the Surgeon General's Office.

Although the Medical Department made few notable scientific contributions to medicine from Beaumont's day to the Civil War, important administrative developments occurred during that period. Among the most important were the granting of definite rank to medical officers in February 1847; an increase in the Medical Department in 1848 to service the many new garrisons in the new territory acquired during the Mexican War; the bestowal upon medical officers of the right of command in their own department, with special reference to patients in hospitals; the appointment of hospital stewards in 1856; the publication of *Medical Statistics, U. S. Army*, the first part in 1857, the second in 1859; the detail of the first delegate of the Medical Department to the American Medical Association in 1851, and the adoption of the use of ambulances in 1859. Otherwise, the Medical Department went along doing its duty in garrison and field, in peace and war. It fought scurvy, malaria, typhoid, dysentery, diarrhea, as well as Indians, Mexicans, and official neglect.

The Civil War found the government and the Medical Department unprepared. There was no organized ambulance or field hospital service, and no organization for evacuation to the rear, where hospital service was hastily improvised in hotels, barns, and neighboring private houses. The introduction of rifled arms, with fixed ammunition and conoidal bullets, had vastly increased the range and rapidity of fire, with much wider danger zones and greater dispersion of the wounded over the field. As the engagements

increased in magnitude, the wounded lay helpless on the battlefield for hours extending to days before the slow work of evacuation was completed. This not only caused immense suffering and losses among the wounded, but also interfered seriously with the mobility of fighting units through delays and stalling of vehicles, sometimes demoralized commands as to fighting capacity, and encouraged skulkers to desert the lines under the pretext of assisting the wounded to the rear. All this was changed by the advent of Jonathan Letterman (1824–1872), who became the medical director of the Army of the Potomac on June 19, 1862, and whose genius for medical administration brought about the epoch-making reforms which became a pattern for all armies, and eventually fixed principles in our own. Letterman organized a system for the evacuation of wounded, which was placed in operation under the chaotic conditions following the seven days of fighting near Harrison's Landing. At Antietam, this system was applied with great success. By this orderly system of field service, with aid stations in close support of battalions and regiments, and an ambulance service and field hospitals in the rear of divisions, 12,000 Union and 2,000 Confederate casualties were transferred to the field hospitals in 24 hours. The Letterman plan constitutes the basis of the plan of evacuation in the United States Army today.

Another extraordinary medical officer whom the Civil War brought forward was Surgeon General William A. Hammond (q.v.). He was the first to hold the rank of brigadier general with its pay and emoluments. Surgeon General Hammond, despite his unfortunate conflict and prolonged controversy with Secretary of War Edwin M. Stanton, was the strong man of the Medical Department in those days of stress. Under his administration the general hospitals were placed under the control of the surgeon general and, in May 1862, the Army Medical Museum was established. Hammond also recommended the foundation of the Army Medical School in 1862, an ideal consummated by George M. Sternberg (q.v.) in 1893; recommended a permanent hospital and ambulance corps for the Medical Department, and independent transportation for the medical service; and succeeded in placing volunteer medical officers under the direction of the surgeon general. Hammond's administration was singularly effective, although marred by his dismissal by general court-martial Aug. 30, 1864. The findings and sentence were annulled, however, and Hammond was made a brigadier general on the retired list in 1878.

Following the Civil War, there was, as in all previous American military history, a general demobilization, followed by a reorganization of the Regular Army. From this time until the outbreak of the Spanish-American War, very little was accomplished in the field of army medical service.

The outstanding events during the period were the establishment, by act of Congress, of the Hospital Corps, composed of men enlisted by the Medical Department for medical service exclusively, and the establishment of the Army Medical School in 1893 for the training of regular medical officers in military medicine and surgery, with particular reference to preventive medicine. George M. Sternberg, who was surgeon general from 1893 to 1902, was the American pioneer in bacteriology and a lifelong worker in public health. He discovered the pneumococcus bacterium independently of, and almost simultaneously with, Louis Pasteur. Sternbergs' *Manual of Bacteriology,* issued in 1893, was a landmark of the science in America. Throughout most of his career, General Sternberg was a student of, and a writer on, yellow fever. It was he who appointed the commission, of which Walter Reed was head, to study yellow fever in Cuba after the Spanish-American War.

In spite of Sternberg's scientific attainments, the Medical Department, like the rest of the country, was totally unprepared for the Spanish-American War. Our military forces, distributed in small commands throughout the United States, had had no military training in large units. The medical service was organized on the post basis, without plans or preparations for expansion of personnel and procurement of supplies. The strength of the army was barely 25,000 and the Medical Corps numbered 192 officers.

During this war Congress made no provision for an increase in the regular Medical Corps, except for 15 assistant surgeons. The war was fought largely by volunteers. The act of April 22, 1898 authorized 8 corps surgeons, 110 division and brigade surgeons, all volunteers, and 650 contract surgeons. The strength of the Hospital Corps was 6,000. Approximately 2,500 medical officers and 22,500 hospital corpsmen were needed. Consequently, the medical service was totally inadequate and the results appalling. This breakdown in medical administration was due in part to the meager equipment and personnel allotted the army on a peace footing and, in part, to the fact that the war was entered upon without previous planning or forethought. The findings of the Dodge Commission (Grenville M. Dodge, q.v.) appointed by President McKinley to investigate the conduct of the war, resulted in certain important changes in the organization of the Medical Department, to which Surgeon General Robert M. O'Reilly (q.v.) devoted his administration (1902–1909). These changes were to prove the main factors of success in our medical arrangements for later wars.

The Dodge Commission, as a result of its investigation, recommended for the Medical Department a larger force of commissioned officers; authority to establish in time of war a volunteer hospital corps; a reserve corps of selected trained female nurses; a year's supply of all medicines, hospital equipment, and stores for an army at least four times the actual strength, to be held constantly on hand in medical supply depots; a better arrangement for the transportation of medical supplies; the simplification of administrative paper work; the creation of a fund for the purchase of special diets for the sick; and more adequate accommodations for the transportation of convalescent soldiers. Practically all of these recommendations were carried out during the administration of Surgeon General O'Reilly.

The military forces in Cuba, Puerto Rico, and the Philippines accomplished what they set out to do in good time and without difficulty; but the severe incidence of malarial and yellow fevers among troops in Cuba necessitated withdrawal of the army from the island, once the main object of the expedition had been accomplished. A board, composed of Walter Reed, Victor C. Vaughan (qq.v.) and Edward Shakespeare, made an exhaustive study of the typhoid fever epi-

demic in the military camps and published a very valuable report. The outstanding conclusion reached was that typhoid fever was not necessarily always a waterborne disease, and that its spread during the war was largely through intimate contact. The role of typhoid carriers was not then understood.

The appalling typhoid incidence during the Spanish-American War was the motivating influence in the Medical Department's intensive and successful search for a protective vaccination against this scourge. By 1908 the results of experimentation in the British Army in India were sufficiently promising to justify Surgeon General O'Reilly's sending Maj. Frederick Fuller Russell to England and Germany to investigate the subject. On his return Russell submitted a report on the epidemiology and control of the disease. A board of eminent members of the newly constituted Medical Reserve Corps convened to consider the subject; it recommended the use of typhoid vaccine in the army. This report was approved by the War Department and voluntary antityphoid vaccination was commenced in the military establishment in 1909. Such vaccination has been compulsory in the military service since 1911.

Environmental sanitary measures have undoubtedly had their effects in lowering the incidence of typhoid fever, yet the remarkable decrease in the admission rate of this disease from 3.53 per thousand per annum in 1908 to 0.78 per thousand in 1911 and 0.03 per thousand in 1939 is significant of the success of typhoid vaccination in the United States Army. During World War I the admission rate was 0.37 per thousand as against 141 per thousand in the Spanish-American War.

The Philippine expedition dispatched soon after the Battle of Manila Bay was a force composed of regulars and volunteers. The medical service was a regenerated organization composed of an administrative overhead of regular medical officers, volunteer surgeons, and contract surgeons. This force encountered all of the usual tropical diseases in the Philippine Islands, which caused high morbidity and mortality. Chief among these were malarial fevers, dysentery, and sprue. So excellent had been the results of vaccination on the population of Puerto Rico in 1898 that it was duplicated in the Philippines, where smallpox had ravaged the islands for centuries. There also the application of the principles of preventive medicine and practical sanitation resulted in markedly lessening the admission rate for these infectious diseases.

Important research work performed by the Medical Department of the army resulted in the demonstration by Maj. Walter Reed and his three associates, James Carroll, (q.v.), Jesse Lazear and Aristides Agramonte (q.v.), of the transmission of yellow fever by the mosquito. By a most careful and scientific investigation they positively demonstrated that yellow fever was transmitted by the bite of *Aëdes aegypti*. The revolutionary findings were put into such practical application by Gen. Leonard Wood and William C. Gorgas (qq.v.), later surgeon general, that yellow fever does not now exist in United States territory. Undoubtedly Reed's discovery and Gorgas' application of its principles in a practical way enabled the United States to build and maintain the Panama Canal, and the effects upon commerce, trade, and industry in southern United States and Central and South America have been of inestimable value from an economic as well as a humanitarian standpoint.

Two important congressional enactments affected the organization of the Medical Department between the Spanish-American War and World War I. The act of Feb. 2, 1901 radically reorganized the military system. The Medical Corps was increased and the Army Nurse Corps was established. The act of April 23, 1908 created the Medical Reserve Corps, which was the first reserve of officers, with the exception of the National Guard, that this country had ever had during its previous military history of 125 years. This was one of the most advanced steps taken in military preparedness in the history of the Medical Department. Not until eight years later did the National Defense Act of 1916 establish the Officers' Reserve Corps for each of the arms and other services. During the same period, two new corps were established as commissioned components of the Medical Department—the Dental Corps in 1911, and the Veterinary Corps in 1916.

In 1916 and 1917, during the punitive expedition into Mexico, motor ambulances were given their first trial in the military operations of the United States Army.

At the beginning of World War I, the Medical Department was better prepared than it had been for earlier wars. Its numerical expansion kept pace with the rest of the army, and its operations during World War I dwarfed all prior accomplishments, although they were, in turn, exceeded by those of World War II. The following table illustrates the expansion of the department during the two wars:

PERSONNEL

	World War I			World War II
	Apr. 6, 1917	Nov. 15, 1918	June 20, 1940	Aug. 31, 1945
Medical Corps	833	30,591	1,230	45,300
Dental Corps	86	4,620	267	14,000
Veterinary Corps	62	2,002	126	2,070
Sanitary Corps	0	2,919	0	2,500
Medical Administrative Corps	0	0	72	19,900
Army Nurse Corps	403	21,480	949	56,000
Pharmacy Corps	0	0	0	68
Medical Department Dietitians	0	0	0	1,575
Physical Therapists	0	0	0	1,300
Enlisted Men	6,619	281,641	13,628	493,000

During World War I, many problems theretofore relatively unimportant or unknown were presented. Wounds by high explosives caused a predominence of fracture requiring frontline immobilization prior to evacuations. Lacerated wounds required débridement and open antiseptic treatment with secondary closure, particularly to avoid ordinary wound infection and gas bacillus (Welch) infection. The necessity for early operation in gunshot wounds forced the establishment of surgical and evacuation hospitals as near the front as the military situation would permit. The system of evacuation was expanded for practical use in large-scale operations. The use of airplanes made new demands on personnel operating them and resulted in a new specialty—aviation medicine.

Between the two world wars, major developments in the organization and structure of the Medical Department resulted from the National Defense Act of June 4, 1920. The number of enlisted men was established at 5 per cent—raised in 1940 to 7 per cent—of the total actual

strength of the army. The proportionate basis which this act established for determining the number of officers in the Medical Department was replaced, in 1939, by allotments for each corps. One new corps, the Sanitary Corps, was established during World War I. The act of 1920 established still another corps, the Medical Administrative Corps. In addition it gave the Dental Corps the same grades and system of promotion as the Medical Corps, and reorganized the Veterinary Corps. The latter did not achieve a system of promotion parallel to that of the Medical and Dental corps until 1935. Members of the Army Nurse Corps gained relative rank in 1920. This accorded them equal rights and privileges with officers, but not equal pay or command functions.

As a result of World War I success in training officers in schools and camps for field service, the department established the Medical Field Service School in 1920. To continue the training of flight surgeons and research in aviation medicine, initiated during the war, the School of Aviation Medicine was established in 1919. At about the same time, two professional service schools in addition to the Army Medical School, were established—the Army Veterinary School in 1920, and the Army Dental School in 1922. These three schools, known collectively as the Medical Department Professional Service Schools, were redesignated the Army Medical Department Research and Graduate School in 1946.

During World War II, the Medical Department profited from its experiences of the previous war. Its problems and operations, however, were of far greater magnitude. The dispersion of military forces throughout the world in all kinds of environment intensified the problems of preventive medicine and multiplied the difficulties of supply and evacuation. New types of military operations—amphibious landings, large-scale strategic and tactical bombing, and highly mobile land warfare—presented new problems of medical support. The medical demands of a military force twice the size of that in World War I taxed the capacity of the country to supply enough physicians for both military and civilian needs. The department's success in achieving its mission in this global war is indicated by a comparison of the mortality rates of the army with those for World War I. In the earlier war, deaths from disease were 16.5 per 1,000 troops per annum; in World War II, the rate was 0.6. The respective death rates among battle casualties reaching medical facilities were 8 and 4 per cent.

World War II caused important administrative developments in the Medical Department. Advances in medicine and the increasing specialization which occurred between the two wars resulted in a trend, during World War II, toward separation of administrative from advisory and professional functions and in the extension of the consultant system, begun during World War I. Experts in particular fields of medicine and surgery, appointed as consultants, exerted a potent influence in the determination of policies pertaining to the prevention and treatment of disease. Civilian consultants, placed on a permanent basis in April 1946, gave the Medical Department during the war the benefit of the knowledge of experts in the fields of gastroenterology, cardiovascular diseases, dermatology, infectious diseases, chemotherapy, allergy, tropical diseases, and tuberculosis. Military consultants, through close supervision of the classification, assignment, and professional work of specialists, contributed to the effective utilization of these scarce types of personnel. A further contribution toward that end was the specialization of general hospitals, a procedure first used during World War I, in neuropsychiatry, general surgery, arthritis, neurology and neurosurgery, neurosyphilis, tropical diseases, trench foot, thoracic surgery, amputations, plastic and ophthalmologic surgery, vascular surgery, deep X-ray therapy, radium therapy, blindness, and deafness.

To relieve medical and dental officers from administrative and certain professional duties, the Medical Administrative and Sanitary corps were expanded and three new commissioned components were established—the Pharmacy Corps, Medical Department Dietitians, and Physical Therapists. In June 1944, an act of Congress gave all female officers of the department full commissioned status in the wartime Army of the United States. After the war, a Medical Service Corps replaced the Sanitary, Medical Administrative and Pharmacy corps, and, in April 1947, a Women's Medical Specialists Corps, composed of dietitians, physical therapists, and occupational therapists, was established in the Regular Army. The Army Nurse Corps achieved Regular Army status at the same time.

Problems in furnishing medical supplies and equipment to armed forces throughout the world led to an army-navy study in the autumn of 1944 of the possibilities of joint procurement. As a result, the Army-Navy Medical Procurement Office was established in December 1945.

The increasing importance of the functions of the Army Medical Museum as a reviewing and diagnostic center for the laboratories of the Medical Department resulted in the surgeon general's approval in November 1943 of a new designation for the establishment—The Army Institute of Pathology. The institute served as headquarters for mobile units of artists and photographers, sent into all theaters of operation to provide the Medical Department with photographs and motion pictures of nearly every phase of medical activity in combat areas.

Important advances in the Medical Department's professional functions and in its field service occurred during the war. One of the chief advances in surgical treatment was the concept of wound management which involved the "phasing" of surgical treatment. In the first phase, initial wound surgery was performed in mobile hospitals near the front lines, often within artillery range of the enemy. To bring surgical skill forward to the casaulty, the Medical Department increased the mobility of its field units and organized highly specialized teams to be shifted as the needs of the combat zone demanded. The second phase of surgical treatment, more definitive and reparative wound surgery, occurred at general hospitals in the communications zone; the third, corrective and rehabilitative surgery, at general hospitals in the United States. Of equal importance with front line surgery as a lifesaving measure were air evacuation, which played an increasingly important part as the war continued, and the use of blood plasma, whole blood, sulfonamides and penicillin in theaters of operation as well as in the zone of interior. Medical Department studies and field

trials which confirmed the effectiveness and extended the range of usefulness of penicillin bridged the gap between experimentation and practical application with unprecedented speed.

The Medical Department's success in preventing and treating diseases equaled that of saving casualties. The sulfonamides and penicillin proved effective in the prevention of meningococcal infections and complications of upper respiratory infections, and in the treatment of bacillary dysentery, gonorrhea, syphilis, and diseases caused by staphylococci, streptococci and pneumococci. The extension of established policies of immunization and sanitary discipline decreased the incidence of typhoid and paratyphoid fevers in World War II to about one seventh that of World War I. Only thirteen cases of cholera and only twelve of tetanus occurred in the entire army despite the fact that the former was epidemic or semiepidemic in a number of areas where troops were stationed, and that much of the fighting was over terrain heavily infested with the spores of tetanus. The most significant development in the control of insect-borne diseases was the adoption of DDT. It proved singularly effective in the control of a serious epidemic of typhus in Naples during 1943 and 1944 and played an important part in controlling malaria, the disease of greatest strategic importance in World War II.

Consonant with the army's mission of conserving manpower, emphasis in the care of neuropsychiatric casualties was shifted from "diagnosis and disposal" to prevention and treatment of psychiatric disorders. The effective use of a well-balanced program of physical, educational, and occupational reconditioning in the treatment of neuropsychiatric cases, and in hastening the convalescence of other patients led to the establishment in November 1946 of a physical medicine service, designed to coordinate and integrate the use of physical reconditioning, occupational therapy, and physical therapy in a well-rounded therapeutic program under professional supervision.

Since V-J Day the Medical Department has declined greatly in numbers—to 52,350 officers and enlisted personnel (October 1947). Its responsibilities are still global, however, reaching wherever American forces are stationed. The increasing importance of the Army Air Forces, reflected during the war in the growth of a semiautonomous air forces medical service, has resulted in the separation of the air forces from the army. Important organizational and operational problems in the medical services of the two forces are now in the process of solution.

Functions.—The Medical Department is a noncombatant branch of the army. Its personnel, equipment, and supplies, except those of the Veterinary Corps, are protected by the provisions of the Geneva Convention. Nevertheless, it deals with the whole combat force, and, in every tactical operation in time of war, it executes a major withdrawal in the evacuation and hospitalization of casualties. The fact that withdrawal of noneffectives must be made against the forward flow of troops and supplies, yet with the least possible interference with this flow, adds to the difficulty of the task. Casualties to be evacuated are gathered individually from all units of the field force and are neither organized nor self-supporting. Evacuation to the rear must be carried out as a piecemeal process by the successive medical echelons of higher units. Types of transportation range from the hand litter to the hospital train and airplane ambulance, and medical installations are usually located at points where the transition from one kind of transport to another occurs.

Major duties and responsibilities with which the Medical Department is now charged are as follows:

(1) The conduct of physical examinations for those entering the army.

(2) The preservation of health and the prevention of disease among the personnel subject to or assigned to army control, including the inhabitants of occupied territory.

(3) The provision of medical, surgical, and dental care, including the maintenance of prescribed medical establishments and units, for sick and wounded personnel, and the methodical disposition, including transportation, of such personnel, with prompt restoration to duty of those rendered capable and removal of those incapacitated.

(4) Proper selection, classification, and training of Medical Department personnel.

(5) The operation of a veterinary service, including both the conservation of health of public animals, and the inspection of meat and dairy food products.

(6) The procurement, storage, issue, and maintenance of medical supplies and equipment.

(7) The research and experimentation connected with the development and improvement of Medical Department materiel, equipment, and supplies.

(8) The preparation and disposition of records and reports.

In the coordination of its policies on an army-wide basis the Medical Department works closely with other branches of the Department of the Army; with the Quartermaster Corps in the development of army rations; with the Corps of Engineers in the construction of hospitals; and with the Chemical Corps in research on the medical aspects of chemical warfare. Long-existing relations with the Bureau of Medicine and Surgery of the navy have been strengthened by the inclusion of the departments of the Army and the Navy in one military establishment.

In areas in which the status of health of army personnel impinges upon general public health, as in the prevention and cure of the venereal diseases, and in measures taken to prevent the entry into the United States of communicable diseases from abroad, the Army Medical Department cooperates with the Public Health Service and with local health authorities. It receives the aid, intensified during war, of a variety of quasi-governmental and private agencies, especially in the field of medical research (see section on *Research and Development*). The National Red Cross which aided with the provision of certain medical supplies, notably whole blood, and with the recruitment of army nurses in World War II, furnishes recreational and social workers at army hospitals.

Organization.—The Medical Department of the army is now under the jurisdiction of the Department of the Army within the National Military Establishment, following the National Security Act of July 26, 1947, which united the army, navy, and air forces in a single organization. The Medical Department consists of a surgeon general, four assistants, the Medical Corps, the Dental Corps, the Army Nurse Corps, the Veterinary Corps, the Women's Medical Specialist Corps, the Medical Service Corps, Medical Department enlisted personnel, and a small number of contract surgeons. Contract surgeons are civilian physicians appointed by the surgeon general to meet emergency professional needs in situations where it is impracticable to maintain a medical officer.

Under the National Defense Act, as amended

by the Officer Personnel Act of 1947, the surgeon general and one of his assistants, who must be an officer in the Dental Corps, have the rank of major general, while the three other assistants have the rank of major general or brigadier general, as determined by the secretary of the army. The surgeon general and assistants are appointed by the president for four-year periods. They must be of the grade of lieutenant colonel or higher and must be recommended for the office to which they are appointed by a board of officers established for the purpose by the secretary of the army.

The officers of the several corps of the Medical Department and its enlisted members are distributed in all United States Army stations throughout the United States and its overseas possessions and in stations located in areas under United States Army occupation. The sanitary and health supervision at each station falls under the jurisdiction of the station surgeon, an officer of the Medical Corps, who is responsible to the station commander for all matters affecting the health of the command. He has charge of the conduct of sanitary inspections; the station veterinary activities, including the meat and milk inspections made by his veterinary assistant; the supervision of the station hospital, or dispensary, with its staff of medical and dental officers, and often nurses; the training of the Medical Department enlisted men; and, in stations having tactical organizations, the furnishing of medical personnel and supplies during training excursions in the field. Each army and major tactical force in the field also has its surgeon and medical headquarters, together with attached hospitals and other medical units.

Since most military stations and establishments in the United States fall under the control of the six army commanders of the six areas into which the country is divided, the medical activities of stations in each area come, in an administrative sense, under the Medical Department adviser to the army commander, an officer of the Medical Corps known as the army surgeon. In Panama, Hawaii, and Puerto Rico such medical supervisors are called department surgeons. On his immediate staff each army and department commander has an adviser of the Dental Corps and one of the Veterinary Corps.

Principles and policies governing the operation of the medical service of the army are promulgated by the secretary of the army as compulsory regulations. These policies are established on the advice of the surgeon general, who is a member of the technical and administrative staff of the Department of the Army. The surgeon general is thus able to formulate a uniform policy of medical service, carried into effect as a requirement by all army and department commanders through their Medical Department personnel and other subordinates, in all military stations and establishments both at home and overseas.

The operations of certain medical establishments, however, are under the direct command and administrative supervision of the surgeon general. Such establishments include the Army Medical Center (q.v.) at Washington, D. C., composed of Walter Reed General Hospital, Medical Department Research and Graduate schools, Central Dental Laboratory, Army Prosthetics Research Laboratory, and Veterinary Research Laboratory; Fort Totten Army Medical Center at Fort Totten, New York; Brooke Army Medical Center at Fort Sam Houston, Texas, comprising Brooke General Hospital, the Medical Field Service School, the Fourth Army Area Laboratory, the Surgical Research Unit, and the Central Dental Laboratory; the Army Institute of Pathology in Washington; the Army Medical Library in Washington, together with the Cleveland branch of the library; four medical depots and medical sections of certain general depots; certain specialized laboratories; and the general hospitals. The general hospitals are—in addition to Walter Reed and Brooke—Army and Navy (Hot Springs, Ark.), Fitzsimons (Denver, Colo.), McCormack (Pasadena, Calif.), Murphy (Waltham, Mass.), Oliver (Augusta, Ga.), Percy Jones (Fort Custer, Mich.), Valley Forge (Phoenixville, Pa.), William Beaumont (El Paso, Texas), Letterman (San Francisco, Calif.), Madigan (Tacoma, Wash.), and Tilton (Fort Dix, N. J.). General hospitals provide definitive treatment and prolonged hospitalization. Post, camp, or station hospitals, on the other hand, provide treatment for less serious cases of local origin for limited periods. The latter are under the command which has jurisdiction over the post, camp, or station at which they are located.

These and all other medical establishments having a more or less fixed location in the United States and its possessions, "named" units, are distinguished from the more or less mobile units designed to serve armies in the field. The latter, "numbered" units, have a standardized form of organization and include additional varieties of units appropriate to work in the field. They may be roughly divided into three categories: (1) those whose main function is to provide care and treatment (such as clearing companies and various types of hospitals echeloned farther toward the rear); (2) those whose primary purpose is to provide transportation from the battlefield at successive stages in the chain of evacuation (the medical detachments of regiments, the collecting companies, hospital-train units, ship platoons, etc.); and (3) certain ancillary units not directly concerned with the care or transportation of patients (depot companies and laboratories). As indicated above, the evacuation of sick and wounded takes place through a chain of medical stations which provide progressively more elaborate treatment as the rear areas are reached. The transporting agencies, however, from the litter bearers in the medical detachments at the front through the hospital train and other units farther to the rear, supply emergency treatment while patients are in their hands. A variety of specialized detachments (blood transfusion, auto maintenance, supply, etc.) also exist whose function is to supplement or support certain principal units in the three categories mentioned above.

The Medical Department is continuing the system of affiliated units which made effective contribution to the medical service in World War II. These units are established in civilian medical schools and hospitals. Organized and trained in a reserve status, they consist of personnel assigned to specific duties and accustomed to working together, and are therefore prepared to render efficient service whenever called to active duty.

The Surgeon General's Office.—The central bureau of the Army Medical Department is

the Surgeon General's Office located in Washington, D. C. The surgeon general is not only chief of the Medical Department but also senior medical technical staff officer of the Department of the Army. In the latter capacity he acts as medical adviser to the secretary of the army, the army chief of staff, the army general and special staffs, and other components of the Department of the Army. His command responsibilities include command of such troops and activities as may be assigned to his control by the Department of the Army.

In the absence of the surgeon general, the deputy surgeon general acts in his stead. An executive officer supervises the administrative operations of the Surgeon General's Office. Principal units of the executive office are: the administrative office, which attends to general office needs for supplies and equipment, distribution of all communications, the filing of records, and printing and duplicating services; the legal office, which serves as general counsel; and the editorial branch, which publishes the *Bulletin of the U. S. Army Medical Department*, a monthly periodical designed primarily to keep Medical Department personnel informed on developments in military medicine, including the dental and veterinary fields.

A deputy for plans has responsibility for the preparation of long-range plans and policies designed to solve major Medical Department problems. Technical aspects of plans peculiar to the work of specific divisions of the Surgeon General's Office are handled by these divisions.

The number and character of divisions and their component elements shift from time to time as various phases of the Medical Department's work increase or decline in importance. The field of work of currently operating divisions is described below.

Four divisions are concerned primarily with operations of four of the corps of the Medical Department: the Dental, Veterinary, Nursing, and Medical Service Corps divisions. The last-named division is concerned with the newly established corps of the same name which assumed the functions of the former Medical Administrative, Sanitary, and Pharmacy corps.

Five other divisions reflect the emphasis placed upon the use of civilian consultants in special fields in World War II: the Medical Consultants, Physical Medicine Consultants, Surgical Consultants, Dietetic Consultants, and Neuropsychiatry Consultants divisions. These, composed of specialists, have the responsibility of adapting to army needs the best professional practices in their respective fields.

The preventive medicine division develops and supervises programs for sanitation and prevention of disease for the army and for areas under army control, including a program for the establishment of good health conditions in industrial plants operated by the army. In addition to its analysis of disease incidence data within the army, it analyzes medical, epidemiological, and sanitary data in foreign areas insofar as they affect the army. It also supervises the medical laboratory service of the army.

The personnel division has charge of the staffing of all Medical Department activities with both military and civilian personnel through such procedures as recruitment, classification, assignment, promotion, and separation.

The education and training division plans and supervises programs for training commissioned and enlisted personnel in medicomilitary subjects and devises training aids.

The procurement of medical supplies and equipment is now handled jointly with the navy at the Army-Navy Medical Procurement Office, Brooklyn, N. Y. For the army side of the program the supply division of the Surgeon General's Office determines needs of both the army and of civilians dependent on it in occupied territories, supervises procurement through the Army-Navy Medical Procurement Office, and supervises distribution through the chain of medical supply depots and using agencies.

The hospital division plans and supervises the operations of the program for the evacuation of the sick and wounded and for their hospitalization. It also makes recommendations concerning the construction, lease, and maintenance of army hospitals.

The resources analysis division attempts to match requirements of the Surgeon General's Office as to personnel and facilities with the available resources.

The medical statistics division analyzes statistics pertaining to the health of the army and reports its findings.

The special projects division handles medical problems incident to the development of special weapons.

The fiscal division maintains accounts pertaining to the expenditure of Medical Department funds, makes budget estimates, and prescribes fiscal standards and procedure.

The Medical Research and Development Board (see below) has functions which are sufficiently indicated by its name.

Medical Department Officer Corps.—The Medical Department of the Regular Army comprises six officer corps. There are also now on duty Reserve officers and officers temporarily commissioned in the Army of the United States in each of these corps. The Officer Personnel and the Army-Navy Nurses acts of 1947 established the quotas and the promotion regulations for the Regular Army segments of these corps. Thus the Army Nurse Corps has a Regular Army authorized strength of six per thousand of army strength, and the Women's Medical Specialist Corps a strength of nine tenths per thousand. Individuals may be commissioned in other Regular Army corps in such numbers as the service may require with the general limitation that the total number of Regular Army officers in all branches of the army must not exceed 51,000. The Officer Personnel Act established separate promotion lists for the Regular Army members of the Medical, Dental, Veterinary, and Medical Service corps; their promotion is based on length of time in grade and past performance for all grades above first lieutenant, as in the case of all other Regular Army officers. However, to compensate for the extra years of education required by their profession, officers appointed to these lists after Jan. 1, 1948 receive constructive service credits for promotion purposes. These credits amount to four years for physicians, three for dentists, two for veterinarians, and three for members of the Medical Service Corps possessing a degree of doctor of philosophy or comparable degree recognized by the surgeon general in a science allied to medicine. Officers commissioned in the Regular Army in these corps during 1946 and 1947 received service credits based on age and military

service to assure them proper grade and seniority on their list. Officers receiving Regular Army appointments in the Veterinary, Army Nurse, Medical Service, and Women's Medical Specialist corps are credited with an amount of service equivalent to the period of active commissioned service performed subsequent to Dec. 31, 1947, up to a maximum of five years. All Regular Army officers must take an annual physical examination to qualify for continued service, and all such officers in the Medical, Dental, and Veterinary corps must pass a professional examination as one prerequisite to promotion. In most branches of the Regular Army officers are appointed without reference to the corps in which they serve. In the Medical Department, however, appointment is made to a specific corps. Base pay and allowances of all officers are fixed in the Pay Readjustment Act of 1942, as amended in 1946.

All officers in the Medical Department are classified for service to conform with their training and experience in civilian and military life. Every effort is made to give professional rather than administrative assignments to those desiring and qualified to perform them. Medical and Dental corps officers are encouraged to seek certification by the specialty boards in order to achieve the highest standards of professional competence.

Medical and Dental Corps.—These commissioned components of the Medical Department comprise groups of graduate physicians and dentists. Appointees to these corps must be graduates of a medical or dental school acceptable to the surgeon general and legally authorized to confer the degree of doctor of medicine or doctor of dental surgery, or its equivalent. A candidate for the Medical Corps must also have had an internship acceptable to the surgeon general, or its equivalent in practical or professional experience as determined by the surgeon general. Minimum age for a Regular Army appointment is 21 years, and candidates for grade of first lieutenant may not be over 32 years of age, except by special permission. Above first lieutenant the grade to which a person is appointed is determined by his age and amount of professional practice, including residencies and postgraduate training; no commissions are granted in the Regular Army in grades higher than colonel. By an act of Congress (1947), Regular Army officers of these two corps receive supplemental pay of $100 a month; all other members receive the same amount if they volunteer for a year of active duty.

Veterinary Corps.—Applicants for commission in this corps must have been graduated from a veterinary school acceptable to the surgeon general and legally authorized to confer the degree of doctor of veterinary medicine, or its equivalent. Minimum age for Regular Army appointment is 21 years, and maximum 32; however, the maximum age limitation for any person who served in the armed forces of the United States prior to Sept. 2, 1945 may be waived by the secretary of the army until June 30, 1953. Applicants for Regular Army commissions must complete a one-year period of trial service, and initial appointments are ordinarily made in the grade of second lieutenant. After one year the officer is promoted to first lieutenant, and subsequently to higher grades according to the promotion schedule.

The duties of Veterinary Corps officers fall into two general classes: those pertaining to the inspection of foods of animal origin for consumption by the army, and those having to do with the care and treatment of army animals. The members also train and direct the enlisted personnel of the Medical Department assigned for duty to the corps, investigate and make recommendations on the hygiene and sanitary conditions of the animals of the army, and inspect forage when procured, stored, and issued. As the number of animals used in the army has decreased, food inspection has assumed relatively greater importance. This includes methods and procedures by which such foods are transported, stored, and made available for troop consumption.

Medical Service Corps.—This corps consists of four sections, the names of which suggest the functions performed: pharmacy, supply, and administration; medical allied sciences; sanitary engineering; and optometry. The corps performs such functions as the secretary of the army may prescribe, and he may create such other sections as he deems necessary. Grades range from second lieutenant to colonel. With certain exceptions the minimum age for Regular Army commissions is 21 years and the maximum 30. Each applicant must complete a one-year trial tour of active duty.

Army Nurse Corps.—Original Regular Army appointments to this corps are given to those women who are between the ages of 21 and 27 years inclusive, who have been graduated from a school of nursing approved by the surgeon general, are registered nurses, and members of the Army Nurse Corps Reserve. Such applicants must be unmarried and are appointed in the grade of second lieutenant. Grades in this corps range to lieutenant colonel, except for the chief, who holds the temporary rank of colonel during her four-year term. Retirement is authorized, although not mandatory, after 20 years' service in the corps.

Women's Medical Specialist Corps.—Minimum and maximum age limits for initial Regular Army appointments in this corps are 21 and 28 years respectively. Such applicants must be college graduates and have additional training prescribed by the surgeon general. Dietitians supervise the preparation of food, including special diets, for patients in army hospitals. Physical and occupational therapists, acting upon the prescription of a medical officer, perform or supervise physical or occupational treatment of patients and train personnel of the Medical Department in such techniques.

Officers' Reserve Corps.—This component of the army consists of commissioned civilians qualified and willing to serve as officers in times of emergency. Each of the six corps in the Medical Department has its section in this reserve. In this interim period between hostilities and the final establishment of our peacetime army, not all policies relating to the Officers' Reserve Corps have been settled (1948). Grades range from second lieutenant to general officer. Anyone honorably discharged from service during World War II in commissioned status, or from the first three grades of noncommissioned rank, is eligible for appointment in the Reserve. Appointment holds good for five years and may be renewed. At present any officer may, with his own consent, be ordered to active duty for such time as the president may prescribe. In time of national emergency, declared by Congress, he may be so ordered without his consent. An officer in this

corps receives the pay and allowances of his grade while on active duty. Retirement age is 60 years.

The Honorary Reserve consists of officers retired from the Regular Army on account of age, those who have completed 20 years' service in the Reserve Corps, and those who have become physically disqualified through no fault of their own.

The Officers' Reserve Corps forms the largest source of expansion to meet emergencies short of war, and with the increase of the army, beginning in 1939, Reserve officers of all sections, including those in the Medical Department, were called to active duty in ever-increasing numbers. They formed the bulk of officers on active duty at the time of Pearl Harbor. Classification of Medical Department Reserve officers according to civilian and military experience was initiated in 1940, and these officers performed practically every type of duty called for in the Medical Department.

Consulants.—Highly trained specialists, either civilian or military, may be designated as consultants in the Medical Department. Consultants are assigned to the surgeon general, the surgeons of the Department of the Air Force, Army Ground Forces, and major commands, and the commanding officers of hospitals and other medical installations. In the general hospitals a large part of their time is occupied with the graduate instruction of Medical Department officers. Elsewhere they act as advisers and assistants in evaluating and improving the quality of medical and surgical treatment and preventive medicine. About 1,000 consultants, mostly civilians working on a part-time basis in the general hospitals, are now employed by the Medical Department.

Medical Department Insignia.—The distinguishing emblem of the Medical Department, exhibited on the guidons of its organizations and worn as insignia on the uniform of its members, is the caduceus. As an openwork metal pin on the lapel of officers' uniforms, this device is worn plain by Medical Corps officers or has superimposed upon it small letters identifying those belonging to the other Medical Department corps; as Dental Corps (D); Veterinary Corps (V); Army Nurse Corps (N); Women's Medical Specialist Corps (WS intertwined); Medical Service Corps (MS intertwined); and Contract Surgeons (C). For the Women's Medical Specialist Corps and the Medical Service Corps the caduceus is silver plated; for all others, gilt. Enlisted personnel wear a solid metal button with an unadorned caduceus in high relief.

Training.—The rapid (almost precipitous) demobilization of the army at the close of World War II and the implementation of the army-wide, long-range "Gerow-Board plan" for the postwar training of officers required of the Medical Department not only a drastic consolidation of its facilities for formal training but also a radical revision of its wartime educational system both for officers and enlisted men.

Except for the tactical training of units under control of the Army Ground Forces and on-the-job training received in all Medical Department installations, the Army Medical Department, within two years after the end of hostilities, had concentrated most of its formal training at the following centers: the Medical Field Service School (Brooke Army Medical Center, Fort Sam Houston, Texas), the Army Medical Department Research and Graduate School (Army Medical Center, Washington, D. C.), the Medical Department Meat and Dairy Hygiene School (Chicago Quartermaster Depot, Chicago, Ill.), the St. Louis Medical Depot (St. Louis, Mo.), five general hospitals within the United States, and one hospital in the Canal Zone operated by the civil government but staffed by army medical officers. Additional Medical Department training was being given at numerous civilian medical schools and in certain army hospitals in Europe. By the early months of 1948, the postwar training program of the Army Medical Department was about 75 to 80 per cent operative. Since the plans were firmly drawn, however, it was expected that the program would soon be functioning at capacity.

Departing from its practice during most of World War II the postwar Medical Department does not give basic training to newly enlisted men. Instead, enlisted personnel destined for service as medical soldiers receive basic military training for about three months in one of the four training divisions of the Army Ground Forces. At the conclusion of this training a certain number of enlisted men are assigned to the Medical Department either as replacements (who immediately start on-the-job training), or as candidates for advanced training in medical and related subjects in the several service schools operated by or in cooperation with the Medical Department. Replacements, if qualified, are also encouraged to take advanced training.

As markedly demonstrated during World War II, one of the most important training agencies producing medicomilitary manpower is the Reserve Officers Training Corps program conducted in selected four-year medical schools. Approximately twice as many medical schools as in prewar years are participating in the revival of this program, and plans call for its early extension to schools which will train officers for the Dental, Veterinary, and Medical Service corps reserve. The selected medical schools and the Department of the Army assume joint responsibility for the operation of the ROTC units. A medical officer of the Regular Army, serving as instructor in military science and tactics, is assigned at each school to conduct the medicomilitary instruction; for its part the school insures a membership of at least 50 students—all of whom must be citizens of the United States and physically suitable for military service—and provides for 90 hours of instruction each year in certain medicomilitary subjects. Membership in the ROTC units is generally voluntary. Prescribed courses of instruction, which incorporate war-learned lessons in such subjects as medical aspects of atomic energy, preventive medicine, health and national security, military psychiatry, and field medicine and surgery, extend throughout the four years of medical school curriculum, the first two years of which constitute the basic and the last two the advanced course. Attendance for six weeks at a summer training camp is also required. Subject to availability of funds, selected individuals who complete the basic are enrolled in the advanced course and receive a nominal compensation for their attendance. Upon completion of the advanced course and upon recommendation of the instructor in military science and tactics and the school authorities, the ROTC graduate is given a commission in the Medical Corps Reserve of the army. Qualified reservists, like other graduates

of approved medical schools, may then apply for a commission in the Regular Army.

All Medical Department officers newly commissioned in the Regular Army, unless excused because of prior service, will be required under the postwar program to take military training in a four-month "basic branch course," the first class of which is scheduled to begin in September 1949. A similar eight-week basic course for Medical Department female officers is planned to run twice annually for army nurses and for members of the Women's Medical Specialists Corps. After completion of such basic military training, an officer may be assigned at once to duty, or he may either then or later be selected for advanced training in medical or related subjects.

Selected enlisted personnel of the Medical Department are given advanced training in medical and allied subjects at an appropriate service school. Some are instructed, for example, in the procedures of pharmacy, dental laboratory, medical laboratory, or X-ray; others are trained as medical, surgical, or neuropsychiatric technicians or as psychiatric social workers' assistants, electroencephalographers, physical reconditioning instructors, or medical aid men. Still other enlisted men are given in-service training as specialists in the repair of medical equipment, as opticians, or as inspectors of meat and dairy products.

Medical Department officers, with proper approval, may receive advanced professional or related training at service schools, at civilian institutions, and at the newly designated "teaching" hospitals. In the service schools an army medical officer may take a course in the basic sciences; a Medical Service Corps officer may elect to study physical reconditioning, clinical psychology, hospital administration, or psychiatric social work—or he may choose to train as an optician, a supply officer, or a medical equipment maintenance officer; and a hospital dietitian of the Women's Medical Specialists Corps may enroll in a class in mess administration. Similarly, Veterinary Corps officers and army nurses may take service school courses appropriate to their professions. When unavailable at service schools, furthermore, courses in the professional specialties, such as internal medicine, thoracic surgery, or obstetrics; in dentistry; and in other fields related to the duties of Medical Department officers, such as business administration, bacteriology, public health, or sanitary engineering, may be secured for limited periods under army contract with an approved civilian institution offering the course desired.

The development in this postwar graduate professional educational program expected to produce the greatest improvement in professional service rendered by the Medical Department is the establishment of internships and residencies in the six teaching hospitals—Brooke, Fitzsimons, Letterman, Oliver, and Walter Reed General Hospitals in the United States, and Gorgas Hospital in the Canal Zone. Although by early 1948 no one of these hospitals had residencies approved in all of the professional specialties, collectively they had available for Regular Army Medical Corps officers, and for applicants for the Regular Army, programs of one- to three-year residency training in each of the following fields: cardiology, contagion and tuberculosis, dermatology and syphilology, internal medicine, physical medicine, anesthesiology, obstetrics and gynecology, ophthalmology, orthopedic surgery, otolaryngology, surgery, thoracic surgery, urology, neurology, pathology, psychiatry, and radiology. All of these residencies by early 1948 had been approved, some temporarily, many permanently, by the American Medical Association's Council on Medical Education and Hospitals and by the American Specialty boards. Several of the hospitals had residencies, notably in pediatrics, approval of which had been recommended by the council but which had not been acted upon by the appropriate specialty board. Some had established residencies in certain specialties pending approval of the accrediting agencies. All six had internships that were permanently approved.

General direction of the program for the training of residents and interns is vested in a committee of professional experts in the Office of The Surgeon General. The program in each hospital, under the local direction of the hospital education committee, is so organized as to be carried out by a professional staff of assigned Medical Corps officers and attending civilian consultants who are diplomates of, or are acceptable to, the particular specialty board concerned. The third- and second-year residents, too, are expected to supervise and instruct the interns and residents who are less experienced than they. Instruction is accomplished through bedside and general conferences with, and supervision by, the assigned and attending professional staff; through training in the allied sciences, which may be taken locally in civilian institutions; and through individual research projects. Residents completing the prescribed course of study are eligible to take the examinations for certification by the appropriate American Specialty board.

All Regular Army medical officers, if possible between the third and tenth year of their active service, are expected to attend the advanced branch course, which is divided into two phases: the four-month tactical and administrative phase, to be given at the medical Field Service School; and the professional phase, extending from four to nine months, depending upon the type of specialized training, which is to be given at the Army Medical Department Research and Graduate School.

All training opportunities afforded Regular Army officers, except residency training, are also available to Medical Department officers in the Officers Reserve Corps and National Guard.

Beginning in January 1948, the Medical Department instituted in overseas hospitals a program offering advanced training and experience, analogous to residency training, in the various special fields of medicine and surgery to qualified Reserve officers, regardless of prior military service, who applied for extended active duty.

Finally, a limited number of Medical Department officers, in preparation for positions of great responsibility, are usually sent annually to four high-level service schools. Some attend the ten-month courses at the Command and General Staff College, the National War College, or the Industrial College of the Armed Forces. Others take the five-month course offered at the Armed Forces Staff College. Seldom does any one officer, however, receive advanced training at all four of these institutions.

Research and Development.—Medical Department scientific activities are directed primarily toward discovery of more effective methods for prevention or eradication of conditions that may jeopardize the success of troops during military operations. These activities, like scientific work

n general, are divided into two main categories: (1) research, involving the discovery of basic principles of medical phenomena, and the application of these principles, generally comprehending discovery of a novel product, process, or technique, and (2) development, in which experimental production and testing is performed on products, processes, techniques, or devices that previously have been discovered or invented. Applied research and development receive the main emphasis.

A considerable amount of scientific work is carried on in the hospitals, laboratories, and testing installations of the Medical Department, as well as in its schools, incidental to, or in close relationship with their ordinary professional duties. The large number of specialized centers for treatment of disease, injuries, and wounds, which are organized in wartime, afford great opportunities for clinical observations. Unfortunately, time does not always permit these opportunities to be used. Before World War II, however, an organized, comprehensive, and long-range program of research and development was scarcely known in the Medical Department. In earlier years, particularly, it was customary to assign research problems to temporary boards or commissions of medical officers. Among the most notable of these were the boards for the study of tropical diseases set up in Cuba and the Philippines soon after the end of the Spanish-American War. Between World War I and World War II, a number of more permanent units specializing in research and development existed. A Medical Department Research Board functioned in the Philippines from 1922 to 1934, when it was transferred to Panama. There, under the name of Army Medical Research Board, it operated until 1939. Although the board conducted investigations into a variety of subjects, it devoted its chief attention to tropical and animal diseases, and not only demonstrated the exact mechanics of transmission of dengue by *Aëdes aegypti*, but also developed a vaccine which was effective in eliminating rinderpest from the Philippines.

Nearly half of the Medical Department's research and development units of the between-wars period (those concerned with aviation and chemical warfare medicine) functioned, at least in part, under the jurisdiction of other branches of the army, and even, in the case of aviation medicine, with funds not provided by the Medical Department. The beginnings of an attempt to integrate the scientific program of the department occurred in 1937, when a research coordinating board to investigate diseases and conditions affecting health, efficiency, and longevity of army officers, and to coordinate other medical research programs was established in the Office of The Surgeon General.

With the coming of World War II, increasingly large appropriations were made from Medical Department funds for research and development, particularly after the United States entered the conflict. Studies were initiated in the field of communicable diseases, and, toward the end of the fighting, in the development of devices to aid the disabled. New facilities were created within the Medical Department for investigation of respiratory diseases, of industrial hygiene, and the physiology of the armed forces. However, for much of the more fundamental study required by the war, the Medical Department, because of the great pressure on the time of its personnel, relied upon contracts with universities and medical schools as well as upon projects organized by the National Research Council (q.v.) and the Committee on Medical Research of the Office of Scientific Research and Development.

The postwar research and development program has attained a magnitude and scope unprecedented in peacetime. Whereas, during the fiscal year 1938–1939, $14,500 of Medical Department funds were specificially obligated for this purpose, the corresponding amount set aside for the fiscal year 1947–1948 was (as of December 1947), $3,100,000. Studies are made on the medical aspects of operations under climatic extremes, physical and mental standards for the most effective selection and employment of personnel, care and rehabilitation of casualties, prevention and treatment of infectious and parasitic diseases of military significance ordinarily not found among civilians, and adaptation of medical supplies and equipment both to scientific advances and to changing military practices.

World War II brought increasing centralization in the control of Medical Department scientific activities. To integrate such work a series of agencies in the Office of The Surgeon General replaced the weak coordinating board. This process culminated in the organization, in July 1945, of the Army Medical Research and Development Board. The membership of this unit, which, since the middle of 1947, has been known as the Medical Research and Development Board, includes the chiefs of the more important professional units of the Surgeon General's Office, the chief of the supply division, the ground surgeon, and the air surgeon. The mission of the board is to formulate and supervise a coordinated research and development program of prospective benefit to army medical equipment and practice, to adapt to the needs of the military service the best techniques and devices produced by private medical research, and to coordinate the Medical Department's research program with those of all appropriate government agencies.

Functioning under the general direction and supervision of the Medical Research and Development Board is the Army Epidemiological Board, established early in 1941 to provide the surgeon general with consultative service on influenza and other infectious diseases as well as to organize research in these fields. The board consists of civilian consultants and has under it five commissions, likewise civilian in membership, which deal respectively with acute respiratory diseases, influenza, virus and rickettsial diseases, immunization, and environmental hygiene.

The Medical Research and Development Board also finances and controls a number of installations engaged in research work. These include research units of the school at the Walter Reed Army Medical Center (called Army Medical Center until Sept. 13, 1951). The school divisions were among the army's oldest medical research establishments. They were redesignated the Army Medical Department Research and Graduate School in January 1947. Their studies cover medical and surgical practice, preventive medicine, and diagnostic methods, as well as development of vaccines. The board also has direct control over the Army Prosthetics Research Laboratory, which was established as part of Walter Reed General Hospital in September 1945 and later made a separate component of Army Medical Center, and the Brace Research subsection of

the Hospital's Orthopedic section, which originated in a project authorized in August 1945. The board likewise controls the Medical Nutrition Laboratory, which was orginally situated at Army Medical Center and was transferred to Chicago under an order of September 1944, and the Surgical Research Unit, established about the beginning of 1947 at Brooke General Hospital. Studies carried on at the Surgical Research Unit look toward the development of new antibiotics and their surgical application. The Medical Department Field Research Laboratory was founded at Fort Knox, Kentucky, in 1942, and was originally devoted to studies of the physiological and psychological aspects of armored warfare. In February 1944 it was transferred from the jurisdiction of the Army Ground Forces to that of the surgeon general, and now operates under the Research and Development Board. Since the activities of the establishment soon were broadened to include many other aspects of what may be called military occupational hygiene, its name was changed, effective April 1, 1947, from Armored Medical Research Laboratory to Medical Department Field Research Laboratory.

The Medical Department Equipment Laboratory, which was established at Carlisle Barracks, Pennsylvania, in 1920, was made an attached activity of the Army-Navy Medical Procurement Office in February 1946. In June of the same year, it became a component of that office and was redesignated as the engineering development division. The laboratory and shop branch of this division was moved from Carlisle Barracks to Fort Totten, New York, toward the end of 1947. In its new status, the engineering development division continues to play an important role in the program of the Medical Research and Development Board. It is primarily concerned with developmental work on field equipment, such as mobile units, medical chests, dental engines, and operating lamps for the army, navy, and air force. The Medical Research and Development Board also uses hospitals and other Medical Department establishments as occasion may warrant. Among these is the Army Institute of Pathology (see below) which long has had the function of conducting research on the material in its collections. Finally, the Medical Department continues to carry on a large part of its research by means of contracts with universities, medical schools, and other government agencies. Investigations so arranged are those which cannot feasibly be done within the service. They generally involve the more fundamental aspects of research.

Research is also performed under the supervision of Medical Department personnel at the medical division of the Army Chemical Center, Edgewood, Md.; on July 15, 1943, the Medical Department Research Laboratory, located at Edgewood, was transferred from the jurisdiction of the surgeon general to that of the chief of the Chemical Warfare Service. Two former army centers for research in aviation medicine, the School of Aviation Medicine at Randolph Field, San Antonio, Texas, and the Aero-Medical Laboratory, at Wright Field, Dayton, Ohio, are now under the jurisdiction of the Department of the Air Force.

The Medical Department's statistical and medical intelligence programs constitute important auxiliaries to its research and development work. Medical intelligence involves the gathering and analyzing of information concerning foreign discoveries of importance to military medicine and health conditions and medical facilities in areas abroad which may be the scene of American troop operations.

Army Institute of Pathology.—This institute comprises four departments. The *Department of Pathology* serves as the central laboratory of pathology not only for the army but also for the Veterans Administration. Here many surgical specimens and all of the autopsy materials from these two sources are analyzed and original diagnoses are verified or corrected. The department also provides Medical Department officers and other qualified physicians with instruction in pathologic anatomy. The *American Registry of Pathology,* sponsored by the National Research Council, forms another of the departments of the institute. The registry comprises pathologic materials and records brought together through the cooperation of national societies in the various medical specialties. This material, together with that obtained through official channels, raises the number of accessions in the custody of the institute above 200,000. The *Army Medical Illustration Service* serves as a central agency for collection and reproduction of medical illustrative material for the army and the civilian members of the profession. A collection of about 400,000 negatives has been amassed. The service supervises the activities of the Clinical Photographic Laboratories of the Army hospitals in the United States, and receives from them moving picture films as well as "stills." It maintains a Photographic Department, dating almost from the Civil War, which pioneered in photomicrography. One of its most valuable activities is the presentation at scientific meetings and similar gatherings of exhibits on a wide range of medical subjects. The *Army Medical Museum,* which is the fourth department of the institute, is the only establishment of its kind which is open to the general public. The world's largest aggregation of war wounds, contrasting the effects of arrows, tomahawks, small arms, high explosive shells, and gases, is in the custody of the museum, but its accessions comprehend all forms of injuries and diseases. Medical medals, microscopes, stethoscopes, and other diagnostic instruments also are among the collections.

Army Medical Library.—The library of the Surgeon General's Office, known since 1922 as the Army Medical Library, has long been the largest medical library in the United States. Its growth as a great research facility dates from the post-Civil War period when Dr. John Shaw Billings (q.v.) was placed in charge of it and surplus hospital funds were allotted by the surgeon general for its expansion. With the momentum thus provided, the library, whose collection, covering not only the field of medicine, but also various related sciences, has become so large and so well known that it often is referred to as the National Medical Library. It possesses over 1,000,000 items, including at least 500,000 bound volumes, and provides reference service not only to the armed services, but also to physicians, institutions, and libraries throughout the country.

The function of the library is to collect the medical literature of the world regardless of language, form, or date of publication. It possesses a great number of the earliest printed works, including over 500 incunabula, early manuscripts from European and Oriental sources, and a medical art collection containing approximately 12,000 items.

One of the most important recent developments in the history of the library is the growth of its photoduplication and microfilm service. This is operated for the benefit, not only of the Medical Department, but also of the medical profession at large.

The Index-Catalogue of the library was formally established by Congressional Act of 1879. This publication, now in its fourth series (inaugurated in 1936), has become the "foundation for medical library service both here and abroad." Thus far 56 volumes have appeared. Since September, 1945, the library also has been publishing the *Current List of Medical Literature*. Inaugurated in 1941 by Atherton Seidell under the sponsorship of the Medical Library Association, this publication is issued weekly and is supplemented by a monthly subject index.

Inadequate appropriations and antiquated quarters (dating from 1887) have made it difficult for the Army Medical Library to provide completely satisfactory service. In 1943, a committee of civilian authorities on libraries recommended far-reaching changes, including a complete recataloguing of the library's holdings. Since then, the recataloguing project has been inaugurated, the personnel has been virtually doubled, and steps have been taken to provide the staff with more men and women trained in library work. The urgent recommendation that a new building, to house the equally cramped Army Institute of Pathology as well as the library, be constructed, remains unfulfilled, but, to some small extent, the pressure on space has been lessened by the establishment of the history of medicine division in Cleveland in 1942, to which rare items were removed for greater security against possible enemy action. Another unit of the library is the historical division, which carries on the tradition of the Medical Department, established after the Civil War and continued after World War I, of preparing comprehensive accounts and evaluations of the department's experiences during major conflicts.

HISTORICAL DIVISION,
Army Medical Library.

MEDICAL ORGANIZATION, United States Navy. The Medical Department of the navy is administered by the Bureau of Medicine and Surgery which is one of the seven bureaus of the Navy Department. It is charged with and is responsible for maintaining the health of the navy through the promotion of physical fitness, the prevention and control of diseases and injuries, and the treatment and care of the sick and injured. The responsibility for coordinating and integrating the administrative and professional functions of the Medical Department is vested in the surgeon general of the navy who is the chief of the Bureau of Medicine and Surgery. These functions are carried on by the personnel of the following corps which constitute the Medical Department: Medical Corps, Dental Corps, Medical Services Corps, Nurse Corps, Hospital Corps, and by the civilians in the bureau and in the field activities.

The maximum personnel allowed for each of the corps is prescribed by law as a percentage of the total officer and enlisted strength of the United States Navy and Marine Corps, but insufficient appropriations have in the past sometimes prevented employing the total authorized officer strength. On the other hand, since World War II, the difficulty has been in finding enough candidates to keep the Medical and Dental corps up to authorized strength. The percentage allowances, with the corresponding actual numbers based thereon that were authorized for the fiscal year 1948, are as follows:

Corps	Allowance in percentage of total officer and enlisted strength of the Navy and Marine Corps	Authorized strength in actual numbers for fiscal year 1948
Medical Corps	0.65%	3,092
Dental Corps	0.2 %	952
Medical Services Corps	0.13%	618
Nurse Corps	0.6 %	2,854
Hospital Corps	3.5 %	14,910

Medical Corps.—Appointments to the Medical Corps are normally made either in the grade of assistant surgeon with the rank of lieutenant (jg), or in the grade of acting assistant surgeon, also with the rank of lieutenant (jg). In both cases such appointments are made after a competitive examination, which is held in June of each year. Candidates must be between the ages of 21 and 32. In order to enter the examination for appointment as an assistant surgeon, the candidate must be a graduate of an accredited medical school and must have had an internship in a civilian hospital. For appointment as an acting assistant surgeon, the candidate must have completed the fourth or senior year in an accredited medical school, but is not required to have had an internship. Those who enter as acting assistant surgeons are assigned for one year to an internship at a naval hospital. Should the intern at the end of the year desire to return to the practice of medicine in private life, his appointment as an acting assistant surgeon is terminated and he is honorably discharged from the naval service. If he desires to continue in the naval service, he must pass a further competitive examination.

The professional examination for assistant surgeons embraces the subjects of general medicine, general surgery, obstetrics and gynecology, preventive medicine, and medical jurisprudence. The professional examination for acting assistant surgeons covers only the subjects of general medicine and general surgery, in addition to an oral and practical examination. Each candidate must also pass a prescribed physical examination.

Under certain circumstances to meet special needs of the navy, medical officers may be commissioned from the Naval Reserve or from civilian life in higher age groups and in higher ranks up to and including the rank of captain. The same provision applies also to the Dental Corps.

The ranks in the Medical Corps are lieutenant, junior grade; lieutenant; lieutenant commander; commander; captain; and rear admiral. Promotion is by selection made by a board of medical officers but, before being advanced in rank, the officer must also pass physical, mental, moral, and professional examinations.

Dental Corps.—The requirements as to age, professional education, examinations, etc., for appointment to the Dental Corps parallel those for the Medical Corps, although there is no requirement as to actual practical experience corresponding to the internship requirement for medical officer candidates. The same ranks are also provided, with the number of rear admirals limited to four, as the Dental Corps is numerically less than one third the size of the Medical Corps. Promotion is by selection.

Medical Services Corps.—This corps was established by an act of Congress in 1947 to fill needs brought to the front by the experience of World War II. Modern warfare has become so highly scientific and technical that specialists in many fields besides medicine are needed to make it possible for the Medical Department of the navy to perform its functions satisfactorily. Some twenty specialties that are recognized as separate sciences will be represented in this corps. Such a corps makes it possible also to provide careers for men that are highly competent to handle administrative and medical supply work, which formerly took up much of the time of medical officers to the detriment of their professional work. The act provides that the Medical Services Corps shall consist of a medical allied scientists section; a pharmacy, supply, and administration section; an optometry section, and such other sections as may be deemed necessary by the secretary of the navy.

Members of the corps hold commissioned rank from ensign to captain. The initial recruitment of the corps was accomplished by transfer to the grade of ensign of temporary and reserve officers in the needed specialties who had served in World War II. Their rank was then adjusted with reference to the dates of their original appointments and the grades they had reached while in their former status. Subsequent appointments are being made in the grade of ensign, except that those holding doctorate degrees in sciences allied to medicine may be appointed as members of the medical allied science section with the rank of lieutenant, junior grade.

Nurse Corps.—This corps has the same status as other staff corps of the navy. Its members hold commissioned rank from ensign to commander. The director holds the rank of captain and is selected from officers in the Nurse Corps of the rank of lieutenant commander and above.

A candidate for appointment to the Nurse Corps must be single, a citizen of the United States, and between 22 and 30 years of age. The candidate must have a broad general education, preferably a college degree, but must at least have graduated from an accredited high school that provides not less than a four-year academic course. She must be a registered nurse, and a graduate of a school of nursing, the educational and professional standards of which are approved by the surgeon general.

Hospital Corps.—This corps consists of chief warrant officers, warrant officers, chief petty officers, petty officers and nonrated men. They are designated below the grade of warrant officer as chief hospital corpsman (formerly pharmacist's mate); hospital corpsmen, first class, second class, and third class; hospital man; and hospital apprentice. Commissioned officers of the newly created Medical Services Corps perform many of the administrative duties which were formerly performed by the higher levels of the Hospital Corps. The Medical Services Corps is expected to recruit part of its personnel by promotions and transfers from the Hospital Corps.

Members of the Hospital Corps perform a great variety of services and are an essential component of every combat force. The Hospital Corps may be termed the main working force of the Medical Department of the navy. The nursing on all ships is, for example, performed exclusively by the Hospital Corps except on hospital ships where the nursing staff is supplemented by female nurses. The smaller naval vessels do not carry a doctor in the medical department (a doctor and a dentist may however be assigned to a group of small ships), but scarcely any commissioned ship is so small but what a hospital corpsman is included in the crew. The hospital corpsman may in an emergency be called on to perform any of the functins which are normally within the province of a medical officer. The incidents of hospital corpsmen who, during World War II, successfully performed appendectomies on members of the crews of submarines while on war patrols in the Pacific Ocean are cases in point.

The lower ratings of the Hospital Corps spend much of their time studying and attending classes in connection with their training, and the upper ratings devote many hours teaching the lower ratings. This is necessary because there is no large calling in civilian life from which to recruit already trained hospital corpsmen.

Scope of Activities.—Medical and dental service and hospitalization are provided for all United States Navy and Marine Corps personnel whether on active duty or retired. With certain limitations, medical service and hospitalization are also provded for the dependents of such personnel. Emergency treatment is also given to the civilian employees of naval shore establishments.

The navy maintains some 30 naval hospitals, 120 dispensaries located in the continental United States, and 60 located overseas. A research laboratory, post graduate schools in medicine and dentistry, and refresher schools form part of the educational facilities provided to keep the Medical Department of the navy in the forefront of medical science..

The personnel assigned to the medical department of naval vessels depends on the size of the ship, that is, on the complement of the ship. Battleships and large aircraft carriers have two medical officers and one dental officer, cruisers, one medical officer and one dental officer, smaller ships, a medical officer but no dental officer, and destroyers, a medical officer for each division. Personnel of the Hospital Corps in appropriate numbers and ratings constitute the main body of the Medical Department complement. As already mentioned there may be no commissioned officer in the medical department of a small ship but there is always a member of the Hospital Corps.

J. A. Furer,
Rear Admiral, United States Navy (Retired).

MEDICAL PEDAGOGY. The theory of education in its application to medicine still is mostly traditional, like many of the subjects it includes, for the pedagogy of the great number of medical schools has no steady, carefully arranged and planned-for, fought-for, curriculum based on personal and educational psychology and knowledge of the modes in which a young (or old) person learns. Both the method and the curriculum at present are largely traditional, like much of medicine in general.

When systematic laboratory work developed, largely in the richer medical schools, and recitations began to be systematically held, this preceptor-system—employing a practitioner to be guide, philosopher and friend, as well as tutor—

gradually disappeared, except as still maintained n or about all institutions of learning in some form or other. In this pedagogic respect, then, he medical school tends continually to imitate nore and more successfully the didactic methods of the university, which, of course, are ancient.

«The requirements for admission to colleges nolding membership in the Association of Amer-can Medical Colleges are 14 units of high school work and two years (60 semester hours) of college work.

THE HIGH SCHOOL REQUIREMENT.

(A) Required, 7 units.	Units
Mathematics (minimum 2 years, maximum 3 years), algebra and plane geometry....	2
English (minimum 2 years, maximum 4 years)	2
One foreign language (minimum 2 years, maximum 4 years)	2
History and civics	1
Total number of required units	7
(B) Elective, 7 units.	
To be selected from the following:	
English language and literature (in addition to the required work)	1 to 2
Foreign languages, additional, Latin, German, Italian, French, Spanish or Greek (not less than 1 year in any one)	1 to 4
Advanced mathematics, advanced algebra, solid geometry and trigonometry (½ year each)	1
Natural science, chemistry 1 year, physics 1 year, and biology, botany, physiology and zoology (½ to 1 year each)	½ to 2
Earth science, physical geography, geology and agriculture (½ year to 1 year each)	½ to 1
Astronomy (½ year)	½
Drawing (½ to 1 year)	½ to 1
History, ancient, medieval and modern, and English (1 year each)	1 to 3
Economics (½ year)	½
Manual training (1 year)	1
Bookkeeping (½ to 1 year)	½ to 1

One unit in any subject is the equivalent of work in that subject for four or five periods per week for a year of at least 36 weeks, periods to be not less than 45 minutes in length. One unit is equivalent to two semester credits or two points.

PREMEDICAL COLLEGE COURSE.

SCHEDULE OF SUBJECTS OF THE TWO-YEAR PREMEDICAL COLLEGE COURSE.

Sixty Semester Hours* Required

Required Subjects:	Semester Hours
Chemistry (a)	12
Physics (b)	8
Biology (c)	8
English composition and literature (d)	6
Other nonscience subjects (e)	12
Subjects Strongly Urged:	
French or German (f)	6–12
Advanced botany or advanced zoology	3– 6
Psychology	3– 6
Advanced mathematics, including algebra and trigonometry	3– 6
Additional courses in chemistry	3– 6
Other Suggested Electives:	
English (additional), economics, history, sociology, political science, logic, mathematics, Latin, Greek, drawing.	

*A semester hour is the credit value of sixteen weeks' work consisting of one lecture or recitation period per week, each period to be not less than 50 minutes net, at least two hours of laboratory work to be considered as the equivalent of one lecture or recitation period.

Colleges may reduce the number of hours in any subject not more than 20 per cent, provided that the total number of hours in a division is not reduced. Where the teaching conditions in a college are best subserved, the subject may be, for teaching purposes, transferred from one division to another. When didactic and laboratory hours are specified in any subject, laboratory hours may be substituted for didactic hours.

Medical Education of Women.—The development of medical education for women in America gave back to the world the opportunity for feminine medical study which had been freely granted in the Middle Ages and then with so many other privileges was denied in modern times. The first woman student of medicine was Dr. Elizabeth Blackwell, who, after being refused permission to study at most of the medical colleges in the country, finally secured the privilege at Geneva, N. Y., when the faculty, feeling sure that her application would be rejected, put it before the students and they voted unanimously to admit her. She was graduated in 1849. Her sister Emily was refused two years later at Geneva, and Rush Medical College, Chicago, was censured by the State Medical Society for receiving her for a term. She was graduated at Western Reserve, Cleveland. The women resolved to found medical colleges of their own. The first of these, the Women's Medical College of Pennsylvania, was founded in 1850. It had a quasi predecessor in the Gregory School of Medicine, established to train women as midwives, founded in Boston in 1848, and lasting until 1874. The Woman's College of the New York Infirmary was opened in 1865 and closed in 1899, when Cornell opened its medical course to women students. The Women's Medical College of Pennsylvania, was founded in 1882, that of Cincinnati in 1886 and that of Kansas City in 1895.

The University of California was a pioneer in opening its courses to women in 1869 and was followed in this policy by all the universities of Western States. This development also included medicine so that the special need of medical colleges for women ceased in the West. When Johns Hopkins, Baltimore, opened its medical school in 1893 women were accorded the same privileges as men. Gradually prejudices disappeared and other medical schools opened their doors to women, but it was not until the World War brought home the need for physicians during and after the war that Harvard and Columbia removed the restrictions against women in their medical schools. In recent years medical schools in increasing numbers have opened their classes to women.

Many medical schools need, and as much as anything else at all, except it be finances, an adequate survey by some wise and practical professional educator—one who would point out, for example, some of the inconsistencies and the lack of co-ordination between the different courses. «Visiting» committees frequently try to demonstrate to chance readers of their reports their own personal importance, but they seldom have any knowledge worth while concerning educational theory. An assistant or teaching fellow in almost any university department of education would be of more use in a really conscientious medical school than the wealthiest and most dignified of these committees.

The principles of pedagogic fatigue, of overwork, and of under-recreation are ignored in most medical schools, with a consequent great waste of mental energy. As has already been hinted, the medical student needs normal recreation as much as any other student, if not more. A course in the economics of learning should be given in the first semester of every medical freshman year.

This suggests medical psychology in general. The everyday psychology of the emotions, for example, especially in relation to the functions of the body and its growth, should be studied and even understood by every medical man while yet a student. The present writer happens to be one of the early ones to say this, namely in *Science* in July 1901. Medical psychology was offered year after year, the Tufts College 1901–02 catalogue-announcement of this pioneer course being as follows: «*Normal medical psychology*—An optional course in normal medical psychology will be given to the fourth-year class in weekly lectures during the first half-year. Its aim is to discuss in their more general relations certain topics of great practical importance to the medical practitioner: such topics for example as suggestability and hypnosis, temperament, mood, the numerous habits, sexual mental differences, will-power, the emotions, pain and pleasure. Knowledge of subjects such as these prepares the student better to understand his patient as an individual and so better to treat his disease. But, in addition to this, the chief value perhaps of such information, the lectures will afford a brief basis of general psychology, which will tend to make the mental phenomena of the diseases of the mind and nervous system more easily understood» (Professor Dearborn).

In nearly a score of years the curiously inherent materialism of the medical schools has begun to soften, without a doubt, and to-day some of the very best medical colleges realize practically that education, any kind of education, that has ignored the study of mind and motive and behavior is incomplete and false in quite the most fundamental kind of way. This common lack of adequate psychology, however, seems still to be the chief pedagogical defect of medical education—man is both mind and body. Nevertheless American medical education still remains the best in the world.

George Van Ness Dearborn, M.D.,
Medical Corps, United States Army.

MEDICAL REGIMENT. See Ambulance Companies; Hospitals, Military; Medical Organization in the United States Army.

MEDICAL SCIENCE AND THE WORLD WAR. Army medical departments everywhere had, before the war, prepared for the treatment of surgically clean wounds made by modern fire-arms in distance engagements. The soldiers' «First Aid» kit, with its sterilized dressings sealed from contamination, was expected to maintain this freedom of wounds from infection almost without exception. Aseptic wounds assure prompt and uncomplicated recovery. Serious injuries of important organs would still often be fatal, but all others, as a rule, would be followed by convalescence without delay or complication. These anticipations were sadly disappointed by the immediate recourse to trench warfare as almost the sole mode of conflict. In trenches recently dug in fields which had been under cultivation for hundreds of years, bacteria abounded and infections inevitably occurred. Two extremely fatal forms of infection, tetanus and gas gangrene, raged among the troops. Both of these were often fatal and the gas bacillus caused long illness and often extensive mutilation, even when recovery took place. Tetanus, after the early sad war experience, was prevented by injections of anti-tetanus serum as soon as the wounded came under observation, the injections being repeated at regular intervals if convalescence from the wound was prolonged, for it was found that delayed infections occurred. The gas bacillus proved a much more difficult problem because of the utter unfamiliarity with it at first. It was unknown in Great Britain before the war, was not seen during our Civil War, and is very rare in civil life. Some 70 per cent of the wounds received in the trenches during the first year of the war were infected by it. It was never noted in wounds of the face or neck where the blood supply is abundant and the tissues well oxygenated, for the bacillus of it, discovered by Welch at Johns Hopkins, like the tetanus bacillus, is anerobic, that is, grows best out of the presence of the air. The successful methods of treatment included thorough opening up of wounds, the use of hydrogen peroxide, so as to provide additional oxygen for the tissues, and after careful investigation, the use of serums for curative and prophylactic purposes, elaborated by various agencies.

The noteworthy difference between the healing of the wounds of soldiers and those of sailors (who were often exposed to cold sea water after the reception of their wounds) led to an important development in the treatment of large shell wounds and penetrating wounds of various kinds. The influence of salt water as a dressing for the surface of large wounds was carefully studied, and subsequently proved beneficial in many cases.

The important development in the treatment of wounds came when Dr. Alexis Carrel of the Rockefeller Institute was put in charge of a French hospital in Compiègne during the second year of the war. He set about the practical application of Lister's principles. Ordinary surgical antiseptics were too poisonous to be used for the flushing out of large wounds. A solution of hypochlorites proved to be bactericidal, yet non-toxic and non-corrosive to tissues. After experiment, Dakin's fluid, so called from the inventor of it who had been the director of the Herter Chemical Institute, New York, was found the most efficient solution of the hypochlorites. The important part of this treatment was the bacteriological control. After removal of all foreign particles and all injured tissues, wounds were thoroughly flushed with Dakin's fluid many times a day, until it was found by careful microscopic examination that the secretions contained very few bacteria and none to be feared. The wound was then closed up and permitted to heal without further interference. The results were excellent. Healing took place rapidly as a rule, convalescence was brief and absorption of septic material so as to produce constitutional disturbance rare and without danger. The after result was better than that produced by any other method and the hospitals where it was employed took on a new aspect from that which had been seen in the war hospitals before.

The most important development of the surgical treatment of war wounds has been what is called by the French *débridement,* that is the thorough excision of all injured portions of tissue. The extent to which this clearing out of the wound was carried in war practice would have seemed utterly unjustified in civil surgery before the war. Where a penetrating bullet wound shows signs of infection, a cylindrical

portion of the tissue around it is removed. In larger shell wounds, a layer of injured tissue is, as far as possible, removed from every portion of the wound so as to present perfectly fresh vital surfaces for healing purposes. Large amounts of tissue are thus often removed, for experience has shown that it is in the end ever so much better for the patient. Any injured cells allowed to remain are of low resistive vitality, have a tendency to die and then break down into material which forms an excellent culture medium for microbes. Where drainage is instituted, most of this will come away, but that is a much slower process and much more exhausting to the patient, and lowers the healing qualities of the part. It has been found by actual bacteriological observations that while very few bacteria are present shortly after the wound is infected, these multiply rapidly in the brood chamber created for them in the tissues, on the good medium for growth, while the healthy cells are handicapped by the presence of injured cells in their struggle against bacteria.

The war's experience with head injuries developed a mode of treatment quite different from that in common use before. The surprise for military surgeons was the wonderful tolerance of the brain to injuries. It was not an unusual thing to have wounded soldiers come into dressing stations as "walking cases," who were suffering from fracture of the skull, even complicated by other injuries. The best surgery for these cases proved the greatest possible limitation of intervention. Depressed bone fractures must, of course, be lifted, but missiles should not be searched for. There is least danger for the patient when the missile is left *in situ*, unless symptoms directly traceable to its presence develop. As a rule, antiseptic rather than aseptic precautions are most valuable in saving lives in these cases. The experience of four years seems to indicate that the after effects of the retention of foreign bodies within the skull does not justify manipulations in reaching them.

The use of poison gas gave rise to the most unsatisfactory medical feature of the war. In spite of the German signature to The Hague Convention article condemning the use of gas, the Germans proceeded to employ this mode of attack and found the Allies and the medical departments unprepared for it. At first heavy gases containing mainly bromine were used, favoring winds carrying them. Later gas hand grenades were employed. These gases had an intensely irritant effect and produced suffocation or were followed by severe purulent bronchitis. Pulmonary edema often proved fatal. Gas masks overcame this mode of attack. When long range gas shells were employed, sometimes with delayed action, so as to lull against precautions. At times, shells containing "sneezing" or "vomiting" gases were used for the displacement of masks. In July 1917, at Ypres, "mustard gas," now known to be chemically dichlordiethylsulphid, was employed. It was persistent and would hang about for hours and make dugouts perilous for days. It burned the skin, and clothes moistened with it produced escharotic effects. Many of the most important German advances were made by means of these gases as a preliminary. The Allies learned to neutralize and reply effectively to all of them.

When the gas was not concentrated enough to produce suffocation or set up fatal pulmonary edema, the men usually recovered, though many of them went through a period of awful discomfort which was, of course, the reason why the use of gas was forbidden at The Hague. Comparatively few of those who survived presented serious lung lesions, though they had to be treated by the open air method, as for tuberculosis, as much as possible. We have learned from tuberculosis how tolerant the lungs are of even severe pathological conditions and how readily, after a time, compensation is secured. The question whether gassing predisposes to tuberculosis has been settled in the negative, though undoubtedly in certain cases latent foci of tuberculosis were made active by the process.

Comparative mortalities from wounds and disease in modern war show what a great gain was made by surgery and sanitary science in the war. In the Russian campaign against Turkey in 1828, some 80,000 died of disease and about 20,000 of wounds. In General Scott's campaign in Mexico the deaths from disease were over 33 per cent of the effective strength. In the Crimean War, out of a total force of 300,900, the French lost by disease 75,000 and by wounds 20,000. In the Prussian war against Austria, of but seven week's duration, the losses by disease were 6,427 and by wounds 4,450 in an army of 437,000. In the Spanish-American War 2,565 deaths were from disease and 345 deaths from wounds, in an army of 274,717. In the South African War the deaths from disease were 69 per thousand strength; from wounds, 42 per thousand. In the Russo-Japanese War the deaths from disease were 41.8 per thousand strength and from wounds 72.9 per thousand strength, the ratio for the first time reversed. Out of 300,000 dead in the Civil War, in the armies of the North over 200,000 were from disease. In the Confederate armies, of 200,000 deaths, three-fourths were estimated as due to disease and one-fourth to the casualties. (Figures furnished by the United States Surgeon-General's Office).

According to the 'Medical and Surgical History of the Rebellion' (Medical volume, part 1, pages xxv and xxvi), there were in the Northern armies altogether 235,583 gunshot wounds with a resulting mortality of 33,653 or 14.2 per cent. These figures represent the total returns from about nine-tenths of the mean strength of the Union army and exclusive of the injuries of those killed in action. In the World War, the deaths from wounds, that is of all those who came to the surgeons alive, no matter how badly wounded, were less than 5 per cent. In view of the large numbers of poison gas casualties, the proportion of fatal cases was very low, being no more than about 3 per cent. This of course does not include the permanently blind. The serious infections with tetanus and the gas bacillus at the beginning of the war make the available statistics much worse than would otherwise be the case. With the control of these the mortality among the wounded in the closing phase of the war was probably below 3 per cent.

The health of army camps at the beginning of the war was most satisfactory. As Dec-

tors Vaughan and Palmer said in their article on "Communicable Diseases in the National Guard and National Army of the United States" (*Journal of Laboratory and Clinical Medicine,* August 1918), "Preventive medicine has made it possible to prevent half a million cases of disease and save the lives of ten thousand soldiers," and they give the figures from the Civil War and the World War for corresponding six months to show the truth of this. The improvement has affected every form of infectious disease. There has been only about one-tenth as much mouth and throat inflammation, less than one twenty-fifth as much intestinal trouble, not one-hundredth as much fever. Malaria, which even in the Northern army was extremely common, has now become a negligible morbidity factor and the mortality from tuberculosis and pneumonia is more than cut in two.

The sad epidemic of influenza proved that it was not the general hygienic conditions that brought improvement but the specific sanitary precautions against particular diseases. Unprepared for influenza in this virulent form, it raged very seriously, while the well-known camp diseases were kept entirely under control.

Typhoid or enteric fever which has played such a fatal part in all previous wars, carrying off in the Spanish-American War more than five times as many as the bullets of the enemy and in the Boer War causing ever so much more havoc among the British than the Boers did, had almost no place in the late war. The reason was better sanitation and careful provision of uncontaminated water with the guarding of latrines from flies and other insects that might find their way afterward to food, but above all, the typhoid immunity of the armies was due to typhoid vaccination, that is the inoculation of the soldiers with cultures of typhoid germs prepared under conditions that produced immunizing results. There is no doubt at all that this is the genuine source of the great saving of life that was effected. The inoculations cause almost no disturbance of the general health,—soldiers have gone into battle the same day,—and only rarely have any serious effect. It is evident that in civil life travelers in distant countries or to parts of the country of whose sanitation they are not sure, will take such vaccinations against typhoid as a protective.

Trench fever was an affection peculiar to the great war and replacing typhoid fever somewhat in its ravages among the soldiers. The men came down rather suddenly with a considerable degree of temperature lasting for from three to seven days, gradually disappearing and causing a great deal of prostration. After some days of normal or sub-normal temperature, the fever occurs again and the relapsing character of the affection has been quite marked. Careful investigation has shown that the disease was distributed through the body lice which proved such a pest to the soldiers under the very difficult conditions as regards cleanliness to which they were subjected. The discovery made possible the prevention of the spread of the disease to a great extent, while the segregation of the relapsing and chronic cases in camps by themselves under favorable conditions of health brought about such a reaction as enabled the patients to throw off the disease. The study of trench fever, its etiology and its successful treatment as well as prevention, was one of the triumphs of the war.

The great medical surprise of the war was the development of a large number of cases of a very severe form of functional nervous disease. Men lost control of themselves completely, very often had disturbances of the special senses,—deafness was rather common, blindness not so frequent,—and sensory disturbances of other kinds, with mutism and tremor or paralyses of various kinds, were noted. At first a great many of the cases were set down as forms of insanity and the patients were sent to insane asylums, but after careful study the purely neurotic character of the affection was determined. The cases were called "shell shock" and unfortunately, early in the war were grouped under this term, besides the neurotic cases, a number of latent injuries to the central nervous system, as from actual wounds by minute particles of shells at high velocity, severe concussions and the like. It was thought for a time that the intense compression of the air with immediate release near an exploding shell caused air at high pressure to be given off from the blood, leading to rupture of capillary arteries of the central system or other definite physical lesions resembling those of caisson disease. The prompt and complete recovery of many serious cases under proper treatment contradicted this theory and made it clear that there must be no organic basis. The term shell shock was suggestive of something much more than a psycho-neurosis, which the affection really was, and the term *nervousness,* the word sick or wounded in parentheses being added to the diagnosis "according to the external conditions to which the man was exposed at the time of breakdown," was suggested for it. This would have been a much better term but the original name maintained itself, as so often happens. The condition was entirely due to an emotional storm with loss of control over nerves, and nothing else. Its importance will be readily appreciated from the fact that during the first half of the war, one-seventh of all the discharges from the British army, or one-third of the discharges if those from wounds were not included, were for "shell shock." It was four times as prevalent among officers as among men. Cowardice was excluded as the basis and there was no malingering, except in cases readily recognizable. The study of the affection has thrown great light on the psycho-neuroses of civil life and above all has been valuable in the matter of treatment.

These patients need special treatment in special hospitals. In ordinary military hospitals, surrounded by sufferers from actual physical conditions, they are the subject of unfavorable suggestion and little incentive to get well. They must not be kept under circumstances, either at home or in hospital, where much sympathy is afforded them and their stories must not be listened to sympathetically, for they have the tendency of all neurotics to assimilate as their own, experiences gleaned from various sources. The first requisite of successful treatment is a careful examination which determines absolutely that no organic morbid condition is present. Then the patient must be given the feeling that his case is of no special signifi-

cance, but, on the contrary, is well understood and above all, has nothing exceptional in it. He must be made to understand that just as soon as the attending physician has the time to give to him, he will be able to remove his symptoms without delay. Three principles are insisted on in the methods of treatment. (1) suggestion, (2) re-education, (3) discipline. The aim of suggestion is to make the patient believe firmly that he will be cured and then after treatment that he is cured to stay so. Re-education overcomes the bad habit of lack of confidence that has been formed and discipline breaks down the psychic-resistance of the patient to the idea of recovery. For such symptoms as mutism or deafness, the patient is told that electricity will cure him and that as soon as he feels the current when the electrode is applied, his power of speech or hearing will be restored *pari passu,* with sensation. The same method is used for blindness and other sensory symptoms. Paralyses are favorably affected the same way, though tremors are harder to deal with. A cure in a single treatment is the best method, for the patient readily relapses unless he has been made to feel that he has recovered his powers completely and that it would be his own fault to permit his symptoms to recur. The cases partake of the nature of hysteria, though typical hysterical symptoms, crying, the making of curious noises, hysterical convulsions, are rarely seen at the front. The experience has made it clear that rest is nearly always an abuse in the treatment of such cases and inveterates the symptoms. The physical condition must be improved but the state of mind must be changed completely at once, if cure is to be effected.

A very interesting development of the treatment of these affections among the French, who had large experience, requiring over 20,000 places in their hospitals for the cases, was with regard to the value of severe discipline. In refractory cases, patients were put in solitary confinement without reading or writing materials or tobacco. This changed the mental attitude and helped to make counter-suggestion effective. In certain cases, strong Faradic currents were used which caused severe pain, so that patients who were mute had to scream out and those who could not use muscles were compelled to move them. Once it became known that treatment of this kind was being used, symptoms were much less persistent. The reason why the neuroses in officers were more difficult of treatment was that these measures were seldom employed on them. It became clear that the infliction of pain on a neurotic patient up to the point where he yields up his pathological suggestion is effective therapeutics. Some older severe methods of dealing with these cases which were condemned in our milder day are now justified by war discipline.

The surgical feature for which the late war was noted is the definite reconstruction work for the wounded which was organized for the first time in history. Not only artificial limbs and helpful apparatus of various kinds were provided, but the crippled were trained to do the work they are particularly suited for in their maimed condition. It was found that some 95 per cent of those who lost an arm or hand could go back to their old occupations, while a very large proportion of those who lost a leg could be trained to bench trades or given clerical or similar occupations which made them thoroughly independent of assistance. Even with the loss of both legs, a man can be self-supporting. Indeed, the care exercised in training the crippled resulted in a great many cases in giving them a better occupation in life than they had before. The temper of this aid has been such as to give men a hearty spirit of courage in facing life, so that they do not feel their handicap as an incubus, but on the contrary, are ready to do their bit in civil life as well as they did in war. The idea that they are crippled is not allowed to overcome them and the old custom of having begging cripples after the war is not to be allowed. Even the blind and the deaf are made self-supporting and at the same time given such occupation of mind as keeps them from being depressed. The effect of example on the part of some of the more courageous proved a wonderful stimulus, so that though the war left many maimed men, it did not tend to create many helpless and the spirit of helpfulness does not provide useless sympathy and paralyzing charity, but just such encouragement as enables the men to help themselves.

Chronic affections of various kinds which developed as a consequence of the war were treated by the same far-seeing after-treatment that was given to the maimed. In a word, the soldier taken in health was either dismissed, after thorough examination, in as good health as before,—or usually much better,—or else he was given the advantage of scientific thoughtfulness and pre-vision in regard to his case, so as to restore him just as far as possible to his former usefulness as a member of the community. In the years following the war these phases of rehabilitation received the closest attention from medical authorities in the former belligerent countries.

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MEDICI, mĕd'ē-chē or mā'dē-chē, a Florentine family who rose to wealth through commerce, became prominent in the affairs of the state, gained supreme power and were in general known as patrons of literature and art. GIOVANNI (1360–1429) rendered important service to Florence and became gonfalonier in 1421. His son, COSMO, the Elder (1389–1464), was called "Pater Patriæ," gained vast wealth, was a munificent patron of art and letters and combined statecraft with commercial enterprise. He was for 34 years the sole arbitrator of the republic and the adviser of the sovereign houses

of Italy. His grandson, LORENZO THE MAGNIFICENT (1449–92) governed the state in conjunction with his brother GIULIANO (1453–78) till the latter was assassinated by the Pazzi, a rival Florentine family. Escaping from this massacre he conducted a war with Ferdinand of Naples, with whom he signed a definitive peace in 1480. The rest of Lorenzo's reign was passed in peace and in those acts of profuse liberality and magnificent patronage of arts and sciences, in which he rivaled or excelled his grandfather. He left three sons — PIETRO (1471–1503), GIOVANNI (afterward Pope Leo X), and GIULIANO, Duke of Nemours. Pietro succeeded his father, but was deprived of his estates when the French invaded Italy in 1494. He finished his career in the service of France. His eldest son Lorenzo came to power by the abdication of his uncle Giuliano, who became Duke of Urbino. He died in 1519, leaving a daughter, the famous Catharine de' Medici (q.v.), queen of France. After several reverses in the family, Alessandro, an illegitimate son of the last-named Lorenzo, was restored to Florence by the troops of Charles V, and by an imperial decree was declared head of the republic, and afterward Duke of Florence. The next name of importance in the family is that of COSMO "the Great" (1519–74), in 1537 proclaimed Duke of Florence and afterward Grand Duke of Tuscany. A learned man himself, he was a great patron of learning and art, a collector of paintings and antiquities. FRANCISCO MARIA I, his son, obtained from the Emperor Maximilian II, whose daughter Joanna he had married, the confirmation of his title of grand duke in 1575, which continued in his family until it became extinct in 1737 on the death of Giovanni Gasto, who was succeeded by Francis, Duke of Lorraine. MARIE DE MÉDICIS (q.v.) (1573–1642), queen of France, was daughter of Francisco I. See FLORENCE; ITALY — HISTORY; LEO X, and consult Armstrong, Edward, 'Lorenzo de' Medici' (London 1896); 'Cambridge Modern History' (Vols. I and II, New York 1903–04); Fabroni, Angelo, 'Magni Cosmi Medicei Vita' (Pisa 1789); Heyck, Eduard, 'Die Mediceer' (Bielefeld 1897); Hyett, F. A., 'Florence' (London 1903); Horsburgh, E. L. S., 'Lorenzo the Magnificent' (London 1908); Meltzing, Otto, 'Das Bankhaus der Medici und seine Vorläufer' (Jena 1906); Roscoe, W., 'Life of Leo X' (5th ed., London 1846); id., 'Life of Lorenzo de' Medici' (10th ed., 1872); Ross, Janet, 'Lives of the Early Medici' (London 1910); Vaughan, H. M., 'Medici Popes, Leo X and Clement VII'; Brinton, 'Golden Age of the Medicis' (1927).

MEDICI, Banks of the. The opulent house of Medici owed its origin, like that of the scarcely less wealthy house of Fuggers (q.v.), to the profits of the woolens trade, the progenitors of both houses having been weavers and dyers of woolen cloths, in their time the principal constituent of European garments; the cultivation of cotton and manufacture of cotton cloths being as yet monopolized by the Saracens. Schoenhof informs us that in 1422 Florence (under the Medici) had more than 70 banks, which by the year 1472 were merged or consolidated into 33. So important were these institutions to the Florentine republic, that they earned the sobriquet of the "Fifth Estate." The Medici had 16 banking houses in different European cities. (*Journal American Bankers Association*, September 1916). In the 15th century one of the Medicis was appointed treasurer to the Papal See; in the 16th century one of the Fuggers held the same high office. It is an interesting circumstance that the former became a Platonist, while the latter joined the Reformation. Lorenzo de Medici's appointment as treasurer was made by Sixtus IV in 1471; Huldric Fugger's, by Paul III about 1549. Both of these popes afterward assailed their appointees; but the banks they controlled and the important trades they financed rendered them too powerful to be easily overthrown. The Medicean banks received deposits of money for safekeeping, loaned the same out upon collateral, discounted commercial paper, issued bills of exchange, and traded in foreign coins and bullion. They possessed mints in Florence, Urbino, Barile, Pezza and other places, in which they struck their own coins, the series beginning in 1204, upon the fall of the Greek Empire, the dates in the old calendar being 10 years earlier. These coinages enabled the Medicean banks to make highly profitable exchanges of old coins and bullion at the various emporia in Europe and Asia which were brought within the circle of their commercial influence. Their earliest gold coin (the Florin) was struck in 1252, the series being issued by the gonfalionere (Standard-bearers) of the Republic of Florence until 1533, when they were struck by the Medici as dukes of Florence, afterward as dukes of Etruria. Maintained at their full legal weight (56 English grains, fine gold) the florins continued to be current in all the ports of Europe for centuries, their only rivals being the sequins or ducats of Venice. For the history of other ancient banks. See BARCELONA, BANK OF; BYZANTIUM, BANK OF; FUGGERS, BANK OF THE; GENOA, BANK OF; TYRE, BANK OF; VENICE, BANK OF.

MEDICINE, American Academy of. See AMERICAN ACADEMY OF MEDICINE.

MEDICINE, Eclectic, embodies the principles and practice of the only established American school of medicine. The term Eclectic was not the most fortunate, for at no time has it adequately defined the school's position. When chosen, the term was very popular and was borne by several education systems and books, and was moreover well known to the laity. The name American School of Medicine, as proposed by Dr. A. H. Baldridge, one of its pioneers, would have been more expressive, would have avoided misunderstandings and would have saved the school much criticism regarding its position among the existing systems of medicine. Eclecticism is the direct successor of the American Reformed System of Medicine originated by Dr. Wooster Beach of New York City in 1825. It should not be confounded with Thomsonism (Thomsonianism), or the doctrines of the steam and herb doctors, promulgated and practised in the early part of the 19th century by Samuel Thomson of New Hampshire, the peculiar theories of which the Eclectic school never adopted; the majority of the followers of Thomson being among their most bitter antagonists. In later years, however, many of the Thomsonians joined the Eclectic school and creditably assisted in up-

uilding it. The most successful organizer of ie Eclectic school was Dr. Thomas Vaughan Iorrow of Kentucky. The investigations in iedical botany and materia medica by Schoepf, Benjamin Smith Barton, W. C. P. Barton, Constantine Rafinesque, William Tully and thers gave an impetus to the movement which esulted in the establishment of the new school. 'he Reformed School of Medicine, by which ame what was later denominated Eclecticism as first known, was organized in opposition to ie drastic practice of the dominant school of iedicine,— bleeding, blistering, and the abuse f the salts of mercury and antimony,— against hich Eclectics, as well as the followers of homson and Hahnemann, protested. Instead f these barbarous remedies the reformer ought to substitute milder measures and to nploy vegetable medicines whenever possible. et, in the light of the present the substituted ractice of the early reformers would be re- arded as but little less barbaric than that which ley sought to supplant. The basis of Eclectic hilosophy was the sustenance of the vital orces, the avoidance of depleting remedies, and ie selection, as with the ancient Eclectics, of ie best of remedies and means from all ources, even despising not the primitive medi- ines of the untutored American Indians. They id not rest contented, however, with merely selecting the best"; they endeavored to im- rove on such selections. To the reformer the ractice of the dominant school was cruel and nhuman, the remedies barbaric. Out of the ommon stock of remedies he chose those best uited to his purpose in what he believed to e a more humane practice. He looked for- ard to certain ideals and objects not in accord ith the views and practice of the dominant chool. For his presumption in thus opposing ie authorities in medicine and by inaugurating nwelcome innovations he was branded an regular; was ostracised by the self-styled egular physicians. An outcast, he was thus orced to organize a school in accord with his ieories and practice.

There are three epochs in the history of Ec- ctic medicine,— the period of reformed medi- ne, from 1825 to 1845; the formative period, rom 1845 to 1869, which was largely concerned organization, and study of plant remedies; id the period of specific medication, from 869 to the present, in which the best work of e school has been accomplished, and during hich the theory of specific medication was romulgated and has been most largely prac- ed.

The educational history of Eclecticism dates om 1825, when Dr. Beach privately instructed udents at his clinic in New York, where, in 27, he established an Infirmary, which in 29, he expanded into the Reformed Medical cademy. In 1830 it assumed the more digni- d title of the Reformed Medical College of e City of New York. It was well equipped d continued in operation until about 1838. extbooks of a high order were prepared by . Beach. A national society was formed and om this body an expansion movement was gun by the selection, in 1830, of Dr. John J. eele as an agent to proceed westward and plore the towns on the Ohio River with a w to selecting an eligible site for a branch the New York College. A circular of the society having reached Worthington, Ohio, Col. James Kilbourne, president of Worthington College, invited the promoters to establish their school in that town. Dr. Steele accepted and Drs. Thomas Vaughan Morrow and Ichabod Gibson Jones were sent to perfect the organization. The Reformed Medical Department of Worthington College, as this school was called, entered upon a successful career in 1830, with Dr. Morrow as the leading spirit, but lack of proper facilities, the machinations of enemies, internal dissensions, and the financial crisis of 1837 caused it to be suspended in 1842. Dr. Morrow next removed to Cincinnati, Ohio, and assisted by Drs. Lorenzo Elbridge Jones and Alexander Holmes Baldridge, at once organized the Reformed Medical School of Cincinnati. In 1845 this college was chartered by the State of Ohio as the Eclectic Medical Institute. From this time the term *Eclectic* has been employed to designate the system and its physicians.

The formative period of Eclecticism began with the chartering of the Eclectic Medical Institute in 1845 and ended with the introduction of specific medication in 1869. During this period large classes attended the Institute. *The Western Medical Reformer,* begun in Worthington in 1836 and suspended in 1838, was now revived and published as the *Eclectic Medical Journal.* Barring a brief half year suspension this periodical has continued to be published to the present time. In this period, Dr. John King, justly styled the father of modern materia medica, began the publication of his numerous textbooks, among which the 'American Dispensatory' gave the school an enduring and monumental work on materia medica. The pharmacy of the school advanced from crude drugs in powder, infusion and decoction past the resinoid and alkaloid distraction to improved galenicals. In this connection be it recorded that Professor King discovered and introduced the resins of podophyllum and macrotys, which together with the alkaloids of hydrastis and sanguinaria, were afterward prepared by Dr. William Stanley Merrell. These valuable agents together with the oleoresins of iris and capsicum attracted the attention of pharmacists. A host of indefinite compounds was added by others and the market was flooded with what purported to be Eclectic resinoids or concentrations. This heterogeneous class of pharmacals was denounced by Professor King and others who had sought to introduce only elegant and definite compounds. This much abused class of resinoids served, however, a temporarily useful purpose in the evolution of a more perfect materia medica. Of these preparations, only those made after the methods of Dr. King, and the alkaloids of hydrastis and sanguinaria have survived and singularly are now mostly employed by practitioners of the dominant school. During this period Eclectic colleges were established at Rochester and Syracuse, Louisville, Philadelphia, New York and Cincinnati. The majority of these were short lived and some of them had a strong leaning toward the system of botanic medicine now represented by the physio-medicalist. The Eclectic Medical College of Pennsylvania for many years in good repute, finally drifted away and during the later years (since 1871) was neither recognized by Eclecticism nor others. In 1856, a portion of the faculty of the Eclectic Medical Institute formed a rival college in Cin-

cinnati which had a large following. This school was absorbed by the Institute in 1859. The Civil War seriously threatened the educational progress of the cause and the withdrawal of a large quota of Southern students caused a marked shrinkage in the attendance at the Northern schools. Times were hard and the outlook gloomy. Dr. John Milton Scudder, a graduate of the Eclectic Medical Institute in 1856, now became the head of that institution. By strict business management he inaugurated a period of renaissance and Eclecticism soon became a recognized force in medicine in America. Specific medication, introduced by Dr. John M. Scudder in 1869, though at first vigorously opposed, is at present the basis of practice of fully three-fourths of the Eclectic physicians and is the leading therapeutic doctrine taught in all the Eclectic colleges. In fact modern Eclecticism is the practice of specific medication. Its theory is as follows:—Disease is a wrong or impairment of life. It is manifested clinically by certain well-defined symptoms. The totality of symptoms express a condition, to which, in the usual nosological classification, a special name is given. This disease name is of value only in the study of the natural history of diseases, for statistical data, for the purpose of recognizing contagious and infectious diseases, and for establishing a prognosis, certain necessarily fatal diseases allowing only of palliative treatment. The specific medicationist, like practitioners of other schools, pursues such a method of nosological diagnosis for the purposes named, but not as a guide to treatment, in which to him it is of little or no value. For therapeutic purposes he reverses this process and studies his case by analysis, not by synthesis, to discover, if possible, the varying conditions which make up the disease, as evidenced by specific and well-defined symptoms revealing disease expressions. Remedies have a certain force, and are definite in action. Like effects follow like causes. Hence, having found, by repeated experimentation, the opposing action of a drug in a certain condition of disease, as expressed by certain specific symptoms, objective or subjective, the same remedy will always relieve or cure like abnormal conditions. The believer in specific medication holds that there is a fixed relationship between drug force and disease expression.

The Eclectic has no specifics for *diseases* but specific remedies for specific conditions of such diseases. Specific diagnosis implies diagnosis to discover the condition curable by a certain remedy, as established by previous experimentation, and specific medication means the application of the known remedy for the pathological condition so found. Specific diagnosis is therapeutic, not nosological diagnosis. In practice the specific medicationist is guided in the selection of his remedy by "specific indications," as illustrated by the few following examples: The strong, excited, bounding pulse indicates veratrum viride; sharp, cutting or lancinating pain in serous tissues, bryonia; the full, oppressed pulse with a sensation of præcordial fulness and dyspnœa, lobelia; marked periodicity, with moist tongue, open pulse and freedom from nervous excitement, quinine; cadaverous odor of the secretions, potassium chlorate, etc.

The modern Eclectic recognizes no law of cure, and does not accept a remedy as a specific until the extended successful employment of it in some particular condition has given it the right to be so called. Empiricism and experimentation are the foundations of knowledge concerning each remedy denominated a specific medicine. The havoc wrought Eclectic pharmacy at the close of the formative period had now to be remedied. The school had been nearly shipwrecked on the shoals of commercial selfishness, as seen in the instance of the resinoids. Calamities often bring about future good, so in this instance the commercial mistakes of a few gave a renewed impetus to better the conditions of Eclectic pharmacy. Uncertain preparations were supplanted by definite medicines. As a result the school has now a materia medica and system of therapeutics much sought by the descendants of those who endeavored to block the efforts of the pioneer Eclectic, in his zealous contention for pure and representative medicines. Dr. Scudder, supported by Dr. King and others, advocated office pharmacy as a step toward a better knowledge of drugs and to secure definite remedies. Special attention was given green and freshly dried products. Formulas were published for the preparation of specific medicines. Finally, in order to secure the integrity of these medicines and protect them from conscienceless manufacturers, Dr. Scudder copyrighted the labels. These bore the title "Specific Medicines" and gave the specific indications for their use. The manufacture of medicines bearing these labels was entrusted to competent pharmacists and from that time the school has been free from objectionable pharmacy. Dr. Scudder advocated the use of specific medicines in the study of the relationship of medicine to disease expressions. The Eclectic of the formative period selected from other schools, but endeavored to improve. He substituted milder for harsher methods; he opposed the use of the lancet and blister, and the abuse of mercury and antimony salts. The modern American Eclectic advocates the use of kindly curative remedies, and the avoidance of depressing or depletive medication. He has been the pioneer in the study of the indigenous materia medica, with special reference to specific indications and specific uses of medicines employed. He contends for the best possible pharmacy so that the minimum amount of medicine may accomplish maximum results. Harmful medication as exemplified in excessive drugging he has consistently opposed, heroic over-drugging having been one of the most potent causes leading to the necessity for the establishment of an Eclectic school. He advocates liberality of thought, the highest medical education, the cultivation of professional dignity, and the ethics that govern gentlemen.

The position of the Eclectic school of medicine is now well established, and the attitude of malice and persecution formerly shown it by rival schools is fast becoming a memory. The two colleges had 253 Eclectic students in 1926. For a period of about 10 years this numerical relation has remained nearly stationary, but because of better facilities for teaching, enlarged literature, and harmony in the ranks of the school it has never occupied so favorable a position nor had a better outlook for the future than it has to-day. Never before in its history has it been so free from internecine bickerings, attacks by rival schools, and unpleasant entangle-

ments and alliances. It challenges all ages in the wealth and completeness of its materia medica. Recognizing the merit of the work accomplished the regular profession in many localities now invites Eclectics to join its associations providing they drop their distinctive title. This the Eclectic is unwilling to do, believing that the school has earned the right to be regarded and recognized as a distinct set in medicine. Its work in the special fields of materia medica and specific diagnosis and specific medication entitle it to this right. The Eclectic school has a strong national organization and numerous State and local societies. A national reform association was founded in 1829, and a second at Worthington, Ohio, in 1836. In 1848 the first National Eclectic Medical Association was organized in Cincinnati, Ohio, with Dr. T. V. Morrow as president, and it held annual sessions until 1858. The present National Eclectic Medical Association was organized at Chicago, Ill., in 1870, with Dr. John W. Johnson, of Connecticut, as president. It holds annual sessions, meeting in various cities throughout the United States. Eclectic practioners now hold positions as examiners in the more important life insurance companies, and are not now debarred from the army and navy medical service as in the earlier days of medical ostracism. No discrimination is now made against them as surgeons for the great railway systems. These recognitions have been earned in the face of vigorous medical opposition, by the consistent and honorable course pursued by the Eclectic school as a whole. The Eclectic Medical College of Cincinnati, Ohio, the parent school of medical Eclecticism, and the Middlesex College of Medicine, Cambridge, Mass., are the leading colleges of this American system of medicine.

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MEDICINE, History of. As far as we can determine or surmise disease has existed since there was life on earth. There was a time when this earth consisted only of inanimate matter. It is quite certain that death began almost simultaneously with the beginning of life. Disease in one form or another must have begun almost as soon. It may be that the earliest form of disease was metabolic, merely a manifestation of the wear and tear of the living organism. Soon perhaps, in addition to these changes associated with senescence, abnormal changes commenced to develop in certain subdivisions of living matter, changes which altered definitely the character of these subdivisions, and which were not the simple changes resultant on ageing.

It is characteristic of what we understand as life that the constituents which make it up are in a state of constant activity, the component elements breaking down and being replaced by additional elements derived from without. The process of building extraneous inanimate material into living tissue has come to be known as anabolism while the breaking down, or disintegration of the living structure has been called katabolism. The whole process, the simultaneous building up and breaking down constantly going on is termed metabolism.

Metabolism, the process of living, can continue only as long as there is available material for repair and for growth, for reproduction and the other functions commonly identified with life. In remote periods, before life had been so far differentiated as to be recognizable in the forms which we now see, all nourishment, all materials for the anabolic processes were without doubt derived from inanimate, inorganic matter. With the progress of evolution, however, the time arrived when, with both living and dead matter surrounding a living structure, the latter developed a capacity for utilizing both the inorganic and the organic substances for its own purpose of living. And thus living matter, or living tissue, developed the capability of obtaining sustenance from other living organisms. This condition, one body living at the expense of another living body, has been termed parasitism. And thus by degrees parasitic diseases have developed. In the animal and vegetable kingdoms parasitic disease takes many forms, the commonest being so called infectious disease.

Infectious disease or parasitic disease no doubt commenced early in the stages of evolution. Today the human body may be invaded by small microscopic living structures known as bacteria which derive their sustenance from and live at the expense of their host. The earliest forms of life were similar simply organized microscopic bodies. But even at an early stage it now appears probable that these so-called unicellular micro-organisms suffered from parasitic disease. Only within the past few years has experimental work suggested that bacteria which cause infectious disease in man, themselves suffer from parasitic disease, such that they may be destroyed entirely by some even more minute forms of living matter multiplying at their expense.

And so, long before man appeared upon the earth, living matter suffered from one form or another of most of the disease types known today.

As soon as man had developed sufficient intelligence to distinguish ageing from metabolic disease, from parasitic infection, in short the occurrence of a diseased state, to interpret and describe pain and the other symptoms characteristic of disease, and to wish to relieve himself or his neighbor of this abnormal state, the practice of medicine in its crudest form took its beginning.

Among the earliest savages, as indeed among the savages of today, disease was customarily looked upon as of supernatural origin, the work of an unfriendly demon or a form of punishment inflicted by an angry god. Disease was ascribed to special demons of disease, the machinations of departed spirits or of ghosts, the activities of slain animals, to human enemies possessed of supernatural powers and the capability of casting spells, or to the wrath or vengeance of one of the tribal gods.

Attempts to rid the body of disease consisted therefore in making sacrifices calculated to propitiate the offended deity, or of doing penance for one's sins even to the point of actual personal torture, self inflicted or inflicted by others, or by seeking the intervention of other more friendly spiritual forces in behalf of the victim. If the disease resulted from invasion of the body by unfriendly demons, the proper treatment lay in making the body as unpleasant an abode as possible for the devils.

This was accomplished by starving, beating or otherwise torturing the victim, by giving emetics to cause vomiting, etc. Again, the evil genii might at times be enticed from their new abode by the offering of a more pleasant dwelling. Thus the demon of yellow jaundice might be lured into the body of a canary bird.

And so we see the medicine man of the savages steeped in spiritualism, employing grotesque ritual in the treatment of his victims, oftentimes causing more serious harm than the ravages of the disease which he had been attempting to cure.

The belief in a supernatural origin for disease, arising in the savage's terror of the incomprehensible, persisted far into historical times and we see it still manifested in the mythology and theology of the Greeks and Romans. Indeed, even in the Christian religion, particularly in the early centuries of our era, we repeatedly observe evidence of belief in the origin of disease as an act of divine retribution coupled with the idea of relief therefrom through propitiation of the omnipotent wrath.

The earliest individual physician known in history was Sekhet'-enanch, an Egyptian who lived about 3000 B. C. From a study of records in Egyptian tombs we learn of the existence even in his day of the lancet and of an instrument for cupping. The earliest operation known is that of trephining of the skull, a procedure which even today is serious and difficult. This was performed to provide portals of escape for demons such as the demon of headache. We learn from the Ebers Papyrus, written about 1500 B. C., that pills, potions, inunctions, inhalations and plasters were all used at that time. The value of the poppy for soothing crying infants was recognized. On the other hand, ignorance and superstition were still strongly active. Thus «against all kinds of witchcraft, a large beetle, cut off his head and wings, boil him, put him in oil and apply to the part. Then cook his head and wings, put them in serpent's fat, warm it, let the patient drink it.»

Early advance in the knowledge and practice of medicine was slow and intermittent and our records thereof are most fragmentary. The ancient Hindus of India progressed to a degree truly remarkable for their epoch, both in their knowledge of medicine and particularly in the art of surgery. Most of our information of these ancients is derived from the Vedas or «Books of Wisdom,» the fourth of which, written around 700 B. C., gives us the major portion of our information. As early as this, new noses were created from cheek and forehead flaps, supraorbital nerves were sectioned for neuralgia, and laparotomy was discussed. In medicine also, remarkable strides were made, particularly in army sanitation, and the establishment of hospitals and of asylums for the blind and the lame.

True medicine had its origin in the early Greek civilization. The Greeks of three and four hundred years before Christ worshipped many gods and demigods. A different god or goddess for every phase of their existence. Among these was Asklepios, (more commonly called by his Roman name, Aesculapius), the god of medicine. To the temples of Aesculapius went all who might, of those who were diseased, there to regain if possible their former health. This was accomplished by prayer, by sacrifice or through other methods of imploring divine intervention. Customarily, while sleeping before the altar of Aesculapius one would receive in a dream the knowledge necessary to recover health.

The Greeks were primarily thinkers or ponderers. Their activities and writings express a natural stage in the evolution of the developing intellect, with its desire to know the why and wherefore of all things. With few or no instruments with which to carry out accurate studies or investigations in any of the lines now known commonly as science, such as physics, mathematics, medicine, etc., they could but recognize the existence of certain phenomena, reflect upon them, reason as to their possible causes, and theorize as to their modes of action. This was but to philosophize and the ancient Greeks became the greatest of all philosophers. They had developed the attributes of inquisitiveness and were searching to know the why and the wherefore of all things with which they came into physical or mental contact.

It was at this time that the temples of Aesculapius had reached the pinnacle of their prominence and the priests and others associated with the work of the temples were searching to know more of the phenomena of disease.

What an opportunity for the study of disease, in these localities where the sick from the civilized world were aggregated! And what a paucity of instruments wherewith to make conclusive investigations! No stethoscope, no thermometer, no methods for examination of the urine, no laboratory facilities whatsoever. Nothing beyond the five senses, —sight, hearing, taste, smell and touch, but reinforced with a truly remarkable insight and judgment and unusual interpretive faculties.

From past experience the priests soon recognized the types of illness with greatest promise of relief through the intervention of Aesculapius and they selected only these from among the thousands seeking admittance into the temples. Consequently the percentage of cures was many times higher than had they allowed all to enter, and the fame of the temples spread. Likewise did their wealth increase for it was the custom, with health regained, to leave large votive offerings to the benign deity.

But as the reputation for healing spread, even more visited the temples and more were perforce turned away. Many of these, too ill to return or lacking sufficient funds, were obliged to remain in the neighborhood and were cared for by lay workers. These latter termed Asclepiadæ were not infrequently men of unusual brilliance. They, above all others, possessed a tremendous opportunity for the speculative study of the symptoms and course of disease.

The temples of Aesculapius and the neighboring buildings where the less fortunate sick were attended became veritable huge sanatoria in which hygiene and hygienic principles were rigorously enforced. The importance of diet, of baths and of various forms of mental and physical recreation was fully recognized. The Asclepiadæ were as a rule on excellent terms with the priests in the temple and had no difficulty in following their cases whether they re-

MEDICINE, HISTORY OF

Right: Hippocrates (460?–?377 B.C.), Greek physician, known as the "father of medicine," visiting a patient in Athens.

Center: Claude Bernard (1813–1878), a French physiologist who studied problems of digestion.

Bottom: Vaccination of patients with smallpox virus taken directly from the infected animal, about 1872, in the United States.

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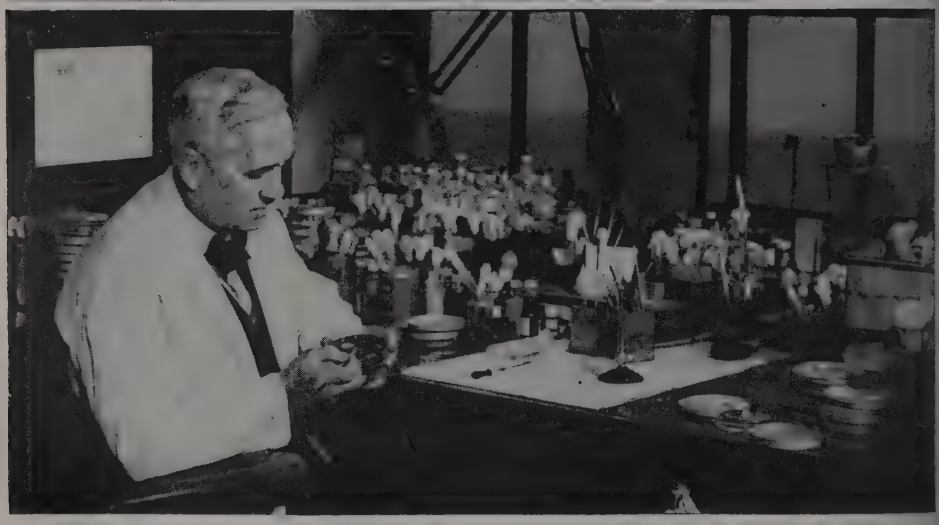
Left: Louis Pasteur (1822–1895), French chemist, vaccinating a child.

Center left: Dr. Robert Koch (1843–1910), German physician and bacteriologist. *Center right:* Paul Ehrlich (1854–1915), German bacteriologist and pioneer in immunology.

Bottom: Sir Alexander Fleming (1881–), British bacteriologist, discoverer of penicillin.



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nained under their care or passed on into the emple. The opportunity was enormous.

The fortunes of the world were materially dvanced when in 460 B. C. Hippocrates, the son nd grandson of physicians, was born. As one f the Asclepiadæ he was trained from early outh in the profession of medicine. One of he keenest observers of all time, Hippocrates vas at the same time an able philosopher. He vrote prolifically and with such clear under-tanding of the symptoms of disease that in his vritings and those of his pupils we recognize nany of the diseases as they are diagnosed oday. While the existence of various maladies vas recognized long before the time of Hip-ocrates, he in particular stressed the impor-ance of differentiating disease entities by a tudy of their symptoms. The greatest Hip-ocratic contribution to medicine and that which bove all others justly allows him the title of 'ather of Medicine was his successful attempt o divorce the phenomena of disease from su-erstition and the idea of supernatural forces. Ie preached that disease is the result of natural auses which must be searched out and con-idered in a most critical spirit until all sources f error are eliminated as far as possible. For-unately also he founded a school of medicine vhere the principles which he was evolving vere put into practice. These were, (a) the bjective investigation of disease, (b) the study f etiology or cause, and (c) an insistence upon ie value of expectant treatment, combined with iild therapeutic measures.

Pre-Hippocratic medicine, steeped in tradi-on and based to a great extent upon idolatry, ad little foundation of fact upon which to uild a rational system of treatment. How ould one prescribe the proper remedy in any athologic condition when practically nothing as known of the anatomy or physiology of the uman body? One must have an understanding f the makeup and mechanism of the machinery hich one is attempting to repair to keep it unning smoothly. Before, and indeed through e Greek civilization, little was known of natomy save those facts discovered by the riests in their dissections of sacrificial animals. ven here the dissections were of a most super-ial character. The organs of sacrificial ani-als were studied for good or evil omens. The ver, because of its size, was considered of un-ual importance. From its examination the urse of future events was predicted. Among e Babylonians hepatoscopy was practiced as rly as 3000 B. C. If the gall bladder were und to be swollen on the right side, it in-cated let us say, an increase in the strength the king's army and was a favorable omen. long bile duct pointed to a long life even as a ngthy line in the palm of the hand today is nsidered by the superstitious as indicative of ngevity.

Hippocrates upset the old tradition, divorced, part at least, the practice of medicine from eological superstition and paved the way ward rational study of the human body. His ritings and those of his followers were soon read over much of the known world and be-me the standard for professional conduct. ippocrates lived in the golden age of Pericles, great epoch of ancient Greece. Not long er his death the beacon of learning in Greece rned low, and the centre of civilization was transferred to Alexandria in Egypt where Ptolemy, one of Alexander's generals, founded a great museum and centre of investigation and teaching. He brought together minds of the times in the various branches of science and philosophy. Here, for the first time, extensive dissections of the human body were carried out and although the interpretations of the findings were more often erroneous than not, some progress was made toward a clearer understanding of anatomy and physiology.

With the growth of the Roman Empire, we observe a new light shining forth in the history of medicine,—Galen, the greatest of the Roman physicians and the greatest physician since Hippocrates. He was born in 130 A. D., of Greek parentage. He was a keen observer, an experimenter and at the same time a philosopher. He was the fashionable physician of his time and, it is interesting to note, collected good fees. It has been stated that he received the equivalent of $2,000 for a fortnight's attendance upon the wife of a prominent Roman.

Galen's greatest contribution was in the study of anatomy and physiology. He had studied anatomy in Alexandria and was thereby well grounded. Most of his investigations were made on apes and pigs. His most valuable permanent contribution was in osteology, or the study of bones. His description of the bones of the body would not require great change to be accurate today.

Galen's hypotheses of physiology, or the working of the various organs, were based on close and careful observation, but his interpretations were usually incorrect. When we realize that the writings of Galen completely dominated the practice of medicine for the next thirteen centuries we may understand how, with erroneous conceptions of the functions of the various organs, scientific progress was slow. It was not until hundreds of years later, when men arose who dared dispute the teachings of Galen, that real progress in medicine recommenced. Prior to Galen's time it had been understood that the arteries were air-containing. It was from this that the name was derived. Galen knew of the valves of the heart and determined the direction of flow of the blood as it entered and left the organ, but he did not appreciate that it was a pump for distributing the blood, regarding it rather as a furnace from which the innate heat of the body was derived. He determined definitely that blood was present in the arteries and veins but he considered it to be of two different types and did not recognize that the blood circulates through a closed system including arteries, veins and capillaries.

During his time we find various schools of medical thought of which three were dominant. The first school considered of greatest importance the discovery of the cause of disease and its removal. The sole interest of the second was with the disease and not with the condition from which it arose. The last group selected their remedies only on the basis of past experience, using what had previously been found in similar conditions to be beneficial, paying little or no attention to the mechanism by which the results were obtained. In the treatment of disease at this time extracts of roots and herbs and similar preparations had a great vogue.

The development and spread of Christianity was a distinct deterrent to scientific progress. With the advent of the conception that existence on this earth is of importance only as a preparation for the world to come, the evanescent problems of our life were greatly ignored. It was not so much that science was taboo as that in view of the teachings of Christianity science was superfluous. «Does your skin roughen without baths? Who is once washed in the blood of Christ need not wash again.»

From the death of Galen, about 200 A. D., up to 1542 the high water mark of the Renaissance, or rebirth, medicine was dominated by his teachings and, except in isolated localities, practically no progress was made. This was the period of which we speak as «The Dark Ages.» Fortunately in three regions of the civilized world, the light was kept burning, albeit dimly. Southern Italy and Sicily has always been more Greek than Roman and in this environment the school of Salernum became the centre of medical studies. The school flourished throughout this time and made some permanent contributions to the progress of medicine.

With the separation of the Roman Empire into the Western and the Eastern Empires, the latter, with its centre at Constantinople less influenced by the Christian doctrine, kept alive the Greek medical tradition. Byzantine medical science gradually decayed, however, and by 1453, when Constantinople fell to the Moslem invaders, the few Greek scholars who remained were dispersed and with them went many precious manuscripts.

But the most important path through which the early Greek knowledge, the knowledge of Hippocrates and of Galen and their contemporaries, was kept alive was through the Arabian infidels.

As the Arab hordes swept from Arabia across northern Africa conquering all in their path and finally subjugating parts of southern Europe, particularly Spain, their appetite for knowledge grew and they gathered to them the great scholars of the times, founding famous centres of learning.

«The world has but once witnessed so marvelous a spectacle as that presented by the Arabs in the 9th century. This pastoral people, whose fanaticism had suddenly made them masters of half of the world, having once founded their empire, immediately set themselves to acquire knowledge of the sciences which alone was lacking to their greatness. Of all the invaders who competed for the last remains of the Roman Empire they alone pursued such studies. While the Germanic hordes, glorying in their brutality and ignorance, took a thousand years to re-unite the broken chain of tradition, the Arabs accomplished this in less than a century. They provoked the competition of the conquered Christians—a healthy competition which secured the harmony of the races.

«At the end of the 8th century, their whole scientific possessions consisted of a translation of one medical treatise and some books on alchemy. Before the 9th century had run to its close, the Arabs were in possession of all the science of the Greeks; they had produced from their own ranks students of the first order and had raised among their initiators men who, without them, would have been groping in the dark; and they showed from this time an aptitude for the exact sciences which was lacking in their instructors whom they henceforward surpassed.»

One in particular stands out during the Arabian domination, Avicenna, the «Prince of physicians,» the rival indeed of Galen, among the great names of medicine. Born about 980 A. D. he became a prolific writer, and was the author of the most famous medical textbook ever written. It was called the 'Canon,' and was followed so blindly that it came to be looked upon as infallible. It was indeed the physician's bible.

Arabian medicine made no noteworthy contributions to anatomy or to physiology since dissections were not permitted, but certain new and important diseases were described and a number of valuable remedies were produced, derived chiefly from the vegetable kingdom. The Arabian hospitals were unusually well constructed and organized. Valuable contributions were made in the study of chemistry and chemical substances were introduced in the treatment of disease.

During the Renaissance, with the resurrection of desire for knowledge in Christian countries, medicine and other sciences were reclaimed from the Arabs chiefly through the Crusaders returning from the Holy Land and from the Arabian cultural centres in Spain.

In the 13th century great universities arose throughout Europe, many being associated more or less closely with the monasteries. Two men stand out as the torch bearers of the period, stirring others to a study of the phenomena of nature and of life. These were Albertus Magnus and Roger Bacon whose «chief merit is that he was one of the first to point the way to original research as opposed to the acceptance of authority—though he himself still lacked the means of pursuing this path consistently.» His teachings were a protest against the acceptance of the ancient tenets of Galen.

The dawn of medical Renaissance will always be associated with the name of one concerning whom contemporary and modern opinions have been at great variance. Paracelsus, called by many the prince of quacks, the greatest of charlatans, hailed by others as one of the greatest physicians. A true medical revolutionary, he was bombastic in his utterances and iconoclastic in his teachings. His fierce attacks upon the medical attitudes of the day brought him into trouble wherever he would go. With the established Church also he was *persona non grata*. Space does not permit a discussion of the interesting though erroneous teachings of Paracelsus. His contribution to the progress of medicine was in the realm of chemistry. Up to his time chief interest of the alchemists had been the discovery of the elixir of life, the secret of perpetual youth and the finding of some means by which gold might be made from the baser metals. Paracelsus' interest in chemistry on the other hand was based on his hope that many chemical substances might be found which would have definite value in the treatment of disease. He established the use of mercury in medicine, and recognized the value of other chemical principles. Paracelsus died in 1541.

The following year saw the publication of wo epoch-making books in the history of cience. First, Copernicus, the great astrono- ner, demonstrated conclusively the existence of he solar system and the fact that the earth evolves about the sun. Second, Vesalius pub- ished his remarkable work on anatomy. From he death of Galen until 1542 our knowledge of natomy had made but little progress.

Vesalius, a Belgian, was made professor f anatomy and surgery in the great University f Padua when he was but 25 years of age. Ie was a tremendous student and a dominant ersonality. Men from the remotest parts of Europe attended his anatomical dissections and ectures. Within three years he had collected nough material and had accumulated sufficient rawings of anatomical figures to place his ook in the hands of the printer.

Vesalius is the true founder of modern natomy. His anatomy is with few exceptions he anatomy of today. His writings, daring to uestion the authority of Galen, were received ith scorn and abuse. Although he had en- husiastic friends, the majority were against im. He was a prolific writer and had volumi- ous and valuable manuscrips not yet published. Thoroughly disgusted with the attitude of his ellow practitioners, in a fit of anger, he threw hem all into the fire and gave up forever the tudy of anatomy. But his anatomy lives today nd Vesalius will go down through the years s one of the great lights in medical history. Not until 1542 did medicine have a correct con- eption or understanding of the anatomy of the uman body.

In Padua, about 1600, we find a young nglish student, William Harvey, studying un- er one of the successors of Vesalius. Harvey's istruction in anatomy was the best of the eriod. Remember that although anatomy had ade distinct progress the physiology was still at of Galen. The vascular system was still nderstood to contain two kinds of blood, the eavy thick blood in the veins, which carried ourishment from the liver to all parts of the ody, and the lighter blood containing the vital pirit which pulsated back and forth from the eart as the tide will ebb and flow, distributing ital heat and life to all parts of the body. he lungs fanned and cooled this vital blood cting as a bellows.

Harvey had studied the veins carefully at adua and had observed, as had his teacher, e presence of small valves in the veins. This ecluded the possibility of back flow in these ssels and further studies of the valves of the art suggested to Harvey the possibility that e blood might circulate from the heart rough the arteries into the veins and back ain to the heart. By ingenious experiment arvey proved the correctness of his theory nd in 1628 published a small book in which he scribed his experiments and conclusions. his was the beginning of the science of ex- rimental medicine. So great was the value nd significance of Harvey's contributions, not one to medicine, that his book can be found day in Dr. Eliot's collection of the greatest ritings, the «Harvard Classics.»

The establishment of the circulation of the ood was a small fact indeed when compared th the rest of our knowledge of physiology day, but it completely upset the only pre- existing physiology, that of Galen. It was the beginning of modern physiology and from the time of Harvey to the present, knowledge of the workings of the human body progressed by leaps and bounds. All is not yet known but that which is known has been learned through experimental medicine rather than through mere conjecture.

By the middle of the seventeenth century we find medicine in the possession of accurate knowledge of anatomy and ever increasing knowledge of the true physiology of the human body. Now for the first time begins a study of the anatomical results of disease. Vesalius and many of his contemporaries had recognized abnormal conditions of organs at necropsy, but they had not followed these patients through life and had paid little attention to the abnormalities. The establishment of modern pathology awaited a group of practicing physicians, one of the earliest and most notable of whom was Morgagni, who attended their patients making careful physical examinations and examined them after death, searching explanations for the abnormalities found during life.

Now the science, study and practice of medicine progressed rapidly. Pathology, the anatomical study of the results of disease, brought a much clearer perception of the nature of disease and enabled investigators to differentiate the types thereof. Among the leaders of the time we must pause to mention John Hunter, one of the greatest clinicians of his period, a man who combined the qualities of Vesalius, Harvey and Morgagni and who did more than all others before him to place treatment on a scientific basis. We are accustomed to divide the treatment of diseases into two epochs. That from the time of Galen to Hunter, and the second from the time of Hunter onward. Hunter marks the severance of the last link of the chain which bound physicians blindly to the teachings of Galen.

In 1819 Lænnec devised the stethoscope thereby beginning the day of physical examination in diagnosis. Richard Bright, in 1836, had studied the urine of diseased individuals and examined their kidneys at autopsy and had been able to demonstrate disease of these organs in individuals with albuminuria. Since then nephritis has been termed both popularly and in medical practice, Bright's disease.

In 1796 Jenner, a country physician, had successfully protected individuals against smallpox by inoculation with the virus of cowpox. The significance of this discovery may be understood when we realize that at his time few individuals reached adult life without being marked with the dread disease. His work was revolutionary, but there was not even a beginning of understanding of the mechanism whereby the immunization was accomplished until fully sixty years later when Louis Pasteur, a young French chemist, began his work upon fermentation. This led to his study of the fermentative diseases of wines and beer and his discovery that they were due to minute living organisms. The microscope had been invented about 1590. Pasteur's work led to his conception of animal disease as due to similar microscopic viruses. There followed his invaluable work in eliminating disease in silk worms, then his successful immunization of animals against anthrax and of man against hydrophobia.

In 1876 Robert Koch a physician practising in a small town in Germany, founded the science of bacteriology. His discovery of the bacillus of tuberculosis revolutionized our methods of treatment of this disease. In 1867 Joseph Lister, an English surgeon, first applied Pasteur's and Koch's theories of the bacterial causation of disease to the prevention of wound infection during surgical operations. Previous to his time practically all surgical wounds had been infected and many had died from resulting septicemia. Lister's work in antiseptic surgery later was supplanted by modern aseptic surgery.

Can we conceive the pain and suffering of a serious surgical operation performed without anesthetic? Consider for a moment the tremendous boon to humanity in the discovery of the anesthetic properties of ether, first publicly established in Boston in 1846.

Morgagni, the founder of gross pathology, was followed around the middle of the 19th century by Virchow, who transferred our conception of the seat of disease from the microscopic organ affected to the microscopic cell or unit of that organ.

During the second half of the 19th century continued advances in the study of the glands of internal secretion led to new conceptions of certain types of diseases and opened the way to the cure of certain previously incurable maladies.

Medicine of the last quarter of the 19th century was dominated by the knowledge of structural pathology, by the observations of men of the type of Morgagni and Virchow. Their chief interest was in the character and extent of the anatomical damage in the various organs. Most of the knowledge acquired was at autopsy and showed the *results* of disease. Study of these characteristic and terminal changes, many of which showed little promise of being altered by therapeutic means even during life, tended toward decreasing confidence in the efficacy of various procedures in treatment.

Among the many advances in the knowledge during the first quarter of the twentieth century that in the study of *functional* pathology has been perhaps the most helpful.

Since the advent of biochemical methods, we can now study in the clinical laboratory, the reaction of the various tissues of the living body to certain test reagents or can analyze accurately the chemical products of metabolism from different organs as found in the blood, urine or elsewhere.

Take for example the kidneys. During the dominance of structural pathology we studied the urine for evidence of kidney disease and, finding albumin and casts to be present, could state that the kidneys were affected. How serious was the extent of the damage we could only surmise. Indeed it was not until after the patient's death that we were able at autopsy to obtain a clear picture of the condition of the diseased organ.

Now, we may determine the secretory capacity of the kidney with the phenolsulphonephthalein and other tests, determine its ability to excrete solids with the two-hour renal test, learn concerning its ability to excrete water by the performance of a water excretion test, and through a study of the blood or even of the saliva we may gain accurate knowledge as to whether substances which should be excreted by the kidneys are being dammed back into the blood stream. We can learn not only whether changes exist in these various features of kidney function but we may know at the same time how extensive are these changes. In other words we are in a position to study and to know quite accurately the functional capacity of the kidneys while the patient is still alive and can therefore more intelligently direct the treatment.

Progress in the knowledge and treatment of disease has indeed gone far. Far from the incantations of the savages, from polypharmacy of the middle-ages when each root and herb had some curative function, God-given and begging for recognition. We have indeed gone far from that time when under the dominance of the «doctrine of signature» it was believed that the All-Powerful had indicated by a sign which plant should be used for each ailment;—the liverwort for liver disease because of a superficial resemblance of its leaf to the human liver; flowers with red centres for inflammation of the throat, and the like.

For a time after the worthlessness of great numbers of remedies had been demonstrated and when under the sway of structural pathology it appeared useless to attempt to alter by a simple medication such extensive and permanent changes as were discovered post mortem, medical leaders were inclined toward the doctrine of «therapeutic nihilism.» No medical treatment could be of great value in the face of the picture presented post mortem, but useless drugs and procedures having been weeded out, there remained a not inconsiderable number of remedies of proven value. Without them and their intelligent use the sufferings of humanity would be increased many fold.

And now, having established the correct value of most drugs, and ruled out those of doubtful worth, medical science is constantly adding remedies which have been tested experimentally and been proven efficacious though harmless. New discoveries in hygiene and nutrition, in bacteriology, chemistry, immunology, allergy, endocrinology, surgery, pharmacology, and roentgenology are gradually being added to our therapeutic armamentarium. Not a year elapses but we see added at least one discovery of permanent value and it is safe to say that every decade one or two discoveries of the first order, such as smallpox vaccine, diphtheria antitoxin, rabies vaccine, thyroid extract, insulin, salvarsan, enriches our knowledge and brings further boon to humanity.

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MEDICINE, Preventive. See PREVENTIVE MEDICINE.

MEDICINE, Progress in. The advance of medical science takes place by no means at a uniform rate. In addition to the many new and sometimes startling discoveries in hitherto unexplored fields, any account of its progress should also include a survey of improvements in medical techniques, new and practical information concerning epidemiology and preventive medicine, and recent changes in statistics of the common diseases in which the morbidity and mortality of man are seriously concerned. This article evaluates published matter of importance in 1950, particularly in the newer fields of medical science as distinguished from surgery. In addition to these reports concerning new discoveries, some of the older fields are reviewed in the light of added knowledge, in order that a proper perspective may be attained. Merely to regard a particular disease as a finished matter, if we know no more of its origin and course than was known a decade ago, is to close our eyes to the fact that the results of treatment may now be infinitely more satisfactory than in former years. For practical reasons the period embracing the last decade (1940–1950) has been chosen as a guide for the presentation of what, in the opinion of the writer, are the more notable advances in medicine. References in the text are to sections within this article and to subjects presented elsewhere in THE ENCYCLOPEDIA AMERICANA.

Adrenal Cortical Hormone.—There is hardly a field of medicine in which more significant research has been conducted than in the study of the principles present in the adrenal cortex. Numerous methods have been employed in its extraction, the object being to isolate the hormone in pure crystalline form in order that its later synthesis may become possible. The commonest procedure is by the use of lipide solvents. For this purpose ether, ethylalcohol, acetone, and benzene have been used. In any method chosen it is necessary to remove every trace of adrenalin, which is a principle of the adrenal medulla. Up to 1950 a great variety of compounds had been isolated and the end is apparently not in sight. Perhaps the most important and interesting of these, from a practical standpoint in future therapy, is Compound E now referred to as cortisone. This substance was isolated by Edward C. Kendall (1886–) and Philip S. Hench (1896–). See section on *Endocrine Therapy*. See also separate article ENDOCRINE GLANDS.

Anesthesia.—In the last decade anesthesia has occupied a prominent place in medicine and a number of new procedures and techniques have been adopted. Anesthesia now includes: (1) preoperative sedation; (2) inhalation anesthesia such agents as ethyl ether, chloroform, ethyl chloride, cyclopropane, nitrous oxide, ethylene, and divinyl ether; (3) regional anesthesia by such agents as novocain, spinal anesthesia, and procaudal anesthesia; (4) intravenous anesthesia. It is concerned largely with surgical procedures. See also separate article ANESTHESIA.

Antibacterials.—Antibacterials are agents which destroy or hinder the growth of bacteria. An antibacterial may be physical or chemical in action. The most important of the antibacterial drugs developed in recent years are the sulfonamides, sometimes called the sulfa drugs.

Sulfanilamide is known also under various trade names. This drug exerts a powerful antibacterial action against streptococci, meningococci, and gonococci. Ordinarily it is given by mouth in 0.1 gram doses per kilogram of body weight. It is successful in active cases of disease and also in prevention.

Sulfadiazine causes fewer toxic reactions than sulfanilamide and is used in the same type of infections.

Sulfapyridine is effective in the same diseases and is used also in colonic infections and dysenteries.

Sulfathiazole is employed largely in pneumonias and infections of the urinary tract. See also SULFA DRUGS.

Antibiotics.—These are agents which tend to destroy life. The term antibiotic is applied specifically to extracts of certain organisms used in combating infectious disease caused by other organisms.

Penicillin, the commonest and best-known example, has been called the greatest therapeutic agent yet discovered. It is produced in small quantities by the mold *Penicillium notatum* when grown in culture, using suitable media. The chemical nature of penicillin is unknown and as yet it has not been produced synthetically. It should be borne in mind that there are several penicillins, at least seven salts having been identified. Of these only the sodium and the calcium are of clinical importance. The drug is effective against several forms of pneumonia, scarlet fever, tonsillitis, gonorrhea, and those diseases caused by spirochetes. It does not harm human tissue. In acute infections of the middle ear it has been of the greatest value, almost banishing the once common sequel, mastoid disease. Moreover, the drug is a valued adjunct to effective surgery, preventing severe infections in lacerating injuries as well as checking incipient or imminent peritonitis, where, without it, serious infection would seem bound to occur. In some cases of probable clinical benefit the satisfactory results reported have been aided by the administration of antibacterial drugs combined with the use of penicillin. The dosage of penicillin must be calculated in units (Oxford unit). This may vary from 50,000 to 200,000 units, or even more, per day. Ampoules of penicillin contain, usually, 100,000 Oxford units prepared for deep injection into a muscle.

Streptomycin is a water soluble antibiotic obtained from *Streptomyces griseus.* It is active especially against Gram-negative organisms, including the bacterium of tuberculosis. It is even more effective than penicillin in the pneumonias and in gonorrhea and will resolve dysentery and whooping cough.

Chloromycetin, a new antibiotic, has been used with reported good results in the rickettsial diseases, such as typhus fever, spotted fever, and virus pneumonia.

Aureomycin has been somewhat disappointing in its action against tuberculosis.

Other and perhaps similar antibiotics have come into limited use, but their effectiveness is yet to be demonstrated. Up to 1950 the causes of the virus diseases, poliomyelitis, influenza, and measles are found to be uninfluenced by any antibiotic. The same is true of the common cold, despite individual and scattered reports to the contrary. See section on *Colds.*

Aviation Medicine.—Since the creation of an

independent air force in the organization for the national defense of the United States, many changes have occurred in the United States Air Force. There are now three directorates in the organizational scheme. These are: (1) Directorate of Professional Service, embracing an aviation medicine division, a physical standards division, and a clinical medicine and preventive medicine divison. Each of the latter is subdivided further into a number of technical branches which include every department of medicine and health. (2) Directorate of Staffing and Education, embracing a management division and a professional education division, subdivided further into branches having to do with procurement, classification, medical education, and medical training. (3) Directorate of Plans and Hospitalization, embracing a medical service plans division, a hospital division, a medical matériel division, a resource and analysis division, a medical personnel division, and a diometrics division. The air force maintains a school of aviation medicine, aeromedical laboratory, and an Arctic aeromedical laboratory.

Blood.—Studies of the blood have resulted in much greater accuracy in diagnosis of many ailments and in more effective means of treatment. Blood transfusions have become routine everywhere and even in small and isolated communities it is possible for acute emergencies to be handled without the necessity—with added risk—of transporting the patient a great distance to a large city hospital. This is of course only possible where facilities for storing whole blood exist. The view of Karl Landsteiner (1868–1943) on incompatibility, as indicated by isoagglutination following transfusions of whole blood, has been amply confirmed. As a rule, not much difficulty is encountered in finding suitable donors, since group O (universal) are considered safe for recipients of all blood groups. Universal recipients of all blood groups (groups A and B) may receive blood from any group (O, A, B). Prior to 1914, the use of blood transfusions was uncertain because of technical difficulties and the absence of lists of donors other than those interested in selling their blood. About 1928 a nonprofit donor bureau was organized and some 10 years later the blood bank was established. Since 1940 the blood bank has become a recognized institution throughout the United States and is now an important function of the Red Cross, both national and state. Blood chemistry has been greatly broadened and developed. In many physical surveys the nonprotein nitrogen constituents, urea nitrogen, uric acid, creatinine, and blood sugar are determined in a laboratory before the survey is regarded as complete. Examinations of the blood also include the determination of the inorganic constituents, as calcium, chloride, iron, magnesium, phosphorus, potassium, and sodium. The sedimentation rate, clotting power, and examination of the blood cells often lead to confirmation of a suspected diagnosis or to a diagnosis as yet unsuspected. See also separate article BLOOD.

Curare.—This drug is of variable and uncertain composition and is prepared from *Chondodendron tomentosum*. It was known formerly only as an arrow poison used by the natives of South America and in physiological laboratories. It is of current medical interest owing to its action in paralyzing the skeletal muscles by blocking the neuromuscular junction, so that nerve impulses are no longer transmitted. It is likely to produce respiratory paralysis. The drug is used to control convulsions and muscular spasms in certain nervous disorders, notably epilepsy.

Encephalography.—This is a procedure in which the cerebrospinal fluid is replaced by a gas passed through a needle introduced into the spinal canal, in order to visualize by X-rays the ventricular system, the base of the brain, and the subarachnoid pathways. This procedure has been shown to be of increasing value in determining whether a particular brain lesion is amenable to surgical treatment. With its wide use a large number of brain tumors are disclosed and many of these are found to be subjects for radical removal. As a diagnostic aid in brain lesions these tests are invaluable.

Endocrine Therapy and Endocrine Preparations.—Due to the fact that there are now produced a great number of chemically pure and physiologically active hormones, some important advances in hormone therapy have taken place within recent years. The basic principle of such therapy is, of course, to correct a deficiency in the endocrine system. The endocrine glands are so intimately related that a state of hyperfunction or hypofunction in one part will affect the entire endocrine system.

The production of chemically synthetized hormones has made hormone therapy of the first importance. Among the important synthetic preparations may be listed the following: (1) adrenal gland preparations, of which about eight are cortical hormones used in such conditions as Addison's disease, hypopituitarism, surgical shock, hyperthyroidism, and Simmonds' disease; (2) about eight adrenal medullary preparations used in edema, asthma, allergies, rhinitis, angioneurotic edema, hay fever, local anesthesia, and hemorrhage; (3) ovarian hormones (estrogenic), approximately 20 preparations, used in deficiencies of the female reproductive system, such as dysmenorrhea, vaginitis, menopausal conditions, acne, amenorrhea vomiting in pregnancy, sterility; (4) approximately 10 preparations of corpus luteum used in functional uterine bleeding, habitual abortion, and dysmenorrhea.

Fever Therapy.—The subject of production and use of fever therapy by physical agents for therapeutic purposes continues to be of great interest. The most important methods in use employ air-conditioned cabinets, since the application of electric blankets has been largely discontinued. The various types of apparatus for production of radiant heat have been improved greatly, and hyperpyrexia is now produced by humidified, heated air passing over the body rather than by direct application of radiant heat to the skin surfaces. Body temperature can be controlled better and more accurately by a diathermy cabinet. Careful selection of patients should be made and generally it is conceded that persons with hypertension, cardiac disease, and general debility should not be accepted for treatment. In general, a person who is a poor risk for surgical operation is not a good risk for fever therapy. This method of treatment has been recommended in some 50 diseases, but its most marked success, according to late reports, has been in chorea, gonorrhea, neuritis, and syphilis of the nervous system. In the opinion of some who have had the most experience in this form of medical treatment, it should be confined to the treatment of gonorrhea and its complications, where the disease is resistant to chemical therapy

to syphilis, when it is combined with chemical treatment, to chorea, and to undulant fever.

Hormone Therapy.—See section on *Endocrine Therapy.*

Immunity; Immunology.—Immunity is defined, in simple terms, as a condition of a living person (organism) by which it resists an infection or overcomes it, if infection has occurred. Some organisms possess a natural or active immunity either as a result of an infection hitherto unrecognized, or as produced by immunization with bacteria or with the products of their growth. Passive immunity can be produced by the injections of antibodies prepared in animals or in other human beings. Immunity in regard to the so-called virus diseases is not easily explained. A number of the virus diseases exhibit a type of parasitism, and it is probable that immunity is acquired, because the parasite does not find, in all cases, appropriate living conditions in some hosts. In the case of animals, some are resistant to inoculations of viruses which can be cultivated, while others easily develop the disease. Almost without exception an animal or a human being that has recovered from a virus infection possesses a lasting immunity to reinfection from outside sources. In this respect these infections are vastly different from those resulting from the majority of bacterial diseases. The fact itself poses the interesting question as to the possibility of obtaining a lasting immunity for any human being through inoculations of inactivated virus. In past years many authorities have held that lasting protection is possible only if an active virus is used, even though it has been so completely attenuated that the virus can no longer be demonstrated. The matter appears to be still unsettled in 1950. The entire field is still virgin soil, and many technical procedures, such as new methods of filtration, dialysis, diffusion, and tissue culture, will doubtless be developed in the near future. And this development in turn will prepare the way for important discoveries among the many riddles of immunity. See also section *Viruses and Virus Diseases.*

Pediatrics.—Since 1945 infant (first year of life) mortality has been lowest in the large cities of the United States. In 1943 the rate per 1,000 in cities of 10,000 or over was 36.1. In rural communities it was from 45 to 50 per 1,000, while in some urban communities the rate was only 25 per 1,000. Contributing factors to the lowered mortality were better water, wider use of pasteurized milk, and the efforts of infant welfare services in particular areas.

Radium.—Although radium was discovered in 1898, its use in medicine did not begin until about 1906. Today its use is confined practically to the treatment of cancer of the genital tract in women, cancer of the bladder in both sexes, to cancer of the external genitalia and the prostate in men, and to a few skin conditions. Usually radical surgery offers the best hope for the cure of malignant tumors, but if wide excision is unsuccessful and recurrence occurs, the use of radium is often advised. In cancer of the body of the uterus, which accounts for about 15 per cent of all cancers of the female genital tract, the results of radical operation ranged from 36 to 50 per cent of cures in a large group of statistics from many different sources over a period of three to five years. Where radium alone was used over a similar period in another group, the percentage of apparent cures was far lower, from 27 to 44 per cent. Experience in such cases during the late 1940's does not indicate that faith in the value of radium is increasing among those best qualified to speak for the medical profession.

Vitamins.—These are substances having a regulatory influence on body metabolism. Their presence is necessary to prevent certain pathological changes from taking place within the organism. Their identification is by alphabetical lettering, which has no relation to their chemical composition. See also section on *Avitaminoses;* separate article VITAMINS.

Visual Aids in Medical Training.—For several years medical teaching, especially in surgery, has been advanced considerably by the use of motion pictures. To this has been added television. Almost every technical procedure in medicine has been reduced to picture form, and films are available to the medical profession everywhere. These aids form a valuable supplement to the medical curriculum. Another striking advance has been of great visual assistance—that of medical illustrating in color. These illustrations have been produced mainly in the fields of anatomy, pathology, and surgery. Many of them are an education in themselves, since they portray the heart, lungs, gastrointestinal tract, breast, reproductive organs, and other anatomical parts in both health and disease, in such a manner as to give a close approximation to the appearance of actual living tissue.

PREVALENT DISEASES

Alkalosis.—Unlike acidosis, which has received a large share of attention in recent years, the condition known as alkalosis has been somewhat neglected. It is known now to be of common occurrence and to be occasionally the cause of great discomfort to the patient. Alkalosis is marked by concentration of bicarbonate above the normal. The condition of excess alkali may be owing to an undue amount of alkali introduced into the blood, unaccompanied by a compensating increase of nonvolatile acid, or to an excessive loss of acid, where no equivalent of alkali loss has taken place. The condition may arise from a too generous administration of alkalis and not infrequently is brought about by injudicious treatment of duodenal ulcer by what is known as Sippy treatment. It may be due also to an excessive use of bicarbonate in diabetic acidosis where insulin is being given. Other recognized causes are pyloric and intestinal obstructions. The common symptoms are headache, loss of appetite, drowsiness, persistent vomiting, myalgia, and excessive nervousness. In the occasional case there will be rapid respiration and even delirium. Muscle ache is one of the commonest symptoms. Even in apparently serious and alarming cases its treatment becomes effective by immediate withdrawal of the alkali and the use of intravenous injections of sodium chloride solutions. As a rule, prompt relief of symptoms will follow and no other treatment will be required.

Arthritis.—The common definition of arthritis is inflammation of a joint. The current term in use by nonprofessional persons is rheumatism. A host of varieties of this disease has been recognized for many years, but the underlying cause, in most cases, is unknown. The worst type and the most crippling is the rheumatoid variety—a chronic joint affection of unknown etiology affecting multiple joints, the disease being ac-

companied by many constitutional disturbances, such as debility and loss of weight. There is proliferation of granulation and connective tissue in and about the joints. Pain, limitation of motion, deformity, and stiffening of the joint are common. This is the disease which has produced so many helpless cripples who are condemned to a life in bed or in a wheel chair. Many are young persons, but the disease occurs at any age and in every walk of life. Over a period of many years the underlying thought among physicians has been to treat the patient by general measures, since no specific therapy was known.

During 1949 a hormone, first derived from the adrenal glands of cattle about 1939, was used by Kendall and Hench (see section on *Adrenal Glands*) in the specific treatment of joint disease. Originally this hormone was called Compound E, but the name has since become synonymous with cortisone. It has also been derived from ox bile. The use of cortisone in selected patients was startling from the first and its prompt action in affording relief in severe cases of joint disease seemed almost unbelievable. Persons almost completely crippled were able to move about freely. Relief from symptoms occurred after a few doses given intramuscularly. However, cessation of the specific treatment was soon followed by recurrence of symptoms, indicating the transitory nature of the drug's action. Very little of this invaluable substance can be produced and, since it cannot be made synthetically, a great difficulty is interposed to its wide use. The compound is extremely complicated, requiring nearly 40 distinct and separate steps before it can be obtained in a pure state. It may be said that the matter of its production, distribution, and clinical use is in an early and unfinished stage in 1950. As a possible substitute for cortisone, adrenocorticotropic hormone (ACTH) has been isolated, its action having been discovered in 1949. This hormone is extracted from the pituitary gland of the hog. The amount obtainable from this source—many thousands of animals—thus far has been insufficient to serve for more than clinical experimental purposes. It has not (1950) been produced synthetically. A limited use of ACTH in selected cases has met with marked success and there is hope that in time it will be produced synthetically in quantity, thus leading the way to the relief of millions of sufferers from chronic arthritis. See also separate article Arthritis.

Avitaminoses.—These conditions, often diverse and dissimilar, arise from lack of certain essential nutritive factors known as vitamins. The various syndromes encountered in these conditions vary in character and in severity. Vitamins are necessary for biochemical reactions taking place in the body. When these are interrupted, body function suffers.

Absence or deficiency of certain vitamins produces what are actual nutritional disorders. These deficiencies are not due to failure of the vitamin supply, since most of the substances exist in abundance throughout the United States and in many other countries which are important food producers. The principal deficiency diseases due to diet are the result of lack of vitamins A,B,C,D,G,K, and PP. Avitaminoses are produced by such factors as lowered food intake, digestive disturbances, and mental disorders. Of late years considerable importance has been attached to methods used in the detection of avitaminoses. Such should include analysis of diet, recognition of specific syndromes (symptom complex), analysis of body fluids, and therapeutic trials of known vitamins whose absence from the body is suspected. In many cases the last will prove the factor most to be relied upon for diagnosis. As a rule, the use of the correct vitamin in a particular case will result in prompt improvement.

Many foods lose much of their vitamin content in processing and, unless this is restored by enrichment, the use of these articles of diet cannot be relied on. An ordinary and varied diet will generally contain the vitamins necessary for body economy. Therefore an indiscriminate and habitual use of vitamins in pill form is unnecessary, since it is physiologically and economically unsound. While vitamin deficiency is common in some localities and is marked in the countries of Europe ravaged by the last war, it has been calculated that only one person in 25,000 of the general population develops vitamin deficiency so severely as to require hospital treatment. As a rule, the average person selects his diet unconsciously so as to provide an adequate intake of vitamins. Only when an individual chooses foods which are markedly different from average selections, is he likely to develop symptoms of deficiency. The daily amount of vitamins required for health will vary somewhat with age, sex, and activity. The amounts required of vitamins A and G do not vary with physical activity, but that of vitamin B complex does. The occurrence of pregnancy will change the vitamin requirements. Based on an average of 2,500 calories in food value, an adult of about 160 pounds will need: 5,000 units of A, 1.5 milligrams of B, 75 milligrams of C, 2.5 milligrams of riboflavin, and 15 milligrams of nicotinic acid. Based on these requirements, diet tables consisting of ordinary palatable food have been arranged. The common clinically recognized avitaminoses, many of which have been reproduced in animals, are listed here.

Avitaminosis A exhibits the clinical features of night blindness, cutaneous lesions, digestive disturbance, and disorder of the liver function. If present in the young, it exerts an unfavorable influence upon tooth development. The deficiency can be supplied from cod-liver oil, beef liver, kale, and other vegetables, or by the use of concentrated vitamin in unit dosage.

Avitaminosis C presents the symptoms of scurvy with loss of weight, tender and bleeding gums, and anemia. It is supplied by ascorbic acid, derived from fresh fruits, especially citrus fruits, and vegetables, such as tomatoes and cabbage, or by use of pills containing ascorbic acid.

Avitaminosis D produces symptoms and signs of rickets in children and osteomalacia in adults. These diseases are especially common in central Europe and in the northern United States. The condition is less likely to exist where exposure to sunlight is common. Marked deficiency in vitamin D results in changes in calcium levels and inorganic phosphates in the blood, which retards calcification of cartilage involved in bone growth. The most striking effects are seen in growing bone with the characteristic deformity. The exact amount of various vitamin requirements in adults is undecided. Dosage is often given in units, as international unit (I.U.). Large doses such as 60,000 units of some vitamins have been used. Fish- and cod-liver oil

and concentrates of these are in wide use for avitaminosis D.

Avitaminosis K occurs in infants and in adults with obstructive jaundice, sprue, and ulcerative colitis.

Avitaminosis B_1 has a classic example, long known to the world, in beriberi, seen mostly in Far Eastern countries. Vitamin B_1 is known also as thiamine. Lack of this substance may produce polyneuritis, cardiovascular dysfunction, and other disturbances. The lack is easily supplied by the administration of thiamine.

Cancer.—The word cancer is an all-inclusive term to indicate a malignant growth or tumor which causes a destructive invasion of the tissues, not necessarily neighboring ones, by actively vegetating epithelium. Since 1937 the subject of cancer has been much in the public mind and millions of dollars have been raised by various societies, groups, and foundations, engaged in studying the disease from the standpoints of cause, prevention, early diagnosis, and effective treatment. Education by means of public addresses, radio talks, publication of articles on cancer in lay magazines and journals, establishment of cancer clinics, and organization of public health programs have given detailed study and attention to arouse the public to the danger of delayed action in cancer cases and to the best means of combating the disease. It is interesting to note that perhaps the most extensive and earliest investigation concerning the occurrence of certain types of malignant disease was established as long ago as 1889 at the Johns Hopkins University. Since that time a record of bone tumors has been continued by Joseph C. Bloodgood (1867–1935) and his successors. These records, embracing thousands of cases accurately studied from a pathological and clinical standpoint, are available for examination by any physician. Other institutions have kept similar records concerning other tissues and organs, such as the breast, colon, and prostate, so that now the medical profession has accurate, statistical information concerning incidence of malignant tumors in all parts of the body, with figures relating to mortality with and without surgical interference. Despite all the scrutiny that cancer has received, the mortality is still shockingly high. The cause, while undiscovered, is perhaps within reach, in the opinion of some who speak with authority. See also separate articles CANCER; TUMOR.

Colds.—Much interest has been aroused since 1947 in the treatment of common colds by antihistaminic drugs. Phenandimine has been reported as effective in a large percentage of cases studied, when the attack was taken in hand promptly. One observer reported a series of 100 cases in which controls were used (employment of inert drugs or substances). In 24 hours, 54 per cent were cured and in all cases studied, where treatment was begun within 48 hours, 75 per cent were cured. In the control cases a like number were relieved of symptoms in 32 per cent of the cases. Side effects, such as drowsiness, dizziness, and headache, were noted in 26 per cent of the cases. By the use of benadryl in a series of 100 cases, 10 per cent were aborted and 95 per cent relieved of symptoms due to the inhibitory effect of the drug on the mucous membrane discharge. A number of other drugs have been used with reported success. The chief objection to the treatment is the drowsiness which makes it unwise for a person driving a car or flying a plane to use this means of relief. The subject continues under discussion among members of the medical profession.

Coronary Artery Disease; Organic Heart Disease.—High on the list of mortality rates from organic disease and collectively occupying first place is the group of organic diseases of the heart. Each year many cases of sudden death result from unsuspected heart disease, of which coronary occlusion is the commonest. Even in advanced form, coronary artery disease may present no clinical manifestations, and symptoms, even if present, are often unassociated with the heart. In recent years attention has been drawn increasingly to the possibility of the existence of coronary disease in all individuals in the so-called arteriosclerotic age (middle life) regardless of the apparent nature of the illness. Thus an elevated blood pressure, the presence of hypertension, a persistent bronchitis, an asthmatic attack, an obscure upper abdominal pain may be of significant import and may call for a careful examination of the heart. The modern treatment of early stages of coronary disease is rarely severely restrictive. Physical activities are, however, curtailed necessarily, reduction of weight is often imperative, and habits of living carefully studied. No startlingly new treatment has been advanced in therapeutics; rather the latest concept is early recognition of the condition for what it is, with prompt regulation of the way of life of the patient, instead of allowing him to go until the inevitable attack of thrombosis and occlusion takes place.

The role of digitalis and quinidine in organic heart disease is worthy of brief review. Although it is invaluable in heart disease, digitalis has its limitations and there are a number of puzzling factors connected with its pharmacological and therapeutic behavior which are still not understood. Of late years the scope of its usefulness is the more clearly apparent, perhaps because it has become recognized generally as both a heart stimulant and a heart depressant. Digitalis affects not only the heart but also the blood vessels and the kidneys. It has toxic effects on both the stomach and the intestines and not infrequently on the heart itself. Occasionally, if administered injudiciously, it may prove a fatal drug. Its cumulative action has long been recognized. Digitalis is useful in congestive heart failure, in auricular fibrillation, in pulmonary edema, and in valvular defects. It is useless in most of the nervous manifestations connected with heart disease and is not advised in the cardiac symptoms of hyperthyroidism. There is almost no satisfactory evidence to support its use in pneumonia, but in certain infectious diseases, such as rheumatic fever and diphtheria, it is said to be of some value. If not well borne by mouth, it may be given by rectum or intravenously.

Of the somewhat newer drugs used in cardiac disease much interest has been aroused in quinidine, now recognized as of great assistance in certain types. Because of its untoward results, at one time the use of quinidine was practically abandoned, but satisfactory results in certain cases have been established beyond question. The principal indications are in auricular fibrillation and auricular flutter in association with advanced myocardial and valvular disease. It should be prescribed neither in coronary thrombosis nor in extensive myocardial involvement.

The drug may be given intravenously, if not well borne by mouth.

Diabetes (modern concept).—It has been assumed not infrequently that since the discovery of insulin diabetes has been a closed book. This is not so, however, and diabetes mellitus remains in the realm of controversy. Its etiology is still the subject of intensive research in connection with problems arising in studies of metabolism and biochemistry. Many of its complications are puzzling to the clinician. Of late years the discovery of the fact that tens of thousands of diabetics are going about their business, eating what they please, in complete ignorance of their affliction is a challenge to the medical profession. This has led to the inauguration of diabetic diagnostic clinics and to publication to the general public of methods of self-testing for sugar in the urine.

The simplest definition of diabetes remains unchanged: a disease of abnormal carbohydrate metabolism. In more explicit terms it is a primary, incurable inability of the tissues to utilize glucose properly because of insufficient production of insulin in the pancreas. The definition makes no mention of complications, such as acidosis, ketosis, arteriosclerosis, and coma, and assumes that insulin corrects only the abnormality in carbohydrate metabolism.

It has been doubted even that diabetes is caused by a lowered supply of insulin alone. In this connection an interesting fact should be cited, that patients who have undergone a total removal of the pancreas usually require but a moderate daily dose of insulin, while many diabetics need a far greater amount.

Under modern concepts and management, which accepts a basic physiology, a knowledge of the characteristics of the insulins, and a properly regulated diet, it has been stated that at least 95 per cent of diabetics can be well controlled and that the remaining small per cent developing unusual or dangerous manifestations may be managed by a more rigid application of the basic principles of diabetic regime. The incidence of ketosis, acidosis, and other untoward symptoms may be regarded as attempts on the part of the body to restore to the normal a mechanism thrown out of gear by the deficiency in carbohydrate metabolism and by the inability of the body cells to oxidize glucose. The essentials of diabetic management are to keep the patient symptom-free, to keep the blood sugar and the urine sugar as near normal as possible, to avoid severe insulin reaction, and to arrange the diet and environment approaching the normal, bearing in mind compatibility with the primary objectives mentioned, and lastly, to educate the patient in prevention of coma. Except for minor variations these essential factors are agreed upon by the foremost authorities, although a few observers hold that the blood sugar level and the presence of sugar in the urine are of small moment, if the patient maintains his weight and is free from acidosis.

Epidemiology.—Epidemiology may be defined as the study of occurrence and distribution of disease, usually epidemic and endemic, but at times broadened to embrace all types of disease. As a result of World War II the study of epidemic disease was undertaken on a worldwide basis and the term "global epidemiology" came into current use. It was recognized then that maintenance of the health of troops in all parts of the world was of first importance to the success of military operations, which might extend from the frozen North to the equatorial belt. In the past such diseases as cholera, malaria, plague, and typhus in its many forms had in great part often determined the success or failure of battles and wars.

At the outbreak of war, surveys of all countries were made by the Medical Intelligence Division of the United States armed forces and approximately 190 areas were studied exhaustively from a sanitary standpoint. Perhaps the most significant lesson of malarial research was to emphasize the highly specific character of malaria in many localities. Measures of control applicable to one locality were not always successful in another. Information was gleaned from all possible sources, both written and other, and the evaluation of data proved of the utmost value. The sanitary surveys covered geography, climate, health service, water supply, disposal of sewage, prevailing insects, food and dairy products, diseases spread through the intestinal and respiratory tracts (including those spread by contact and by means of such insects as ticks and mites), and nutritional diseases. Since practically every corner of the world was under scrutiny, there was collected a vast amount of information which never before had been assembled and documented. This has been disseminated and should have a profound and practical effect on prevention of disease.

Tropical Diseases.—One of the most striking and significant portions of the report (see *Bibliography*) is that indicating the world distribution of the so-called tropical diseases, of which the most important are listed here.

Cholera was found to exist nowhere in the world except in two highly endemic areas of eastern China and south and central India.

Dengue was reported in many large endemic areas of western China, the East Indies, northern Australia, the coasts of the United States and South America, the coast of Africa, central Africa, India, and the Near East.

Filariasis was noted in many large areas of west China, the East Indies, West Indies, the northern coast of South America, and nearly all of Africa except the Sahara Desert.

Malaria was highly endemic in west China, the East Indies, Central America, northern South America, much of the Near East, almost all of Africa, and a great part of Asia. This is probably the widest distribution of any disease known to man. The moderate and low endemic areas comprise a large portion of the remainder of the world. Areas in which malaria is not found are Central Asia, Central and South Australia, the Sahara Desert, a large portion of North America, and the Andes region.

Plague was discovered in western Asia, parts of South America, the coasts of Africa, and India.

Relapsing fever, occurred in nearly all of Asia, western United States, most of Africa, and some parts of South America. It was not reported in Australia nor in the East Indies.

Trypanosomiasis (sleeping sickness) was found only in Central and South America, west coast of Mexico (Chagas' disease), and west central Africa (African sleeping sickness).

Typhus was noted in practically all of Asia, southeastern United States, Mexico, west coast of South America, most of Europe, and the coasts of Africa.

Yaws were found in the East Indies, North Australia, Central America, northern half of South America, and central Africa.

Yellow fever was encountered in central South America, especially Brazil (east coast), west coast of Africa, and central Africa. Yellow fever has been present and can be epidemic in the vector areas covering west China, west coast of Africa, all of South America except Argentina, all of Africa except the Sahara, south central Europe, India, and the southeastern United States. This deduction is made because of the prevalence of the insect vector of yellow fever in these areas.

Gonorrhea.—Since the discovery of the antibacterial action of the sulfonamides and the antibiotic action of penicillin and similar derivatives of certain molds, the treatment of gonorrhea has been almost revolutionized. Apparently there is no true immunity against gonorrhea, and it is probable that while some immunity is built up by the patient, this is limited largely to the infected mucous surfaces. This immunity, such as it is, seems to be achieved more readily in the male than in the female. Even without treatment the disease is self-limited. The modern treatment of gonorrhea centers about the sulfonamide drugs. In the opinion of most clinicians, sulfonamide itself is not appropriate, since the rate of cure is low and its toxicity high. Almost all authorities recommend the use of sulfathiazole. It is not known precisely when a cure takes place, but patients who seemingly are uncured in five days are regarded as drug refractory. Many of these are cured by a second course of medication. If they remain uncured after a second course, such patients as a rule are not given a third. Excellent results seem to be attained by the use of sulfathiazole (20 grams) during a period of five to seven days. Severe drug reactions are said to occur only in about one per cent of cases, although some patients appear to have an idiosyncrasy for any sulfonamide drug. One plan is to give four grams of sulfathiazole powder daily in divided doses over a period of five days. If symptoms persist, after a rest period a second course is given. In some cases prolonged artificial fever (heat cabinet) is used in connection with specific medication. In resistant cases penicillin is frequently prescribed and seems to be particularly beneficial in a large proportion of those cases in this category. Many clinics and also the National Research Council have reported good results in the use of penicillin in combination with chemical treatment. The same routine has been advised in women as in male patients. In addition, local treatment and treatment of complications is often necessary. Statistics as to prompt cure of gonorrhea by modern methods vary, but the rate is probably in excess of 80 per cent.

Infectious Hepatitis.—During World War II, infectious hepatitis was a serious factor in morbidity among newly inducted troops. It became the subject of exhaustive inquiry on the part of medical authorities in the armed forces. The etiologic agent is a filtrable organism (agent or virus) resistant to heat at 56°C. It is not affected by chlorination. It is contained in the blood and feces of the patient. The virus is believed to be spread by water, food, and milk. An attack of hepatitis usually protects the individual from further invasions.

Poliomyelitis (present concept).—Anterior poliomyelitis or infantile paralysis is an acute infection of the anterior horns of the spinal cord by an unknown virus. It has been described as a group infection confined to intimate associates. The carrier state may develop within a short time. Some agency other than man may be an important contributor to the spread of the disease. Since 1890 poliomyelitis has changed from a sporadic to an endemic disease. Why it remains dormant for approximately eight months of the year and then flares up into an explosive epidemic has not been determined. The disease has an uncertain progress in the individual and may result merely in muscular weakness, from which recovery is easy, or it may proceed rapidly to complete paralysis, including the respiratory muscles, ending in death. The causative agent is unknown, but is recognized as a virus, since the disease can be transmitted to monkeys. The virus is presumed to enter the body through the nasal passages, but nothing further concerning it is known. The disease is not particularly contagious and the mortality rate is lower than most people think, certainly less than 15 per cent. It is believed that a considerable number of persons acquire poliomyelitis in mild form, but recover without a diagnosis having been made.

Since about 1940 it has been a subject of wide controversy and of widespread alarm. Its controversial aspects are mainly concerned with what is known as the Kenny treatment (Elizabeth Kenny 1886–). This treatment has not received the unqualified support of orthopedic surgeons, but it has earned great popular approval and much professional support. The treatment is begun as soon as a diagnosis is made. The patient is put to bed on a firm reinforced mattress (bed boards). A footboard is also used to keep pressure of the bed clothing from the feet. If muscular spasm is present, hot fomentations are applied to the affected muscles and passive motion is inaugurated once a day or oftener. As soon as joints can be moved without pain, muscle re-education is begun while the patient is still in bed. The use of a respirator where the respiratory muscles are involved in the paralysis is not a part of the Kenny treatment. In many cases the treatment outlined must be supplemented by the use of apparatus adapted to a specific purpose and used under the supervision of an orthopedic surgeon. In prevention of the disease the use of attenuated virus has by no means met with unanimous professional approval and by some is considered extremely dangerous.

Shock.—This is still regarded as a major problem in medicine and surgery. It is always a menace in accidents arising from present day methods of transportation and modernization of our way of life. It can be treated only by adoption of the physiological application of prevention. Shock has always been difficult to define adequately and at one time it was subdivided according to causation, that is, shock following such circumstances as burns, injury, surgical operation, or hemorrhage. But shock should be regarded as including a great variety of conditions, the common feature being a progressive failure of the circulation. Physiologically speaking, it has been held that shock is not present, unless death is to be expected, if appropriate treatment is withheld. In every clinical case, however, shock must be treated as if this condition were actually present. Shock was once defined by Samuel D. Gross (1805–1884) as a

rude unhinging of the machinery of life, a definition which expresses well its clinical aspect. The latest concept is more detailed and the definition has been accepted that it is a peripheral circulatory failure occurring from a discrepancy in the size of the vascular bed and the volume of blood (or fluid) actually within the vessels. The present trend is to classify shock under three heads: (1) hemotogenic, which is produced by physical injury, hemorrhage, burns, and loss of body fluids from any cause; (2) neurogenic, which is caused by dilatation of the blood vessels due to nervous stimuli, and usually transitory, of which examples are to be seen in spinal anesthesia, manipulation of viscera in surgical operations, and fainting; (3) vasogenic, where the blood volume may be normal, but the blood pressure is extremely low, of which anaphylaxis (serum sickness following serum therapy) and the condition induced after an overdose of insulin may be cited as examples. Early treatment of shock and its anticipation are extremely important, and nothing should be done or left undone that will aggravate the condition. Measures in use to combat shock are: relief of pain by opiates, elevation of the feet, inhalation of oxygen, application of external heat, and early use of blood substitutes and blood transfusions up to a maximum of six pints of whole matched blood.

Tuberculosis (modern concept).—Pulmonary tuberculosis in man has existed probably ever since he began to live a communal life. Until near the end of the 19th century the disease occupied a high place in all mortality tables and the so-called white plague was a serious menace to society. Since 1918 this threat has become less and less grave in the United States. This has not come about by any specific treatment, but from a combination of factors, each one of which has contributed to lowering of morbidity and mortality. Two characteristics are concerned in tuberculosis: the tubercle bacillus and the human host. At least four types of the bacillus are recognized: the human, the bovine (cattle), the avian (birds), and the ichthyic (fish).

In man the disease is always due either to the human or to the bovine type, and the younger the person, the oftener the bovine type is present (38 per cent of infants). Adults seldom become infected with the bovine variety, which in human beings tends to die out after a few years. In the course of the disease, the bacillus produces a protein (tuberculin). All tuberculous subjects are sensitive to the injection of even the most minute quantities. Avenues of infection are said to be nearly 96 per cent through the lungs, the remaining 4 per cent being through such parts as the intestine, nose, or conjunctiva. It is easily disseminated by contact and is to a high degree a family disease. It is not hereditary despite reports to the contrary. It is quite probable that nearly every human being in civilized countries becomes infected at one time or another with tuberculosis and that the manifestations of the disease are largely matters of chance, environment, economic stability, or other factors. Certain occupations have a high incidence. Since the last quarter of the 19th century, the mortality has declined by 50 to 75 per cent, and this has been achieved by generalized pasteurization of milk, isolation of consumptives, popular education in health measures, prophylactic care of children, wide use of chest X-rays for diagnosis, and betterment of economic conditions. In many cases radical surgery has proved a lifesaving measure in selected individuals.

Viruses and Virus Diseases.—Caution is necessary in referring to virus diseases as such, and the term is sometimes used loosely. At one time a number of infectious diseases were thought to be produced by viruses and many of these are known now to be due to bacteria, protozoon parasites, and spirochetes. There still remain a fair number of diseases whose causal agents are unknown. Since these agents can be passed through earthenware filters impervious to ordinary bacteria, such are referred to generally as filtrable viruses, ultrabacterial viruses, and ultramicroscopic viruses. It is well to bear in mind that the word virus is not synonymous with poison, but means here that a germ or microbe is too small to be demonstrated properly or convincingly. Excluding the plant diseases, some of the common virus diseases of man and animals are: hog cholera, rinderpest, swine pox, cowpox, smallpox, varioloid, chickenpox, several varieties of encephalitis (lethargic, Japanese, Australian X-disease), poliomyelitis, rabies, distemper of dogs, mumps, measles, parrot fever (psittacosis), common colds, influenza, and trachoma. Other diseases, both insect-borne and bacterial, among which differences of opinion exist as to their being catalogued as virus diseases, are: African horse fever, pappataci fever, dengue, yellow fever, equine encephalitis, typhus fever, Rocky Mountain spotted fever, trench fever, heartwater disease, Oroya fever, and pleurodynia. It is believed that some viruses are so small that they are not capable of measurement by means of the most powerful microscopes. Not all are so minute, however, as to defy visualization and certain cells have been observed to contain what are known as inclusion bodies. What relation these bear to viruses is not known. (See section on *Immunity*.) See also SURGERY and separate articles on the various medical sciences and diseases.

Psychosomatic Medicine.—Up to about the year 1930 our knowledge of the psychoneuroses was centered largely around certain syndromes or groups of symptoms, unaccompanied by any well grounded system of treatment. Treatment was largely empirical and not conditioned to the needs of the individual patient. In the years that followed, a clearer understanding has come about and this has aided, to a gratifying extent, the evolution of a plan of treatment aimed at correcting, in individual cases, the basic causative factor. Much of this has been achieved through the work of Sigmund Freud (1856–1939) and Adolf Meyer (1866–). Such plans are often referred to as belonging to the field of psychosomatic medicine.

Belief in the psychic origin of mental and physical ills is not at all new but up to the close of the 19th century it encountered much opposition. Not until the significance and purpose of symptoms and syndromes were elaborated in later years was it understood that individual conduct can often only be explained on the basis of fixed ideas which govern it unconsciously. It has been emphasized that psychosomatic unity of the individual must be present for normal functioning of the body. Since 1940 it has become more and more apparent that the physiologic function of organs and the organs systems are closely allied to the state of mind of the individual and that even tissue changes may occur in an organ so affected. Such changes are some-

times referred to as "organ neuroses." The psychoneuroses are subjective chiefly even though incapacitating. A victim of psychoneurosis is not out of touch with realities and there is no intellectual deterioration nor are delusions and hallucinations present. Several types of psychoneuroses are recognized, the most generally agreed upon varieties being: hysteria, neurasthenia, compulsion neurosis, anxiety states, and organ neuroses. The clinical types are not regarded as completely separated by an unchanging entity classification. The predisposing factors which bring about the condition are influences on the mind itself through conscious and appreciated mental problems that cause worry and anxiety, or from deeply seated mental conflicts which are a part of the unconscious or subconscious mind. In the ordinary matter of living there is a constant adjustment of the personality to the environment. Inability to make adjustments to environment produces a mental conflict or a mental compromise and here are the important factors whose comprehension are so necessary to a complete understanding of the origin of the psychoneuroses. For proper diagnosis and adequate treatment, the driving forces present, the type of symptoms observed, and a knowledge of the social background as well as the manner in which these symptoms have developed, must be studied. The forces or "drives" governing conduct may be fear, love, hate, sex, hunger, herd instinct, and so on. The drives, or urges, are striving constantly for expression and their total suppression is impossible. A "complex" or idea arising from a primary urge must express itself in a conscious way. Because this may be repugnant to the individual a "conflict" may arise, with resulting tension. In compensation the complex may be by-passed into some indirect expression or manifestation. A complex has been defined as a group of ideas with associated strong emotion. When it is repressed, it becomes, by dissociation, a vague fear or anxiety, or perhaps a compulsion neurosis, or a phobia.

In hysteria the reactions may be extremely varied. Symptoms may involve the motor, sensory or visceral fields. Bodily disturbances may be permanent, and paralysis, muscular contractures, catalepsy, deafness, loss of voice, and loss of memory are common. In time, if the condition is not benefited by active therapy, tissue changes may occur. Such reactions as have been mentioned have their origin in maladjustment situations often dating back to childhood and, because of unstable personality, may be difficult to treat.

Neurasthenia and hypochondriasis are closely associated. The use of the term neurasthenia has been abused. The condition is actually a state of mental and physical fatigue. Unlike ordinary fatigue it comes with very slight exertion and that of a particular nature. There is also poor memory, inability to concentrate, and nervous irritability. The symptoms are so numerous as to include practically every sensation, the commoner ones being general aches and pains, pressure symptoms, especially those referred to the interior of the head, backache, loss of appetite, nausea, dizziness, and circulatory disturbances. There is often discouragement and a state of low spirits, with insomnia. If the symptoms center around some particular organ or organ system the patient's attention may become fixed upon this deviation which to him portends a serious condition and he becomes a hypochondriac. In general the symptoms of neurasthenia are the result of emotional reaction arising from long conflict with the difficulties of life. These may be of different kinds such as give rise to resentment, feelings of insecurity, and those of deprivation.

Compulsion neurosis is known also as psychasthenia and is characterized by obsessions, compulsive acts, and nervous tension. There may be doubts, fears, phobias, and sometimes rituals (hand washing). The underlying mechanism is some innocent idea which has been substituted for a deeper but unacceptable desire. The patient wishes to avoid the obsessive thought and therefore substitutes something else. Such conflicts often arise in childhood.

Anxiety states show symptoms that are manifestations of acute fear and are referred to as "attacks." Between attacks the patient may be normal. Intense anxiety is shown by heart symptoms, chest and gastric symptoms, etc.

In organ neuroses the physiological function is disturbed. If intense intellectual energy cannot be dissipated in the ordinary way it tends to provoke symptoms in visceral organs and endocrine glands. If the gland or organ disturbance is only temporary, no disease will be found, but if it becomes permanent, organic disease may result. In all psychoneuroses much can be achieved by prevention but in late and well defined cases psychiatric treatment must be relied on.

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MEDICINE DANCE, a common practice among the American Indians; dances being conducted by the medicine men of the tribe for various purposes, and in preparation for different events, like warfare, and the hunt. Both in the dance before a battle and in the conflict itself the medicine chief is the one man most worthy of consideration. If war takes place, he courts the thick of the fight if for no other reason than to show his immunity from danger. The funeral dance of the Yaqui tribe is a representative example of the medicine dance; the chief medicine man arranging the ceremony, which ensures the safe passage of the dead to the spirit world. The dancers to the number of half a hundred appear in the center of the assembled tribal gathering, naked except for a cloth about the loins. Their bodies are painted in imitation of skeletons. Over their heads they wear masks fringed with long horsehair, dyed in many hues, eyelashes and eyebrows hang over the rudely designed faces, and beards reach nearly to the waist. On their legs they fasten strings of rattles cut from rattlesnakes,, and the sound of these is most gruesome to the spectators. Each dancer carries two knives, with which he gesticulates violently in imitation of the act of slaying imaginary enemies.

MEDICINE HAT, city in the Province of Alberta, Canada, on the South Saskatchewan River, about 185 miles southeast of Calgary.

It is in a high, dry area (elevation 2,185 feet; precipitation variable but frequently below 12 inches) originally devoted to ranching and dry farming but now coming under gradual improvement by irrigation under a joint scheme of the Dominion and provincial governments. It is important also as a railway center, being a divisional point on the main line of the Canadian Pacific Railway where the Crow's Nest line branches off into southern Alberta and southeastern British Columbia. It was to the coming of the railway in 1883 that the town owed its birth. It is also on the Trans-Canada Highway and has a Trans-Canada airport with daily flights. The early discovery of one of the largest of known natural gas fields underlying the district, the product being almost pure methane, gave industry an immediate impetus. ("Medicine Hat has all hell for a basement" was a comment of Rudyard Kipling when present at the "blow-off" of a new well in 1902.) There are also large deposits of lignite in the vicinity. Flour and feed milling, grain elevators, foundries, lumber mills, and machine shops are located here. The city handles the gas supply as well as its own water filtration and electric power and lighting systems. It has three business colleges, in addition to public and high schools and an academy. There are 22 churches, a hospital, a daily and weekly newspaper, a radio station, four banks, a chamber of commerce, and an industrial commissioner. The early population was recruited from Ontario, the Maritime provinces, and Great Britain, with a small infusion of Russo-Germans.

The curious place-name "Medicine Hat" is a translation of the Blackfoot Indian word "saamis" meaning the headdress of a medicine man. Various explanations of its application have been offered, several based on Indian legends, and one on the shape of a hill east of the town. A generally accepted one is that of a fight in which a Cree medicine man lost his professional headgear to a Blackfoot in the river. This and other local folklore, including the region of the Cypress Hills to the southeast —a rendezvous of the Cree and Blackfoot Plains Indians as well as of the Sioux under Sitting Bull after the defeat of Custer—have been collected in a brochure by F. W. Gershaw, a member of the Canadian Senate. Pop. (1951 est.) 12,000.

Consult Wilfred Eggleson's *High Prairie.*

MEDICINE MAN, among the American Indians, South Sea Island tribes and other peoples, a man supposed to possess mysterious healing powers. Among most of them the medicine man occupies much the same position as that held in civilized communities by two of the learned professions—medical and clerical. The medicine man is both priest and physician, and is at once the repository of all that a tribe knows, fears and believes. In very low stages of human development, however, he is at best only a magician, dealing in terrors, possessed of occult powers, but laying claim to no special medical knowledge. Thus, among the aborigines of north Queensland, the tribal doctors do not attend the sick, an invalid being cared for by wife or mother. They are not ostentatious, a medicine man being distinguished by no insignia save a small bag for his talismans, death charms and other "credentials." Among the North American Indians medicine men are treated with great respect, and form a secret society with exclusive privileges and "exercise a terrible influence in degrading the people." It is curious to find that, as in Australia, the Indian medicine men are chiefly concerned to do positive harm. In cooperation with good and bad spirits, they bring about the deaths of men or dogs at a distance. Among the Ojibways they are a kind of broker in vengeance, and a coward or a hypocrite who wishes to be covertly avenged upon an enemy will bribe his tribal medicine man to employ the medical attendant of his victim. Then, if the victim dies, the instigators remain unsuspected, and the actual perpetrator of the crime probably goes scot free. Indian medicine men affect to suck out poison from a patient's body, or they cough up an arrow point or small, sharp piece of stone or bone which they suppose has been transferred from him to them by the evil spirit of another sorcerer. The medicine men of the Eskimos are even more extravagant in their pretensions. They profess themselves able to change into wood, stone or animal, or even to walk on the water, or to fly, but they make a condition, which is that "no one must see them."

MEDICINES. See CHEMICAL INDUSTRIES —*Antibiotics*; *Synthetic Drugs*; DRUG TRADE.

MEDILL, mĕ-dĭl′, **Joseph,** American journalist: b. near St. John, New Brunswick, Canada, April 6, 1823; d. San Antonio, Tex., March 16, 1899. Having early removed to Massillon, Stark County, Ohio, he was admitted to the bar in 1846, practiced at New Philadelphia, and in 1849–1851 published at Coshocton the *Republican,* a Free-Soil paper. In 1852 he established at Cleveland the *Daily Forest City,* a Whig organ, which in 1853 was united with the *Free Democrat* and called the Cleveland *Leader.* In 1855 he sold his interest in the *Leader,* removed to Chicago, with two partners purchased the Chicago *Tribune,* advocated radical antislavery measures and supported Lincoln in 1860. He was a member of the Illinois constitutional convention of 1870; United States civil service commissioner in 1871 and in that year was elected mayor of Chicago. In 1874 he became editor in chief of the Chicago *Tribune,* in which position he remained until his death. It was largely due to his individual efforts that the city of Chicago was selected for the World's Fair of 1893.

MEDINA, mĕ-dē′nȧ, **Harold Raymond,** United States jurist: b. Brooklyn, N. Y., Feb. 16, 1888. Educated at Princeton University (A.B. 1909), he went on to Columbia Law School and gained his bachelor of laws in 1912. In the same year he was admitted to the New York bar and became associated until 1918 with the law firm of Davies, Auerbach and Cornell. From 1918 to 1947 he was senior member of the firm of Medina and Sherpick, and taught at Columbia as lecturer in law (1915–1917), associate in law (1917–1925), and as associate professor of law (1925–1947). As a practicing lawyer he was counsel for Herbert Singer, the only defendant acquitted during the trial of officials of the Bank of the United States (1931), and he successfully defended Anthony Cramer

in the first treason case decided by the United States Supreme Court (1945). As both judge and lawyer he shared in effecting numerous reforms in court procedure.

In 1947 Medina was appointed by President Truman as judge on the United States District Court, Southern District of New York, and from January to October 1949 he presided over the nine-month trial of 11 Communists charged with and later convicted of conspiracy to teach and advocate the overthrow of the United States government by force and violence. In June 1951 the Supreme Court upheld the jury's conviction of the Communists as well as Medina's handling of the trial and the sentences he imposed. On June 11, 1951, he was appointed to succeed Judge Learned Hand (q.v.) on the U. S. Circuit Court of Appeals for the Second Circuit.

A prolific author and compiler in the field of law, Medina's works include: *Pleading and Practice Under New Civil Practice Act* (1922); *Cases on Federal Jurisdiction and Procedure* (1925); *Cases on New York Pleading and Practice* (1928); *Selected New York Practice Statutes* (1928); *Cases and Materials on Jurisdiction of Courts* (1931); *Medina's New York Civil Practice Manual* (1932); *Digest of New York Statute and Law* (1941); and *Summary of New York Pleading Practice and Evidence* (1941).

MEDINA, Sir John Baptist, Spanish portrait painter: b. Brussels, 1659; d. Edinburgh, Scotland, Oct. 5, 1710. The son of a Spanish officer who had married and settled in Brussels, then under Spanish rule, Medina studied painting in his native city under François Duchâtel. In his youth he married at Brussels Joanna Maria van Dael who bore him many children. Going to London in 1686 he established himself as a portrait painter, quickly gaining a reputation and many noble sitters. Two years later, one of his patrons, the munificent third earl of Leven (David Melville, 1660–1728), induced him to settle in Scotland; a subscription of £500 was collected to enable him to practice in Edinburgh. Accordingly he moved there with his large family. The antiquary George Vertue tells that he brought with him from his London studio "many postures for heads, the draperys painted—only to put the faces to them, cover'd them over with water-colours." By these mass production means he managed to paint a considerable number of paintings in a short time. He received so many commissions from the Scottish nobility that he was called "the Kneller of the North." He painted 20 portraits for the earl of Leven, including three of the earl himself. In Surgeons' Hall of Edinburgh's Royal College of Surgeons are several portraits of fellows of the college. The duke of Queensberry, as lord high commissioner of Scotland, knighted Medina in 1707, he being the last man in Scotland to receive that honor before the passage of the Act of Union the same year. He is also remembered for his drawings illustrating the Jonson edition of Milton's *Paradise Lost,* done during a visit to England in 1705. One of his sons, John (d. 1764), also practiced as a portrait painter, as did the latter's son John (1721–1796).

MEDINA, José Maria, Central American politician: b. Honduras, about 1815; d. Santa Rosa, Feb. 8, 1878. He was president of Honduras from 1862 to 1863, and was re-elected in 1864–1866 and in 1870. The war with Salvador in 1871 disturbed his successful administration and at the next election he was defeated by the Liberal Party. Defeated again by Leiva in 1874 Medina raised an unsuccessfull revolt in 1875–1876 and in 1877 a second revolt was punished with death by court martial.

MEDINA, José Toribio, Chilean bibliographer, scholar and author: b. Santiago de Chile, Oct. 21, 1852; d. 1930. He received his education at the National Institute and the University of Santiago, being graduated in law at the latter institution in 1873. At the age of 22 he was appointed secretary of legation at Lima. In that city he made investigations in the archives and in 1878 after his return to Chile he published a history of Chilean literature. Already in 1874 he had published a metrical translation of Longfellow's *Evangeline.* In the War of the Pacific, Medina served in the army and at the close of the war was made judge in the provinces ceded by Peru. He was made secretary of legation at Madrid in 1884 and here also he delved into the Spanish archives dealing with the Spanish in America and especially the history of Chile. He returned to his native country after several years' residence in Europe. He went abroad again in 1902 and also visited the United States to make further historical studies. Medina's great work is the *Biblioteca hispano-americana, 1493–1810,* 7 vols. (1898–1907), which contains notices of 10,000 works.

MEDINA, Vicente, Spanish poet: b. Archena, Murcia, 1866; d. 1936. Of humble origin, he earned wide fame after publication in 1898 of his *Aires murcianos* which profoundly influenced the character of regional poetry in Spain and Spanish America. He was not interested in mere depictions of the picturesque, or of physical and social aspects of an environment. He strove, rather, to capture the soul of the people through delineation of emotional conflicts and elemental human qualities.

MEDINA, mĕ-dē'nȧ (Arab. al-Madina), city, Arabia, 500 miles southeast of Palestine, 210 miles north of Mecca and about 120 miles from the Red Sea coast. It is reached from Damascus by an 820-mile railway journey. The city is celebrated for containing the tomb of Mohammed, whence it ranks second to Mecca as a pilgrimage resort of Islam. It is situated in the most fertile spot of all Hejaz, the streams of the vicinity tending to converge in this locality. An immense plain extends south from it; in every direction the view is bounded by hills and mountains. The town forms an oval, surrounded by a strong stone wall, 30 to 40 feet high, that dates from the 12th century, and is flanked with towers, while on a rock, at its northwest side, stands the castle. Of its four gates, the Bab-al-Salām, or Egyptian gate, is remarkable for its beauty. Medina has no large buildings except the great mosque, two smaller ones, a college and public baths. The houses are of stone, two stories high. Beyond the walls of the city, west and south, are suburbs consisting of low houses, yards, gardens and plantations. These suburbs have also their walls and gates. The mosque of the prophet stands at the east side of the city and resembles that at Mecca on a smaller scale. Its court is almost 500 feet in length, the dome is high and the three minarets picturesque. The tomb of the prophet, who died and was buried here in 632, is enclosed with a

screen of iron filigree, at the south side of which the pilgrim goes through his devotions, for all of which he pays, but is consoled with the assurance that one prayer here is as good as a thousand elsewhere. The tombs of Fatima (Mohammed's daughter) and abu-Bekr (father of his wife Aisha), and of Omar, the first caliph, are also here. The mosque dates from the period of Mohammed, but has been twice burned and reconstructed. Omar I and Othman ('Uthmān) both enlarged the original simple brick structure. It was again enlarged by the Caliph Walid (al-Walīd), so that it enclosed the three tombs. It was destroyed by lightning, probably about 850, and the graves almost forgotten. In 892 the place was cleared up, the tombs located and a fine mosque built, which was destroyed by fire in 1257 and almost immediately rebuilt. It was restored by Khaid Bey, the Egyptian ruler, in 1487. It is estimated that one third of the pilgrims to Mecca go on to Medina, the pilgrimage to which may be performed at any time of the year. In the time of Ptolemy the town was known as Lathrippa. There never was much population until the place acquired fame as a resort for pilgrims. From 1814 Medina had been the capital of the north pashalic of Arabia. In June 1916 Husein-ibn-Ali (Ḥusayn ibn-'Ali) proclaimed his independence of Turkey. Mecca thus, with the founding of the new kingdom of Hejaz, was lost to the Turks; Medina held out, however, until Jan. 13, 1919, when the Turkish garrison under Fakhri Pasha surrendered to the Emir Abdullah, the representative of King Husein of Hejaz. In 1924 it was occupied by Wahabis under ibn-Saud, who later established the Kingdom of Saudi Arabia (q.v.). Pop. (1951 est.) 12,000. See also MOHAMMED.

Consult Burton, Sir Richard Francis, *The Pilgrimage to Al-Medinah and Meccah* (London 1855); Twitchell, K. S., *Saudi Arabia* (Princeton 1947).

MEDINA, mĕ-dī'nȧ, village, New York, in Orleans County; altitude 530 feet; on the New York Central Railroad; 41 miles west of Rochester. It is on the line of the old Erie Canal, now the New York State Barge Canal.

Surrounding the village is a fertile agricultural area, producing field crops and fruits, especially grapes and apples. Like most towns in this region, Medina has the canning of fruits and vegetables as a basic, though seasonal, industry. More stable employment is provided by furniture and textile factories, foundries, and machine shops. Many of the buildings in the village are red sandstone which was quarried in the vicinity from the early days of settlement until late 19th century. There is a public library.

Medina was first settled in 1803 and incorporated in 1832. Its government is administered by a mayor and council. The water supply system is municipally owned. The electric power and light are purchased from a private company. Pop. (1940) 5,871; (1950) 6,179.

MEDINA, city, Ohio, and Medina County seat, 28 miles south of Cleveland; altitude 1,086 feet, on the Baltimore and Ohio and the Akron-Canton and Youngstown railroads; has an airport. It produces furnaces, aluminum casting, pickles and relishes, honeybee supplies, and honey products. It has a public library, and public and parochial schools. The government is by mayor and council. Pop. (1940) 4,359; (1950) 5,086.

MEDINA SERIES, *in geology,* a term introduced by the New York Geological Survey for a subdivision of the Upper Silurian series, apparently the base of that system. It is named from Medina, N. Y.; occurs throughout the Atlantic states; and includes shales, conglomerates and sandstones. For the Medina sandstone see LEVANT.

MEDINA-SIDONIA, mȧ-thē'nä-sē-thō'nyä, city, Spain, in the province of Cádiz, 19 miles southeast of Cádiz and 55 miles northwest of Gibraltar, built in the form of an amphitheater on a broad eminence, in the middle of an extensive plain, noted for its agricultural products and cattle rearing, which constitute the chief occupations of the population. A fine Gothic church, a town hall and the ancestral palace of the famous dukes of Medina-Sidonia are the principal buildings. Pop. (1940) 8,361.

MEDINET EL FAYUM, mă-dē'nĭt ăl fā-yōōm' (more properly EL FAIYÛM, or El FAYUM), town, Egypt, capital of the province of Faiyûm, on the Bahr-Yusef, 70 miles southwest of Cairo. It contains a fine bazar and a mosque. It has an extensive trade in grain, woolens and roses. Woolens are manufactured. Pop. (1947) 72,465.

MEDITATIONS POETIQUES and **NOUVELLES MEDITATIONS POETIQUES.** The *Méditations* (1820) and *Nouvelles Méditations* (1823) of Lamartine should be counted rather as heralds of the Romantic School of French poetry than as products of it. The former, its author's first publication—he was then 30—appeared five years after Waterloo. Its sentimentalized melancholy voiced so admirably the temper of that period of political reaction and moral exhaustion that it achieved a success in its day hardly paralleled. Its appeal was to the cultured only, but 40,000 copies of the *Méditations* were sold in four months. The modern reader must strive to realize the temper of 1820 if he would comprehend how these rather thin and always superficial reflections on the relations of man to "Nature"—a creation of the poet's morbidity, with little relation to reality—rather than to his fellowmen, found admiration so ardent, that successive volumes of verses, in his own phrase, "fell from my pen like drops of evening dew." "The soul of the poet," he writes in a volume of *Confidences,* "is a running brook which writes its murmurs and sings them, but we write them with human notes and Nature with the notes of God."

The *Méditations* were the work of an army officer, but it was the army of the Restoration, decidedly more responsive to Rousseau's call for a return to nature as it was also to Chateaubriand's for a return to religious emotionalism than it was to any summons to action. When that mood passed and France recovered the energy that showed itself in politics by the Revolution of 1830 and in literature by the Romantic School, the *Méditations* soon came to be little read, though still conventionally admired. Unquestionably, however, they were the most complete literary reflection of the sentiments and aspirations, the self-deceptions and illusions of the generation of 1820. This gives them a lasting value, greater than any merit of content or form.

Lamartine's verses preserve much of the

verbal mannerisms of the earlier period. They are harmonious, refined, delicate, graceful, sincere, spontaneous, "the indolent pleasure of a too-richly gifted mind." On the other side they are conventional in expression, monotonous in feeling, elusive in development. The themes are throughout those of the true lyric — nature, love, death. The essence of all Lamartine's voluminous poetic effusion can be seen in its full potency in some of the very earliest of the 'Méditations,' for instance, in The Lake (Le Lac), accounted by some to be Lamartine's best poem, in Loneliness (L'Isolement), and in the vague pantheistic melancholy of Prayer (La Prière). In the 'Nouvelles Méditations' the poet's congenial marriage is reflected in the happier vein of the Love Song (Chant d'Amour), Wisdom (La Sagesse), Ischia and The Preludes (Les Préludes), but the poet soon resumes the melancholy pose. The Ode on Bonaparte in this collection goes deeper and rises higher than is usual in Lamartine; as indeed there is unwonted grace in Ischia and force in The Crucifix. Never so popular as the earlier book, 'Nouvelles Méditations' are preferred by many critics, and Brunetière even pronounced them "at once the noblest and the most *voluptueux* in French poetry." It is juster to say, with Lanson, that if, and so far as, poetry is essentially sentiment, disengaged from the ideas and facts that produce or accompany sentiment, the 'Méditations' are great poetry and Lamartine is among the most poetic of poets. Consult 'Life of Lamartine' by H. R. Whitehouse (New York 1919).

BENJAMIN W. WELLS,
Author of 'Modern French Literature.'

MEDITATIONS OF MARCUS AURELIUS, The. There is probably no more romantic story of a book in the history of literature than that of the volume known as the 'Meditations of Marcus Aurelius.' It is merely the commonplace book or diary of a Roman emperor (121–180 A.D.), who at the end of a very busy and troublous reign, just when worries were thickest, jotted down all the serious thoughts that came to him with regard to the meaning of life and the way it should be lived. He called his little book simply "To Himself." It was probably meant only for his own perusal when he was in meditative mood. He so loved the Greek Stoic philosophers whose writings had been his inspiration and consolation that he wrote in Greek. It is not good Greek any more than the 'Imitation of Christ' is good Latin. He paid little attention to the style of it, and yet Headmaster Rendall of Charterhouse in his Introduction to the 'Meditations' does not hesitate to say that "in the whole range of Greek literature, no work (excepting the New Testament) has wider vogue and currency than these untutored meditations of the imperial moralist."

The book created a *furore* in the Renaissance when it was first edited and printed, but it has never ceased to be the favorite reading of thoughtful scholars. John Stuart Mill declared the 'Meditations' as "almost equal in ethical elevation to the Sermon on the Mount." Matthew Arnold went so far as to say that "Marcus Aurelius remains the especial friend and comforter of all clearheaded and scrupulous, yet pure hearted and upward striving men in those ages most especially that walk by sight, not by faith, but yet have no open vision." Americans will be interested to know that the 'Meditations' of Marcus Aurelius were with Machiavelli's 'Art of War' the daily study of Capt. John Smith, the Virginia pioneer whose romantic history might seem to indicate some less stern and stoic reading. The Roman emperor's little book has often since been the daily resource or even the boon companion of men of action in the field as well as of statesmen worried over matters of politics, and of scholars with time on their hands.

It has been suggested that perhaps this last of those Spanish Cæsars, under whose rule for 80 years Gibbon thinks that the world was happier than it has ever been before or since, had the idea while he was jotting down these scattered thoughts on life that some time or other they might be of service to his son Commodus. If that were so, the book might serve as the contrast to Chesterfield's letters. The modern English nobleman wrote an epitome of worldliness; the ancient emperor a manual of otherworldliness. But if Marcus Aurelius wrote for the eye for his son, he was sadly disappointed, for Commodus was probably one of the worst rulers of history. For his weak selfishness no advice would have availed.

The 12 books treat of: I, The debts that he owes for all that has come to him in life — (here are tributes to his grandfather — his father died when he was very young — to his wife "so docile, so affectionate, so simple," and to many dear friends); II, On doing what you do; III, That to obey God is liberty; IV, That there is no such thing as chance; V, On the real goods of life; VI, That the inner life is all that counts; VII, On repressing impulse and finding self-content; VIII, On equanimity; IX, Fate leads the willing man, but drags the unwilling; X, Look around you, look behind you, look ahead of you; XI, Unselfishness; XII, (In conclusion) "Depart then satisfied for he who also releases thee is satisfied."

When the Emperor Julian whom the modern world knows as the Apostate would sum up the life of Marcus Aurelius in a single phrase he gave an excerpt from a dialogue supposed to take place not long before his predecessor's death: "Then Hermes, looking at Marcus, said, 'And to you, Verus [Marcus' family name], what seemed the noblest end of life?' Quietly and gravely he replied, 'The imitation of God.' "

Consult Watson, 'Life of Marcus Aurelius' (New York 1884); 'Marcus Aurelius,' in Matthew Arnold's 'Essays in Criticism'; Rendall, 'Marcus Aurelius Antoninus' (London 1901); Long, 'The Meditations of the Emperor Marcus Aurelius Antoninus' (London 1862); Canon Farrar, 'Marcus Aurelius,' in 'Seekers After God.'

JAMES J. WALSH.

MEDITERRANEAN (med"ĭ-tĕ-rā'nē-an) **SEA,** the great inland sea between the continents of Europe, Africa and Asia, the remnant — according to Professor Suess — "of a great ocean which at an early geological epoch, before the formation of the Atlantic, encircled half the globe along a line of latitude." From its eastern extremity in Syria to the Strait of Gibraltar it is about 2,300 miles long; its maximum width from Venice to the Bay of Sidra

is 1,200 miles; its average width 300 miles. Its area is variously estimated as from 815,000 square miles to 1,145,000 square miles. The shores of Europe are on the north and northwest, those of Africa on the south and those of Asia on the east. The Mediterranean is connected with the Atlantic by the Strait of Gilbraltar, and on the northeast with the Black Sea through the Dardanelles, Sea of Marmora and the Bosphorus, which form a continuous waterway. It is irregular in shape and by the projection of the south part of Italy, and of Cape Bon in Africa and the interposition of the island of Sicily, is divided, near its centre, into two distinct portions, an east and a west. In addition to these, the other important subdivisions are the Tyrrhenian or Tuscan Sea, between the west coast of Italy and the islands of Sardinia and Corsica; the Adriatic Sea or Gulf of Venice, between the east coast of Italy and the west coast of Yugoslavia and Albania; the Ionian Sea, between the west coasts of Albania and Greece, and the south part of Italy and the island of Sicily; the Aegean Sea or Archipelago, between Greece on the west and Turkey in Asia on the east; and the Levant, which is usually understood to include the whole sea east of the island of Crete. The largest gulfs are, on the shores of Europe, those of Lion or Lyons, Genoa, Taranto, Lepanto, Koron, Kolokythia and Salonica; on the shores of Asia, Adrymiti, Smyrna, Adalia, and Skanderoon; and on the shores of Africa, Sidra and Cabes. The largest and most important islands are Sicily, Sardinia, Corsica and the Balearic Isles, in the west division; and Cyprus, Rhodes, Crete, the Ionian Isles and Malta, in the east division. The principal rivers which discharge themselves into the Mediterranean are the Ebro, Rhone, Po and Nile; but its communication with the Black Sea entitles it to claim it as part of its basin, and, consequently, also the great rivers Don, Dnieper, Dniester and Danube. Between Cape Bon and the Sicilian coast, where the sea is shallowest, the depth varies from 30 to 250 fathoms; but in almost all other places, particularly at a distance from the shores and islands, the depth is very much greater, the maximum depth in the eastern division being 2,150 fathoms, in the western division, 2,040 fathoms. The mean depth is practically equal in the east and west divisions, about 883 fathoms. However, half the area is less than 500 fathoms deep. The depth temperatures are very much warmer than in the Atlantic. Owing to the very narrow channel which connects the Mediterranean with the main ocean, there is very little tide; though in some places, as in the Ionian Sea, the Adriatic, on parts of the African coast, etc., a rise of more than six feet sometimes occurs. The prevailing winds are the southeast and southwest in spring, and the northeast and northwest during the rest of the year. They often rise suddenly and with great violence. The most remarkable are the historic Euroclydon or Levanter, mentioned in Acts 27:14, a northeast wind of dangerous whirlwind characteristics; the Bora in the Adriatic; the Etesian and Tramantona in the Aegean; and the burning sirocco from the African desert. The Mediterranean abounds with fish, some 400 species having been noted, and also furnishes the finest coral and sponge. The evidences of volcanic action along its shores are present in the active volcanoes of Vesuvius, Etna and Stromboli (qq.v.). Consult Cook, J., *The Mediterranean and Its Borderlands* (Philadelphia 1910).

MEDITERRANEAN SUBREGION, a subdivision of the Palaearctic region, embracing the basin of the Mediterranean and the plains of Syria. See Zoogeography.

MEDIUM, THE, a two-act opera by Gian-Carlo Menotti (q.v.); libretto by the composer. First produced at the Brander Matthews Hall of Columbia University, New York, May 8, 1946. In the following February it was given three performances by the Ballet Theatre at The Heckscher Theatre in New York, together with the premiere performances of Menotti's *The Telephone* (q.v.). Commencing May 1, 1947 the two operas were produced under commercial sponsorship at The Barrymore Theatre in New York, and continued for several months consecutive run of nightly performances.

Both acts take place in Madame Flora's parlor, in contemporary times. Madame Flora is a fraudulent medium who uses her daughter Monica, and the deaf-mute Toby, as confederates. Toby is deeply in love with Monica. In the midst of a séance Madame Flora feels a cold hand about her throat. She is so frightened that she exposes her tricks to her clients, Mr. and Mrs. Gobineau and Mrs. Nolan. The clients refuse to be undeceived, but Madame Flora cannot believe that the hand on her throat was a supernatural phenomenon. She insists that Toby was trying to kill her. She threatens the boy and beats him, and in spite of Monica's pleadings, turns him out of the house. Madame Flora starts drinking and becomes so drunk that she sinks into a stupor. Toby returns, trying to find Monica. Madame Flora revives and Toby hides in the cabinet. In a panic Madame Flora takes her revolver and shoots at the curtains of her cabinet. Toby's body falls to the floor.

MEDJIDIEH. See Orders and Decorations—*Turkish.*

MEDLAR, a small tree (*Mespilus germanica*) of the apple family. Although a native of southern Europe, it is also grown in America. In central New York it is hardy and produces well with no special care. The top-shaped fruit, which is about the size of a small pear, is used for preserves.

MEDOC, mâ-dŏk', a wine which derives its name from a district of France, in the ancient province of Gascony. It is dry, still and delicate, resembling Bordeaux wines, which territory is immediately south of Medoc.

MEDULLA OBLONGATA, the brain-stem, or that part of the nervous system that lies between the *pons,* or *pons Varolii,* at the upper end, and the spinal cord proper, with which it is continuous, at its lower end. It is a very old part of the nervous system, judged from the standpoint of evolution, and in it are located the important centers of most of the cranial nerves, including the centers that govern the nerves of the heart and of respiration. It

is a triangular cone-like portion of the nerve-axis, about an inch in length and one-half to three-quarters of an inch thick, being tubular below and flattened above. Below, it closely resembles the cervical cord in its internal construction, but above great changes take place to accommodate important new structures. One of the most conspicuous features of the medulla consists in a triangular enlargement of the central canal of the cerebro-spinal axis, constituting what is known as the fourth ventricle. The lower seven cranial nerves have their apparent origin in the medulla, and the first spinal nerve also originates in the medulla proper. The internal anatomy of the medulla is complicated. At the lower end the chief motor tracts, the pyramidal tracts that come from the motor area (q.v.) in the brain cross one another to pass down on opposite sides of the spinal cord. It is because of this decussation that a hemorrhage of the brain of the right side causes a paralysis of the muscles of the left side of the body, and *vice versa.* Just above the decussation of the pyramids the end-stations (nuclei) of the two chief sensory tracts of the body are located. It is into these nuclei — the gracilis and the cuneatus — that all of the sense-impressions from the body below the head are collected, to be passed to higher cerebral centres through the lemniscus or sensory fillet. The chief gray masses in this part of the brain are the nuclei of the cranial nerves referred to, and of the olives, two structures of undetermined function. The best description of the oblongata at present is that of the model of the medulla and pons by Dr. Florence Sabin, which is figured in Barker's 'Nervous System.' Consult also Buck, 'Reference Handbook of the Medical Sciences,' article "Brain," and Johns Hopkins Hospital Reports, Welch Memorial Volume. See BRAIN.

MEDUM, Egypt, village on the Nile, 40 miles south of Cairo, near the Pyramid of Snefru. See PYRAMID.

MEDUSA, mẹ-doo'sạ. See GORGO.

MEDUSA, a disk-bearing jellyfish (q.v.).

MEDWAY, England, a river which rises in the county of Sussex and flows northeast in a winding course across Kent, past Tunbridge and Maidstone, to Rochester and Chatham. Below Chatham it spreads out into a broad tidal estuary, in which are several islets, and joins the Thames at Sheerness. It is 70 miles long and is navigable to Penshurst, 20 miles above Chatham.

MEEHAN, mē'ạn, **Thomas,** American botanist: b. Potter's Bar, near London, England, 21 March 1826; d. Philadelphia, 19 Nov. 1901. From his father, a gardener, he learned facts of natural history when a child; at eight made and recorded an original discovery in herpetology; taught himself from books read at night after daily tasks; at 12 began to publish scientific papers; soon after produced the first hybrid fuchsia; and was nominated to membership in the Royal Wernerian Society. For two years he held a position at Kew Gardens. In 1848 he came to America and took charge of Bartram's Gardens in Philadelphia. In 1854 he established the Germantown Nurseries, which he conducted until the end of his life. For 30 years (1859-89) he edited the *Gardeners' Monthly,* and contributed papers to many other periodicals and to scientific societies. For 23 years he was senior vice-president of the Philadelphia Academy of Natural Sciences, in whose proceedings were published his important 'Contributions to the Life History of Plants.' In 1875 he was elected a fellow of the American Academy for the Advancement of Science, before which, among other noteworthy papers, he read 'A Contribution to the Doctrine of Evolution and the Theory of Natural Selection,' which showed him as a coworker with Darwin and other evolutionary scientists, in whose field he also was a discoverer. From the creation of the office until his death he served as State botanist of Pennsylvania, at one time was a member of the board of visitors of Harvard, and was one of the American editors of the 'Encyclopædia Britannica.' His travels and researches extended throughout the country, including Alaska. In 1878 he began the publication of 'Native Flowers and Ferns of the United States,' an illustrated serial covering a wide field of floral distribution, the main features of which he continued in *Meehan's Monthly,* founded in 1891. Many learned societies abroad enrolled him, and he held intimate relations with nearly all the leading scientists of his time. Among his closest friends was the Comte de Paris, a devotee of plant-study. Meehan was the third American to receive the Veitch medal, awarded to him for "distinguished services in botany and horticulture." Apart from scientific work he devoted himself to public labors; was a member of the Philadelphia common councils from 1882 until his death; during the same period served on the local school board; in both capacities introduced many reforms; and chiefly through his efforts nearly 30 small parks were added to the city. A work of permanent value is his 'American Hand-book of Ornamental Trees' (1853).

MEEK, mēk, **Alexander Beaufort,** American jurist: b. Columbia, S. C., 17 July 1814; d. Columbus, Miss., 30 Nov. 1865. He was graduated from the University of Alabama in 1833 and admitted to the bar two years after. He served in the Seminole War 1836; was attorney-general of Alabama 1836; judge of Tuscaloosa County 1842-44; and member of the legislature in 1853. While there he established the free-school system of Alabama. In addition to a legal digest (1842) he wrote: 'The Red Eagle' (1855); 'Songs and Poems of the South' (1857); 'Romantic Passages in Southwestern History' (1857), etc. His best-known poem is 'The Charge at Balaklava.'

MEEK, Fielding Bradford, American palæontologist: b. Madison, Ind., 10 Dec. 1817; d. Washington, D. C., 28 Dec. 1876. His educational advantages were limited, but his interest in natural history made study imperative to him, and in 1848 he became assistant to David D. Owen in a geological survey of Iowa, Minnesota and Wisconsin. He assisted James Hall at Albany in 1852-58, spending several summers in a geological survey of Missouri and Nebraska, and in 1858 went to Washington, where he devoted the remainder of his life to palæontologic investigations under the government. He was elected in 1870 to the National Academy of Sciences, and was a member of

other scientific organizations. Among his writings are 'Check List of the Invertebrate Fossils of North America' (1864); 'Report on Invertebrate Cretaceous and Tertiary Fossils' (1876), etc. For a complete list of his works, see bibliography published by the Smithsonian Institution.

MEEKER, Royal, American statistician: b. Silver Lake, Susquehanna County, Pa., 23 Feb. 1873. In 1898 he was graduated at Iowa State College and in 1906 took the degree of D.Ph. at Columbia University. He also studied at Leipzig. In 1904–05 he was professor of history, politics and economics at Ursinus College, Collegeville, Pa. In 1905 he became preceptor at Princeton and from 1908 to 1913 was assistant professor of political economy there. On 12 Aug. 1913 Dr. Meeker was appointed commissioner of labor statistics by President Wilson. In 1926–27 he was professor of economics, Carleton College, Minn. He published 'History and Theory of Shipping Subsidies' (1905).

MEEKINS, Lynn Roby, American journalist: b. Salem, Md., 14 Nov. 1862; d. 8 Nov. 1933. He was graduated from Western Maryland College, Westminster, Md., in 1882, and devoted himself to journalism. He was literary editor of the Baltimore *American* 1882–99; managing editor, *Saturday Evening Post,* 1899–1901; editor, Baltimore *Herald,* 1903–06; editor, Baltimore *Star,* 1908–11; on editorial staffs *News* and *American,* Baltimore after 1920. He published 'Robb's Island Wreck'; 'Adam Rush,' etc.

MEERANE, Saxony, town, 10 miles north of Zwickau and 36 miles south of Leipzig. It contains a mediæval church. Meerane is one of the largest textile-producing centres of the state, turning out vast quantities of woolen and mixed cloths. It has also extensive dyeing establishments, machine works, tanneries, boiler works, motor factories, button, paper box and cement works. The town has a Realschule, a textile school and a school of commerce. Pop. 24,094. Consult Leopold, 'Chronik und Beschreibung der Fabrik-und Handelstadt Meerane' (1863).

MEERKAT. See SURICATE.

MEERSCHAUM (Sepiolite), mēr'shâm or -shum, a name given to one of the silicates of magnesium; it is a mineral of a whitish or creamy color, and received its name from its appearance and the position in which it is sometimes found suggesting that it was petrified foam of the sea. It is obtained from various places, but the best quality comes from Asia Minor, rich deposits of it existing about 20 miles southeast of Eskichehir, at a place called Sepetdje. Here are some 20,000 pits in a space of six miles, of which only 150 are worked, all the others being exhausted. It is said that these mines were opened 1,000 years ago, which is not incredible, as it is well known that magnesia was formerly used for many purposes, other than the fabrication of pipes; moreover, fuller's earth was once worked on a vast scale by the ancients. The meerschaum mines are worked by some 500 miners, who live in the surrounding villages. At Gheikli, in the neighborhood of Sepetdje, there are 3,000 pits, of which only 100 are worked, giving employment to 400 miners. The mineral is mined in blocks, which are taken to Eskichehir, where the blocks are cleaned, the operation consisting of scraping and cutting the blocks with a sharp instrument or knife, the meerschaum being still soft and easily cut into any shape or form. Over 1,100 persons are occupied in cleaning and shaping these blocks, which, after being thoroughly cleaned, are separated into four classes, according to size and quality. These blocks being ready for sale, a bargain is struck between the pipe manufacturers and the commission agents and merchants at Eskichehir, of whom there are about a dozen. The latter then pack the blocks of these four classes with very great care into boxes of equal size, each block being wrapped in cotton to avoid any friction or shock between the pieces. The actual annual output of these mines varies from 120 to 150 tons. It is soft when dug up, but becomes hard when dry. Most of it is sent to Vienna, where it is chiefly made into tobacco-pipes, many of them highly artistic. Similar pipes are also made in Paris, London and elsewhere.

MEERUT, India, the capital of the district and division of the same name, in the United Provinces, situated 40 miles northeast of Delhi on the Northwestern Railway. The city is irregularly built, with narrow, filthy streets. It contains several mosques, a fine town hall, a college, normal school and church schools. At Meerut is one of the largest cantonments in India. Flour and soap are the principal manufactures. The first outbreak of the Indian Mutiny of 1857 occurred at Meerut. The city has a good water supply and an excellent drainage system. Pop. 123,000.

MEES, Arthur, American musical director: b. Columbus, Ohio, 13 Feb. 1850; d. New York City, 26 April 1923. He was graduated from Concordia College, Fort Wayne, Ind., and studied music in Berlin. He was assistant director, and later director, of some of the leading operas and musical associations, and published, in addition to his annotated programs for the New York Philharmonic Society and the Chicago Orchestra, 'Chorus and Choral Music.'

MEGACLES. The most illustrious Greek of this name was the head of the family of the Alcmæonidæ at Athens in the time of Solon. After twice expelling Pisistratus, who in 560 B.C., had made himself «Tyrant» of Athens, he was himself exiled by the latter together with all his family.

MEGALENSIA, or MEGALESIA, an annual festival at Rome (4–10 April) in connection with the foreign cult of Cybele, the *Magna Mater* or Great Mother of the Gods, celebrated by a procession of her eunuch-priests, by circensian and theatrical shows, and at the close a carnival.

MEGALITHIC MONUMENTS. See DOLMEN; MENHIRS; STONES, STANDING; STONE CIRCLES.

MEGALONYX. See GROUND-SLOTHS.

MEGALOPOLIS, mĕg-ą-lŏp'ō-lĭs, or **SINANON,** Greece, a ruined city on the ancient Helisson, in the nomarchy of Gortynia, 5 miles north of Leondari. It was founded 370 B.C. by Epaminondas (q.v.) as the federal capital of Arcadia and was a magnificent walled city, five and one-half miles in circumference; it was frequently but unsuccessfully attacked by the

Spartans. In 222 B.C. it was captured and partially destroyed by Cleomenes III. From 1890–93 the British School at Athens excavated the site and revealed the Precinct of Zeus Soter, the Agora, the Stoa of Philip and the Stoa of Myropolis, etc.

MEGALOSAURUS, mĕg″ą-lō-sâ′rús, a genus of huge carnivorous dinosaurs of the group *Theropoda.* Their remains occur frequently in the European oölitic rocks. The extreme length was about 50 feet. They were covered with scales and built like lizards, but with proportionally longer, heavier legs. See DINOSAURIA.

MEGANTIC, Canada, town and county seat of Frontenac County, Quebec, on Lake Megantic, the Chaudiere River and the Canadian Pacific Railway, 50 miles east by north of Sherbrooke. It is the seat of a business college and of a convent. The leading industry is the manufacture of pulp. Pop. 5,000.

MEGAPHONE (a Greek word meaning «great sound»), an instrument magnifying the sound of the voice many times, so that one can be heard at a considerable distance. In its simplest form it is a cone-shaped trumpet, and the speaker shouts into the small end, the instrument directing the sound waves wherever it is aimed. This form is used by announcers at base ball games, etc. The form invented by Thomas A. Edison consists of two large funnel-shaped receivers in which the waves of sound are collected and concentrated and carried by means o. flexible tubes held to the ears of the person using the instrument. In the instrument called telephone-megaphone, the mouthpiece of the telephone is connected with four transmitters which multiply the usual telephone sound of the voice by four, and it is sent by wire, so increased, into the megaphone, which sends it forth into space with sufficient intensity to carry it with perfect distinctness throughout a large church or hall. One form of megaphone is largely used by deaf persons.

MEGAPODES, a general name for the brush-turkeys or mound-birds of Australia constituting the gallinaceous family *Megapodiidæ,* so named in reference to the disproportionately large size of the feet; and remarkable for their breeding habits. The family, although mainly Australian, is represented in many of the South Sea Islands and in the Philippines, replacing the pheasants, which are absent from that region. There are 7 genera and 20 or more species, mostly with restricted individual ranges, and varying in size from that of a turkey to that of a large pigeon, the sexes being always alike in plumage. The general colors are browns and yellows with the naked wattled parts brightly colored. They have a short, strong bill; the head and neck almost naked and wattled; the wings short and round, the tail large; the legs and feet large, strong and provided with great claws. Megapodes are terrestrial birds found in hill-valleys, among thickets or along river and sea beaches. They run well, but if hard pressed will take to trees where they hop about awkwardly; their flight is heavy, but may be long sustained. Hoarse, chuckling, cackling or mewing cries express the utterances of the different species, which are often heard at night. The food consists of fallen fruit, seeds, berries, worms, snails, insects and even small crabs. The flesh is dark-colored and not good, though palatable to the Australian aborigines.

One of the best known species is the brush-turkey or mound-turkey (*Catheturus lathami*), also known as the wattled talegalla and the New Holland vulture, the latter name being given to it on account of its yellow, naked head and neck, covered in part with fleshy wattles. It is rather common in New South Wales, inhabiting the most thickly wooded parts. It is a large bird, about the size of a turkey, with blackish-brown plumage. It is shy, and when pursued, endeavors to escape by running through the thickest brush, or by leaping to the lowest branches of a tree, and thus avoids the dingoes or native dogs, which, however, often hunt it down on open ground. It is easy game to the sportsman, who finds it roosting under shelter of the branches of trees during the heat of the day, and although several of a flock are shot, the rest keep their place undisturbed. They are generally seen in small flocks, and make their nests together, the females heaping up, by means of their feet, mounds of several cartloads of earth and decayed leaves, which are used from year to year, new materials being added every year. The eggs are separately buried, often by several females, within the mass, where they are hatched by the heat of the fermenting mound. The parent birds partially uncover them during the day. Nearly a bushel of eggs may sometimes be found in a single heap. The male bird pays great attention to the young after they are hatched, covering them up partially in the mound at night for warmth. The flesh of the talegalla is excellent, and the eggs are also very delicate and eagerly sought after. Two other species occur in New Guinea.

South and West Australia have another familiar megapode in the mallee-hen or «native pheasant» (*Lipoa occellata*)—a large gray-brown bird with eye-like markings on the wings and back, and the naked neck and wattles blue; its mounds are comparatively small and often made individually. A bird often confounded with this in books because of similarity of name is the maleo (*Megacepalon maleo*) of North Celebes, which has the singular habit of making a general migration in the breeding season to the sea-beach, where small groups of females dig large holes in the sand just above high-water mark, and day by day bury eggs there until the quota of each is laid; these gradually hatch under the influence of the hot sand. The largest genus is *Megapodius,* whose 15 species are scattered over all the island region between Samoa, the Philippines and the Micobars, each group having a distinct species. The most widely distributed and best known is *M. tumulus,* the common mound-bird or scrub-turkey of Northern Australia and the Papuan archipelago, which fashions mounds 10 or 11 feet high in the densest woods, continues to use them year after year, and lays pale, coffee-colored, thin-shelled eggs in straight burrows penetrating the mound. In some islands the eggs of these birds are an important food resource. The young are well fledged when they emerge from the egg and scramble out of the mound, but are attended to by their parents for some time. Consult Newton, 'Dictionary of

Birds' (1869); 'Proceedings,' Zoological Society of London, 1876, 1888, etc., and works on the ornithology of Australia and Oceanica.

MEGAPOLENSIS, Joannes, Dutch Protestant missionary to the North American Indians: b. Koedyck, Holland, 1603; d. New York, 24 Jan. 1670. His family name, van Mekelenburg, he Hellenized to Megapolensis. In 1642 Van Rensselaer, the first Patroon, brought him to New York from Holland, and he soon learned the Mohawk tongue and preached successfully among the Indians near Albany, several years before John Eliot's mission or any other Protestant preaching to the Indians. From 1649 until his death he was pastor of the Dutch church in New York, where he showed little tolerance to Lutherans and Independents. He advised peaceable surrender to the English in 1664. His account of the Mohawks is published in the third volume of the New York Historical Society's 'Collections' (1870).

MEGARA, Greece, the capital of ancient Megaris (q.v.), between Attica and Corinth; also a modern town in the eparchy of Megaris, of 9,500 population.

MEGARIAN SCHOOL OF PHILOSOPHY, a Greek school of philosophy based on and developed from a part of the Socratic system. Euclid of Megara was the first to give definite form to its teaching. Eubulius was also a prominent member of this school, which confined itself mainly to dialectic methods, and sought to unite the Socratic ethical principle and the Eleatic theory of the One, to whom only true being might be attributed.

MEGARIS, mĕg'a-rĭs, Greece, the name of an ancient state or small district bounded north by Bœotia, east by Attica, south by the Saronic Gulf and the territory of Corinth, west by the Corinthian territory and the Corinthian Gulf; area, about 143 square miles. It is a mountainous country, the only plain being that on which the capital was situated. Mount Cithæron was on the north boundary, separating it from Bœotia. The people were traders and sold their textiles over a large area. The only important town was Megara, situated a mile from the sea, opposite the island of Salamis. It contained a Pelasgian citadel, called Caria, on a hill northwest of the city, with a temple to Demeter called Megaron, from which the name of the town is supposed to be derived. It had flourishing colonies at an early period, and its navy was so powerful that it was only after a long struggle with it that Athens obtained possession of Salamis. It afterward became annexed to Attica, of which Megaris formed one of the four ancient divisions. It was successively conquered by the Dorians and the Corinthians, but afterward asserted its independence, and became wealthy and powerful.

MEGASTHENES, a Greek historian, who about the year 300 B.C., as ambassador of King Seleucus Nicator at the court of the Indian king Sandracottos, gathered the material for a geographical and historical account of India that, reaching us in the form of fragments and worked over in Strabo, Diodorus and Arrian, is our chief source of knowledge of that country in antiquity. There is an edition of the fragments by E. A. Schwanbeck (Bonn 1846); also a translation by McCrindle, 'Ancient India as Described by Megasthenes and Arrian' (Calcutta 1877).

MEGATHERIUM, a gigantic fossil ground-sloth, the largest known edentate, representing the family *Megatheriidæ,* and especially the species *Megatherium americanum,* whose remains are found plentifully in the Pleistocene strata of Argentina and Patagonia. These early edentates were so generalized, that, as compared with modern forms, they exhibit the head and teeth of a sloth, associated with the vertebræ, limbs and tail of the ant-eater. Some of them attain a gigantic size, at least as large as an elephant, but with shorter limbs and a bigger tail, and the latest species are the most bulky. *Megatherium,* according to Woodward, seems to have been entirely destitute of dermal armor. The only one of its allies in which bony plates have been discovered is *Mylodon,* and they are very small and not fused together. The pelvis and hind limbs are heavily formed, showing that the animal was in the habit of standing on them, steadied by the powerful tail, like a kangaroo. They fed on the branches of trees. The mylodons were somewhat smaller than the megatheria, with a skull and teeth more like those of the modern sloths, and the three inner digits of the forefoot bear claws, about equal in size, instead of the huge middle-finger claw of the Megatherium. In both animals the hind foot lacks digit I, but II and III bear claws. The typical species of mylodon (*M. harlani*) was about as large and of much the same form as a rhinoceros, and inhabited the southwestern United States, while various other species lived in South America. The long-headed South American genera, *Scelidotherium* and *Megalonyx,* are other forms of the same family. See GROUND-SLOTHS. Consult the palæontological writings of Leidy, Lydekker and Woodward; also Scott, G. B., 'History of Land Mammals' (1913).

MEGIDDO, an important fortress city of ancient Canaan. Thothmes III captured it in the 23d year of his reign, and took therefrom magnificent spoils. The city is mentioned several times in the Tel-el-Amarna correspondence. Though nominally in the territory of Manasseh (Jos. xvii, 12, 13; Judg. i, 27, 28) it remained in possession of the Canaanites. Near the «waters of Megiddo» Barak and Deborah defeated the Canaanites under Sisera (Judges v, 19–21). Solomon restored the fortifications (1 Kings ix, 15) and Ahaziah is said to have died there (2 Kings ix, 27). Finally it was at Armageddon (*Har-Magedon,* mountains of Megiddo) that the great conflict of Revelations xvi, 16, was to take place. The site of Megiddo may now be considered as proved to be Tel-el-Mutesellim, a great mound four miles northwest of Tel Taanach. It was evidently of great strategic importance since it commanded the pass from the Plains of Sharon to the Plain of Esdraelon, which in all the centuries from Thothmes III to Allenby in 1917–18 has been the route of armies. Fortifications preceding 2000 B.C. have been uncovered on the site, together with the remains of several cities which rose here successively and vanished. Here too was found the seal of Shama, servant of Jeroboam (II?). In Roman times the place was a fortified post — the *Legio* of

Eusebius, the modern *el Lejjun*. Consult Schumacher, 'Tell el Mutesellim: Bericht über die 1903 bis 1905 veranstalteten Ausgrabungen I' (Leipzig 1908).

MEGNA, mĕg'nạ, or **MEGHNA,** India, the estuarine outlet of the Ganges and Brahmaputra (qq.v.), in Bengal. There are four principal mouths, producing three islands. The tidal bore is characterized by its velocity, which endangers navigation, advancing at the rate of 15 miles an hour, and frequently attaining a height of nearly 20 feet. As the bottom is loose sand; it shifts continually, making navigation difficult.

MEGRIM. See MIGRAINE.

MEHEMET (mā'hĕ-met), or **MOHAMMED** (mō-ham'ĕd), **ALI,** viceroy of Egypt: b. Kavala, Macedonia, 1769; d. Cairo, 2 Aug. 1849. An orphan, he was brought up by a janizary captain, governor of Kavala, who married him to a kinswoman and made him a militia officer. When the French invaded Egypt he was sent there, rose rapidly, became the confidant of Koshrew, pasha of Egypt, and, by treachery both to the pashas and the Mamelukes and by a liberal use of his wealth, in July 1805 became pasha of Cairo, whence his power quickly spread over the rest of Egypt. His utterly unscrupulous policy was shown by his massacre of nearly 1,700 Mamelukes in 1811. He extended the limits of Egypt by wars on the Arabian Wahabees, by the possession of Nubia and Kordofan, and by the treacherous conquest of Syria, in which he aimed at independence of the Porte. This first break with Turkey was settled by the Powers; and in 1839 the Sultan was forced to call on the Powers to help him turn Mehemet out of Syria: by the treaty then concluded he surrendered Syria, Candia and Hejaz; but was made hereditary pasha. His internal administration was vigorous; both agriculture and manufactures flourished, thanks to French capital solicited by Mehemet, who also introduced European methods into his army, and established a system of education. He was insane during the latter part of his life, and was succeeded by his grandson; his son, who took his place as regent in September 1848, died in November 1848.

MEHMET, Turkish form for MOHAMMED.

MEHRING, Franz, German historian, critic and socialist philosopher: b. Schlawe, Pomerania, 27 Feb. 1846; d. Berlin, 29 Jan. 1919. He was of middle-class Pomeranian origin, but became interested early in life in the struggles of the poor. His life is an interesting example of the career of a political thinker who passes out of the organizations of his own class and into those of the lower classes, by natural sympathy, although in Mehring's case this process took a long time. He attended the University of Berlin, where he obtained the Ph.D. degree, simultaneously working for a democratic newspaper, *Zukunft,* under the direction of Johann Jacoby and Dr. Guido Weiss. After this paper was suppressed (1871), he became a member of the staff of *Die Wage,* a weekly edited by Dr. Weiss. In 1873 appeared Mehring's first socialistic pamphlet, "Herr von Treitschke, der Sozialistentöter, und die Enziele des Liberalismus," which, as its title indicates, is an attack upon Treitschke (q.v.). When the two chief socialistic bodies in Germany united at Gotha in 1875, Mehring was sympathetic to the new party but did not become a member, and a rather personal controversy which he had with Leopold Sonnemann, editor of the *Frankfurter Zeitung,* for which Mehring had been Berlin correspondent, removed him more and more from the activities of the Social-Democratic party. From 1877 to 1882, Mehring was unfavorably disposed toward the leaders of the party, and in his 'Geschichte der deutschen Sozialdemokratie,' which he began writing in those years, he made many attacks upon them, for which he was seriously taken to task at the Dresden Party Congress. He defended himself in a little book 'Meine Rechtfertigung' ('My Justification'), in which he asks forgiveness for having been so foolish as to believe that the monarchic régime might develop into an honest democratic republic, which idea, he explains, has been completely corrected by the anti-socialistic laws as administered by the Prussian government. Yet Mehring still hoped that it might be possible to found a bourgeois democratic party in Germany, in which work, which was foredoomed to failure, he was associated with Lenzmann (1884). He was editor-in-chief of the *Berliner Volkszeitung* (1885–89), but was forced to resign from that paper because of a controversy with Paul Lindau (q.v.), arising out of the latter's maltreatment of the actress Elsa von Schabelski (by a curious coincidence, Paul Lindau's death in January 1919, coincided almost to a day with that of Mehring). Mehring has written profound historical analyses, among which the best are 'Die Lessing-Legende' (1893) and 'Gustavus Adolphus' (1894). As a man of 70 his hostility to the German Imperial government was still unbroken, and together with Rosa Luxemburg and Karl Liebknecht he wrote, in January 1915, a pamphlet attacking the militaristic system that had plunged Europe into war, known as the "Junius" pamphlet. This appeared in Switzerland and was secretly circulated in Germany (English translation: 'The Crisis in the German Social-Democracy,' New York 1918). He spent considerable parts of 1916 and 1917 in jail, under "preventive detention," but had to be released because of his failing health. In January 1918 he was elected a member of the Prussian Landtag, on the socialist ticket, and distinguished himself in that body by his biting comments on the inability of the Prussian military leaders; Mehring had always had a sort of amateur interest in military affairs; a number of his pamphlets deal ably with questions of this kind. Shortly before (September 1918) the final defeat of the German armies (October) on the western front, Mehring predicted that the hope of the militarists in the inability of the United States to land sufficient troops in Europe would be disappointed. His death was due to pneumonia, and coming, as it did, close upon the murder of Liebknecht and Rosa Luxemburg (15 Jan. 1919), it considerably depressed the hopes of the radical element ("The Reds") of the German Social-Democracy. Of the four chief leaders of the so-called "Spartacus" group, three had therefore met death in one month, and only one, Klara Zetkin (q.v.), an old woman, herself seriously ill, was still alive

in April 1919. Consult also *Die Neue Zeit* (1882 et sequitur, Stuttgart); *The Class Struggle* (New York 1917 et sequitur).

JACOB WITTMER HARTMANN.

MÉHUL, Etienne Henri, ā-tē-ĕn ŏn-rē mā-ül, French musical composer: b. Givet (Ardennes), 22 June 1763; d. Paris, 18 Oct. 1817. For some years he substituted the name Nicholas for Henri. He studied at Paris under Gluck; and after the departure of the latter for Vienna, Méhul presented to the Royal Academy of Music the opera of 'Cora and Alonzo,' the representation of which was delayed for six years. He then turned to the Opéra Comique, which gladly received his 'Euphrosine and Coradin' in 1790. His patriotic hymns, 'Chant du Départ,' 'Chant de Victoire,' and 'Chant Retour,' greatly increased his fame. He was chosen a member of the Institute in 1796, of the Academy of Fine Arts in 1816, and a knight of the Legion of Honor in 1802. His chief operatic work is 'Joseph' (1807). His style as a composer is remarkable for dramatic force and coloring. There is a 'Life' by Pougin (1889). His statue was erected in his native town in 1892.

MEIBOMIA, a genus of erect perennial herbs of the pea family, of which about 150 species are natives of warm and temperate America, Africa and Australia. More than 40 species belong to the United States, some of the more familiar of which are called «tick-seeds.»

MEIDERICH, Prussia, town of the Rhine province, 15 miles northeast of Krefeld. It contains several large iron and steel mills, machine shops, brickyards, phosphate works and saw mills. Coal deposits are worked in the vicinity and there is a large cattle trade. Its history as an industrial centre began in 1850. It was annexed to Duisburg in 1905. Pop. 40,000. Consult Graeber, 'Tausendjährige Geschichte von Meiderich' (1893).

MEIER, Edward Daniel, American mechanical engineer: b. Saint Louis, Mo., 1841; d. 1914. In 1858 he was graduated at Washington University and subsequently studied four years at the Royal Polytechnic College at Hanover, Germany. In 1863 he enlisted in the 32d Pennsylvania Volunteers; served later in the artillery and in the engineers and was a cavalry lieutenant at the close of the war. He entered locomotive works at Paterson, N. J., after the war, became superintendent of machinery of the Kansas Pacific Railroad in 1867; chief engineer of the Illinois Coke Company in 1870; and two years later constructing engineer of the Meier Iron Company. He founded the Heine Safety Boiler Company of St. Louis in 1884, of which he was president in 1914. For many years Mr. Meier was president of the American Diesel Engine Company. In 1908–14 he was president of the American Association of Boiler Manufacturers and of the Machinery and Metal Trades Association. In 1911 he was president of the American Society of Mechanical Engineers.

MEIGGS, mĕgz, **Henry,** American contractor: b. Catskill, N. Y., 7 July 1811; d. Lima, Peru, September 1877. He was engaged in the lumber business in New York and other places but met with financial reverses and in 1848 went to California, where he again took to the lumber business and gained an immense fortune. Reverses, however, once more swept away his wealth, leaving him with an indebtedness of more than $1,000,000. He fled with his family to Peru, where he soon embarked upon a series of bridge- and railway-building enterprises which won for him immense wealth and a world-wide fame as a railway contractor. His engineering achievements in South America comprise some of the most daring feats in the history of the profession. The construction of the Callao, Lima and Oroya road, which crosses the Andes, was his crowning achievement.

MEIGHEN, Arthur, Canadian statesman: b. Anderson, Ont., 16 June 1874. He was educated at Toronto University and became a barrister. In 1908 he was elected to the House of Commons and in 1913, was Solicitor-General in the Borden government and Secretary of State and Minister of Mines, 1917. He was premier of Canada in 1920–21, and again in 1926 from July to September.

MEIGS, Charles Delucena, American physician: b. Saint George, Bermuda, 1792; d. 1869. In 1809 he was graduated at the University of Georgia, and in 1817 at the medical college of the University of Pennsylvania. In the same year he established his practice in Philadelphia and became prominent as an obstetrician. He was professor of obstetrics and diseases of women and children at the Jefferson Medical College from 1841 to 1861. He was one of the first editors of the *North American Medical and Surgical Journal,* which he helped to found in 1826. Dr. Meigs published 'The Philadelphia Practice of Midwifery' (1838; 2d ed., 1842); 'Lectures on Some of the Distinctive Characteristics of the Female' (1847); 'Females and their Diseases' (1848; 2d ed. with title 'Woman; Her Diseases and Remedies,' 1851; 3d ed., 1854); 'Remarks on Spasmodic Cholera' (1849); 'Obstetrics' (1849; 3d ed., 1856); 'Observations on Certain Diseases of Children' (1850); 'Treatise on Acute and Chronic Diseases of the Neck of the Uterus' (1854); 'On the Nature, Signs and Treatment of Childbed Fevers' (1854); translations of Hufeland's 'Treatise on the Scrofulous Disease' (1829); Velpeau's 'Elementary Treatise on Midwifery' (1831); Colombat de L'Isère's 'Treatise on the Diseases and Special Hygiene of Females' (1845). Consult Meigs, John F., 'Memoir of Charles D. Meigs' (Philadelphia 1872).

MEIGS, Montgomery, American civil engineer: b. Detroit, Mich., 27 Feb. 1847. He was educated at Harvard and in Germany, and was for several years in the employ of the Northern Pacific Railroad. In 1882–1926 he had charge of the Des Moines Rapids Canal under the government. He is the inventor of a «canvas coffer-dam.» He also constructed the United States dry dock at Keokuk. In 1898 he proposed a new method of improving country roads by using oil with a sprinkler to make a water-tight surface and lay dust, which attracted wide attention and has since been generally adopted. He built and designed many steamboats and steam dredge tenders for the United States. In 1910–13 he was the government local inspecting engineer in the construction of the great lock, dry dock and power developments in the Mississippi at Keokuk, Iowa. Died 9 Dec. 1931.

MEIGS, Montgomery Cunningham, American soldier and engineer: b. Augusta, Ga., May 3, 1816; d. Washington, D.C., Jan. 2, 1892. He was graduated from West Point in 1836, and entering the engineering corps the next year, was engaged in the construction of forts in the Great Lakes region until 1852 when he took charge of building the Potomac Aqueduct and, later, other structures in Washington, including parts of the Capitol. In 1861 he was appointed quartermaster general of the army, which post he held throughout the Civil War.

MEIGS, Return Jonathan, American soldier and pioneer: b. Middletown, Conn., Dec. 17, 1740; d. at the Cherokee agency, Tenn., Jan. 28, 1823. After the Battle of Lexington, he marched a company of men to the American camp at Cambridge. He subsequently accompanied Benedict Arnold's expedition against Quebec where Meigs was taken prisoner. Following his release, he led a brilliant raid on the British at Sag Harbor, Long Island, in 1777. In 1779, he further distinguished himself under Anthony Wayne during the capture of Stony Point, N. Y. In 1788, he emigrated to Marietta, Ohio. In 1801 President Jefferson appointed him a Cherokee agent.

MEIGS, Return Jonathan, American statesman, son of the preceding: b. Middletown, Conn., Nov. 17, 1764; d. Marietta, Ohio, March 29, 1824. He went to Marietta with his father in 1788 and became a prominent lawyer. He was the first chief justice of Ohio (1803–1804); a judge in Louisiana 1805–1806, and in Michigan. He was a senator from Ohio from 1807 until 1810 and governor of that state for the next four years, during which period he was an active supporter of the war measures of 1812–1814. He was postmaster-general of the United States from 1814 until 1823.

MEIGS, William Montgomery, American historian and lawyer: b. Philadelphia, Aug. 12, 1852; d. Dec. 30, 1929. He was admitted to the bar in 1879, but ill health kept him from a strenuous practice and he turned to biography and studies of the relations between American constitutions and the courts. Besides his biographies of Charles Jared Ingersoll (1897), Thomas Hart Benton (1904), and John C. Calhoun (1917), his legal works include *The Relation of the Judiciary to the Constitution* (1919).

MEIJI, mā-ē-jē, "enlightened government": the name given the period from 1867 to 1912 in Japanese history. Until the Gregorian calendar was adopted in 1875, the Japanese fixed historical dates according to the *nengo,* or year-period. The beginning and ending of a *nengo* was originally fixed arbitrarily, but was later made to coincide with the emperor's reign, so that the 33rd year of Meiji was 1900, Mutsuhito (q.v.), whose reign title was Meiji Tenno, having succeeded to the throne in 1867.

MEIKLEJOHN, mīk'l-jŏn, **Alexander,** American educator: b. Rochdale, Eng., Feb. 3, 1872. He was educated at Brown University and at Cornell. He taught at Brown from 1897 until 1912 when he became president of Amherst College. He resigned this position in 1924, and in 1926 became professor of philosophy at the University of Wisconsin where, the following year, he put into effect a far-reaching experiment in higher education, an attempt to combine the individual attention possible in a small college with the greater facilities of a large university. Students and teachers were brought closer together, and individual instruction and group discussion were substituted for the conventional classroom lectures. Included in his writings are *The Liberal College* (1920); *Freedom and the College* (1923); *The Experimental College* (1932); *Free Speech and its Relation to Self-Government* (1948).

MEILHAC, Henri, mā-yăk, French dramatist: b. Paris, Feb. 25, 1831; d. there, July 6, 1897. Much of his work was done with Ludovic Halévy (q.v.). They furnished the book for Offenbach's *La Belle Hélène* (1864), *Grande-Duchesse* (1867), *La Périchole* (1868), and *Les Brigands* (1869). Among his independent plays are *Décoré.* In 1888 he was elected to the Académie française.

MEILLET, mā-yā, **Paul Jules Antoine,** French philologist: b. Moulins, France, Nov. 11, 1866; d. Paris, Sept. 22, 1936. He studied in Vienna and Paris, becoming a professor of the École des Hautes Études, Paris, in 1891. Commencing with the Slavic group, he gradually extended his knowledge of languages until it embraced all of the Indo-European family. His *Les Dialectes Indo-Européens* (1908) traces the modern differences between the members of that family back to what were originally variations in dialect. Besides a search for rules which would be applicable to all languages in tracing their development, his works stress the importance of the social changes reflected in linguistics. He was the author of works on Old Slavic, Old Persian, classical Armenian, Latin and Greek, as well as on the Germanic languages.

MEININGEN, mī'nĭng-ĕn, Germany, a town in Thuringia, formerly capital of the duchy of Saxe-Meiningen, in the narrow, wooded valley of the Werra, 40 miles southeast of Erfurt. It is an attractive town with handsome streets, having been practically rebuilt since the disastrous fire of 1874 which destroyed the old town, but a church built by the Emperor Henry II and a 17th century ducal palace survived. The stock company of a local theater which for 16 years enjoyed a European reputation for the excellence of its acting and staging, and which helped to turn the German theater towards realism, was dissolved in 1890. Local industries include brewing, chemicals and textiles. Pop. 22,189 (1939).

MEIN KAMPF (MY STRUGGLE). The National Socialist "bible" was dictated by Adolf Hitler while he was imprisoned in the fortress of Landsberg on the Lech following the unsuccessful putsch of 1923, and is dedicated to his followers killed in that attempt. It is primarily a propagandist essay, reading like a passionate speech designed to overwhelm the listener with its endless repetition of Hitler's views. Lacking intellectual power, it appeals to the emotions of a frustrated people. Historical facts which do not suit Hitler's purpose are warped or omitted. The highest race, Hitler says, is the "Aryan" of which the purest strain is the German, but a world-wide conspiracy of Jews, whom he calls the lowest race, keeps this Master Race

divided and threatens to destroy it. This can be averted only by uniting all Germans, including those living beyond the boundaries of Germany, into one, pure racial state. "Aryan" races which mix their blood with that of inferior peoples perish because they lose the force of resistance contained only in the pure blood. Germany, therefore, must be made internally strong by the elimination of all except the racially pure. Hitler lays Germany's defeat in World War I to Jewish treachery inside the nation. Like an army, the state can have but one leader. Citizens must give up their rights as individuals because the state is the embodiment of the race's will to live and the guardian of its future, and because the state has a mystic mission to enforce the domination of the Master Race over inferior peoples. Germany is to move toward the domination of Europe by installments, so that no one aggression will seem to other nations to be sufficient cause for war. In this struggle Hitler foresees two implacable enemies: France, the traditional enemy of Germany, and the USSR which, as the supporter of European communism, must be destroyed, and whose conquest will provide Germany with living-space and natural wealth. He also counts two possible allies: England and Italy. The army, Hitler says, is the finest school for the formation of character; the object of all education being to furnish soldiers for war, and mothers to continue the race. Peace makes peoples weak; only the strong, aggressive nation can survive. Hitler boldly outlines the propaganda methods he later used so successfully in his rise to power. The history of the party is traced from its humble beginnings, showing the origin of Hitler's dictatorship, which started with an unquestioning obedience inside the party and which, using the Storm Troops as its arm of violence, was to be extended over the entire nation. There is also the outline of a Socialist program which was later abandoned when Hitler found it necessary to appeal to German industrialists for financial support. Besides showing that he knew himself to be a gifted propagandist and speaker, *Mein Kampf* shows that Hitler pictured himself in a messianic role destined to save the German people; an idea his book helped him to persuade the German people to accept. That Hitler could so clearly have indicated his intentions in 1923, without being stopped short of the point where Germany by 1939 had become stronger than its former enemies of World War I, can only be explained by the lack of unity among the former allies, each of which sought its own advantage after the end of that war; by a guilty feeling in these latter countries that Germany had been too harshly dealt with after World War I; and by the futile hope that no people which had experienced the horrors of World War I would follow its leader into the bloody catastrophe of World War II.

JOHN LEE DE WITT,
Editorial Staff, "Encyclopedia Americana."

MEISSEN, mī'sĕn, Germany, a town in Saxony founded by Henry I about 928, on the Elbe at the confluence of the Meisse and the Trierbisch, 14 miles northwest of Dresden. The town was severely damaged during the Thirty Years' War and again during the Seven Years' War. Russian troops, in their advance into Germany, reached the Elbe near Meissen on April 23, 1945, three days before they contacted the American Ninth Army near Torgau. Overlooking the town is a noble castle originally built in the 10th century and rebuilt in the 15th century and one of the finest early Gothic cathedrals in Germany. So-called Dresden china, the first hard porcelain made in Europe, developed by Johann Böttger, or Boettcher (q.v.), has been manufactured here since 1710. It achieved widespread popularity during the 18th century, but Meissen lost its pre-eminence during the Seven Years' War when the town was taken by Frederick the Great who received a tribute in porcelain, but deported some of the best craftsmen. The town manufactures matches and stoves, and has machine-works and breweries. Pop. (1939) 47,833.

MEISSONIER, mā-sŭn-yā, **Jean Louis Ernest,** French genre painter and etcher: b. Lyon, France, Feb. 21, 1815; d. Paris, Jan. 31, 1891. He came to Paris in early youth and entered the studio of Léon Cogniet, meanwhile forming his style on the Dutch masters as represented in the Louvre. He first attracted attention by his illustrations of the Bible, Bossuet's *Universal History; Orlando Furioso, Paul and Virginia,* etc. His earliest paintings in genre to be exhibited in the Salon were *The Little Messenger* and *The Chess Player* (1836). His reputation grew rapidly on the successive appearance of *The Monk* (1838); *The English Doctor* (1839); *The Game of Chess* (1841). The times of Louis XIV and Louis XV with all the accessory richness and variety of costumes, weapons and domestic luxury, found in him their most successful delineator. In the many canvases which he produced in this narrow department of genre he showed a keen and strong, but not too florid, power of characterization, which was accompanied with a marvelous technique in the handling of stuffs and metals. But modern history eventually claimed his attention. He followed the army of Napoleon III to Italy in 1859 and later found a congenial field for the exercise of his special gifts in the campaigns of Napoleon I. His pictures were often small, but finished with minute and delicate virtuosity, a good example of which may be seen in his *Cuirassiers of 1805,* but he is considered less successful in large canvases and elaborate figure compositions than in his small paintings. Among his most famous pictures of the Napoleonic cycle are *Napoleon I with his Staff* and *Napoleon III at Solferino* (1864); *Napoleon I at Friedland* (1875), now in the Metropolitan Museum of New York.

MEISTERSINGER, mīs'tĕr-zĭng'ĕr, or **MASTER-SINGERS** (Ger., *Meistersinger*), a society of German singers formed in the 14th century. During the long evenings of winter the worthy burghers of the German cities assembled to read the poems of the minstrels. Some of the hearers were naturally led to try their own skill in verse; others followed, and the spirit of the age soon embodied these votaries of the muse into societies after the fashion of corporations. Charles IV gave them a charter and a coat of arms. They met on certain days and criticized each other's productions, in which external correctness seems to have appeared to them the chief object; few, indeed, had an idea of the difference between poetical and prosaical ideas or expressions. Their attempts in the lyric style were chiefly limited to spiritual songs; in the epic to rhymed versions of the scriptural narratives. They were also

ond of the didactic style. The rules by which he members of the societies were to be guided s to the meter, etc., of their compositions were ritten on a table, and called *tabulatur*, for the ake of enforcing a strict observance of purity n language and prosody. The chief faults to e avoided were collected; they were 32 in num-er, and distinguished by particular names. He ho invented a new meter, invented also a new une, the names of which were the drollest and ometimes the most senseless imaginable. Be-ide their stated meetings they held public neetings, generally on Sundays and festivals n the afternoon in churches. In Nuremberg, here the mastersingers flourished particularly, uch meetings were opened with free singing, n which anybody might sing, though not belong-ng to the corporation. In this the choice of the ubjects was left comparatively uncontrolled; hen followed the chief singing, when only those ho belonged to the corporation were allowed to ing, and only on scriptural subjects. The judges ere called *Merker*, and sat behind a curtain. here were four: one watched whether the song as according to the text of the Bible, which lay pen before him; the second whether the prosody as correct; the third criticized the rhymes; ne fourth, the tunes. Every fault was marked, nd he who had fewest received the prize, a chain ith medals. Whoever had won a chain was llowed to take apprentices, to have many of hom was a great honor. Money was never aken from apprentices. After the expiration f his poetical apprenticeship the young poet as admitted to the corporation, and declared master after having sung for some time with cceptation. These strange societies originated oward the end of the 14th century at Mainz, trassburg, Augsburg and continued in several ree cities of the empire until the 17th, in Nu-emberg to the 18th century, where probably he renown of Hans Sachs (q.v.), the famous hoemaker and poet, kept them longer in exist-nce.

MEITNER, Lise, Austrian physicist: b. ienna, Nov. 7, 1878. As assistant to Otto Hahn n Berlin and professor at the Kaiser Wilhelm nstitute there, she became one of the world's oremost women nuclear physicists. With the ise of the Hitler regime, she was forced to ee, going to Bohr's Institute in Copenhagen. he came to the United States in 1946 to join he faculty of the Catholic University, Wash-ngton, D. C. Her researches have included tudy of continuous beta-ray spectra, positron mission from heavy nuclei and neutron disinte-rations. After her experiments with Otto Hahn n the uranium reaction, she, with Otto Robert risch, showed that the process occurring was splitting of the uranium nucleus. This phe-nomenon, now called fission, was utilized in the levelopment of the atomic bomb.

MEKONG, mā-kŏng', a large river of south-astern Asia, which rises in Tibet, passes through unnan (a province of China), Laos, Cambodia, nd French Cochin-China, and falls into the hinese Sea by several mouths, after a course f about 2,600 miles. Its navigation is much in-errupted by sandbanks and rapids. The Tonle ap, a lake covering an area of 100 square miles n the dry season and 770 square miles in the ainy season, in the southwestern part of Cam-odia, receives the flood waters of the Mekong.

MELA, mē'lȧ, **Pomponius,** Spanish geographer of 1st century A.D. and author of *De Situ Orbis* containing concise view of the then-known world.

MELAMPUS, in Greek mythology, son of Amythaon, who was the first mortal endowed with the gift of prophecy, and who first practiced the medical art. He is said to have introduced the worship of Bacchus into Greece. According to the legend, he could converse with animals, and was favored by Apollo, who taught him divination. His powers saved his life when he was imprisoned in Thessaly. The worms in the wall informed him that the structure would soon fall, and he told his jailers, who withdrew, taking him with them. They informed the king and Melampus was at once in demand, courted and feted. He married one of the king's daughters and was given large estates. In ancient Megaris he was worshipped and a temple erected in his honor.

MELANCHOLIA. See INSANITY.

MELANCHTHON, Hellenized name of PHILIPP SCHWARZERD (Eng. "black earth"), German reformer: b. Bretten, in the Palatinate, Feb. 16, 1497; d. Wittenberg, April 19, 1560. He was left an orphan in his 10th year and taken into the house of his grandmother, a sister of Reuchlin (see REUCHLIN, JOHANN), the great German humanist, by whom he was affectionately treated and encouraged in his studies. In his 12th year he entered the University of Heidelberg and two years later was graduated bachelor. While he was occupied as tutor to the son of Count von Löwenstein, he continued to give attention to his own progress in Greek; in 1514 was made master of arts at Tübingen and thenceforth devoted himself to humanism, lecturing on Cicero, Terence, and Greek grammar. He also gave much time to the study of theology, jurisprudence and medicine. Here he first became acquainted with Erasmus' edition of the New Testament, and was through the influence of Reuchlin elected professor of Greek in the newly founded University of Wittenberg. He delivered an inaugural address (Aug. 29, 1518), *De Corrigendis Adolescentiae Studiis,* which produced a revolution in German educational methods and above all met with the approbation of Luther, professor of philosophy at Wittenberg. From this time Melanchthon became *Preceptor Germaniae* (The Schoolmaster of Germany), and the Ally of Luther. These two champions of the Reformation were brought still closer together by their union at the Leipzig Disputation (1519), in which they were confronted by Dr. Eck (see ECK, JOHANN VON), the great opponent of Luther and the movement he was inspiring. In his handling of this adversary, both orally and by his writings, Melanchthon showed himself to be the leader of Protestant controversialists and the most learned, judicious and ready of Protestant disputants.

In 1520 he married Katharina Krapp, daughter of the burgomaster of Wittenberg, and Master Philip, as he was familiarly called, as he settled down to domestic life, was placed on the theological faculty of the university, and the first fruit of his increased application to the theological study and teaching was his *Loci Communes Rerum Theologicarum,* which was

the first declaration of the Protestant position delivered in formal terms of dogmatic theology. The volume ran through 60 editions in his lifetime, and established its author's position as Luther's complement — in some respects the lesser spirit of the Reformation movement, but the scientific talent which supported on the intellectual side the genius and the faith of Luther. Melanchthon, by his historic learning, by his power over the classic languages, was enabled to communicate to the learned world the real principles of the new movement and the facts of the past on which it was founded. He brought to bear his deep knowledge of theological philosophy, his acquaintance with the precise terms in Greek and Latin of scriptural, patristic and scholastic statement on the main question of the dispute, and he had the calmness of the well-balanced humanist which enabled him to direct with cool and even mind the movements of his party and to keep it as free as possible from the fury and blindness of intolerance. His knowledge of Greek made him invaluable to Luther in translating the Bible. His pen had an immense influence in securing the after success of the initiative taken by bolder but less cautious and reasonable spirits, and left a mark on the German Reformation deeper, more permanent and characteristic than that of any among his most enthusiastic contemporaries. His *Epitome Doctrinae Christianae* became from the first an influence which establishes its claim to be called the pandect and code of European Protestantism.

The spirit of Melanchthon was distinctly conciliatory. The Reformation had resulted not only in a German revolt from the papacy, but in the creation of a host of jarring Protestant sects. Melanchthon's broad and far-seeing spirit was averse to division of any kind. The Augsburg Confession (q.v.), which was presented to the diet in 1530, surprised even the Roman Catholics by its moderate tone. It was drawn up by Melanchthon in accordance with memoranda supplied by Luther and it has all the breadth, calmness, and judicial cautiousness of Luther's friend and good genius. But this spirit of compromise, hopefulness, and patience was out of harmony with the passion for controversy which made Wittenberg a center of storm and strife. Melanchthon, however, stuck to his post at Wittenberg long after the great power and influence he once wielded had passed from him into the hands of more positive, violent, and aggressive leaders. There occurred a breach between the Philippists, the followers of Melanchthon, and the Lutherans, who adhered to the extreme views of his friend on the subject of free will and irresistible grace, on the doctrine of the Lord's Supper, and on the adiaphora (indifferent matters), as the former was inclined to term the ceremonies of the Roman Catholic Church. He and his followers were assailed as "rogues" and "worshippers of Baal." Luther stated his own views on the sacrament with such violence that the recollection of his *Short Confession Respecting the Lord's Supper* filled him with remorse on his death bed, where he acknowledged to his friend "Dear Philip, I confess to have gone too far in the affair of the Sacrament." The death of Luther left Melanchthon to the mercy of such zealous and fiery sectaries as had been engendered in that teeming period of intellectual and theological movement, which the monk of Wittenberg had inaugurated. He survived Luther by several years, waiting for death, he said "as a refuge from the frenzy of theologians," and praying that the Protestant world might find its way at last to reunion, a prayer which as yet remains unfulfilled.

Melanchthon's important part in the Reformation movement has often been lost sight of in the blaze of Luther's more striking and popular personality. Yet he may with some reason be called the brains of the Reformation. More than that, he was a man who, while he stood for progress, was averse to revolutionary change. He was a constructive rather than a destructive religious reformer; he could affect his generation only by presenting an example of intellectual refinement, moderation, tolerance, and conservation, which the warring giants of the Reformation refused to follow. In 1865 a statue was raised to him at Wittenberg and in 1883 a group comprising Melanchthon and Luther at Leipzig. He was the author of many books, including theological and controversial treatises, commentaries on the classical authors, and works on history and philosophy. His works are found complete in the 28-volume *Corpus Reformatorum* (1834–1860). Consult biographies by George Wilson (London 1897); J. W. Richard (New York 1898), Karl Hartfelder (Berlin 1899); Georg Ellinger (Berlin 1902).

MELANESIA, měl-à-nē'shĭ-à (Gr. *melas* black; *nēsos,* island), collective name for the great southwesterly division of the Pacific Islands (see OCEANIA). The insular groups comprising Melanesia lie, from north to south, between the equator and the Tropic of Capricorn; and from west to east they are bounded, respectively, by New Guinea and the Fiji Islands. The division is named for the extreme blackness of the people rather than of the islands themselves, for the Melanesian (q.v.) is dark-skinned and Negroid. Some of his ancestors migrated from Indonesia to New Guinea, where they intermingled with the Papuans, and thence moved eastward and southward through the Solomons and New Hebrides as far as New Caledonia; to the east, their migration ceased in the Fijis. Politically, the islands of New Caledonia belong to France and the New Hebrides constitute a Franco-British condominium. Fiji is a British colony, and the British Solomon Islands Protectorate comprises all save the northernmost of the Solomons. Bougainville and Buka, most northerly of the Solomon Islands, and the Bismarck Archipelago (comprising New Britain, New Ireland, Lavongai, and Admiralty Islands) are part, politically, of the Territory of New Guinea, the designation for former German colonies in Melanesia captured by the Australians in World War I and subsequently administered by the Commonwealth, at first as a League of Nations mandate and later as a United Nations trusteeship. The political components of Melanesia are discussed in articles under their names.

Although Melanesia still awaits a systematic geological survey, it is known to be highly mineralized. Gold has for long been mined in Fiji and the Solomon Islands, and nickel, chrome, and other minerals are worked in New Caledonia. Sugarcane is the most important agricultural product throughout Melanesia, and in many parts of the division rice, coffee, cacao, and rubber are of great economic value. North and

northeast of Melanesia lie, respectively, Micronesia and Polynesia (qq.v.), the other main divisions of the Pacific Islands. Consult Blackwood, B., *Both Sides of Buka Passage* (London 1935); Wood, G. L., *The Pacific Basin: A Human and Economic Geography* (Oxford 1942); McGuire, Paul, *Westward the Course: The New World of Oceania* (London 1943); Robson, R. W., ed., *The Pacific Islands Handbook* (New York 1945).

MELANESIAN, a term denoting the dominant ethnic stock in Melanesia (q.v.). It was formed by the intermingling of an aboriginal black, wooly-haired population of Papuan origin with an immigrant Indonesian stock which had been previously modified by proto-Malayan blood and culture. However, the Melanesians vary considerably in type and language. In some parts of the New Hebrides and the southern Solomon Islands there are numerous small, primitive, and physically debased tribes very close to the lowest level of savagery who practice polygamy, infanticide, and cannibalism; but in the western Solomons the people are fine, upstanding specimens with intensely black skins. Tongan (Polynesian) blood has mixed with Melanesian in the eastern group of the Fijian Islands to produce a handsome, intelligent, well-built race with a light copper-colored skin; while the Fijians are characterized by tall, fuzzy hair, in the northern Solomons the hair of many tribes is straight or only slightly wavy. Excepting in the Fijis, where one language is spoken throughout the islands, the differences of speech between island and island, and even between village and village on the same small island, amount to complete incomprehensibility. Thus there has come into widespread use a primitive form of "pidgin" English with most limited vocabulary which is employed as a lingua franca not only by the Melanesians but also by French and German missionaries and traders among them. Missionary effort in Melanesia has followed the flag for the most part, although in the interior of some of the larger islands, and particularly in the northern New Hebrides, there are large numbers of savage peoples which have not yet come under civilizing influences. Those who have been long engaged in evangelizing among the Melanesians include the Church of England, Presbyterian, Methodist, London Missionary Society (Congregational), Roman Catholic, Evangelical, and Seventh Day Adventist missionaries. Consult Fox, C. E., *The Threshold of the Pacific* (London 1924); Mytinger, Caroline, *Headhunting in the Solomon Islands* (New York 1943); MacQuarrie, H., *Vouza and the Solomon Islands* (London 1945).

MELANISM, an excess of pigment in the skin and its appendages, producing real or comparative blackness; the opposite of albinism (q.v.). Melanism is less frequent than albinism, but more inclined to affect large numbers of individuals of a species, forming melanistic varieties and is seen not only in man but in other mammals; and in birds, reptiles, fishes, and in insects as, for example, certain moths which are found in Labrador and in the White Mountains of New Hampshire, showing a possible connection between melanism and cold or high altitudes. Moisture is also considered to be a determining factor, as is indicated by the fact that the darkest races of men inhabit the warmest and dampest regions of the earth. A conspicuous example of melanism is afforded by the American black squirrels, which are melanistic varieties of various species, especially the fox squirrel (*Sciurus niger*) and the gray squirrel (*S. carolinensis*). These varieties prevail in certain parts of the United States, as the region of the Great Lakes and upper Mississippi Valley, and rarely occur elsewhere. Thus a black squirrel is almost unknown in New England or the Hudson Valley. Another familiar example is found in the black leopards, which in a direct light seem absolutely black, but under reflected light betray a pattern of spots similar to those of the ordinary leopard. Such examples, as is the case with other melanistic animals, often occur in the same litter of young with normal forms. In many of the lower animals, as butterflies, melanistic tendencies are developed under certain conditions, especially of excessive moisture. The pigments in the skin are mainly of the class called melanins, which produce dark hues. Total abnormal melanism in man is unknown, but cases of partial melanism are on record. In one instance one half of the face was white, the other black. A case is on record of a 16-year-old girl, a laundress, whose neck, face, and upper chest became blue on certain occasions. She was otherwise apparently normal, but the skin was so pigmented that when she blushed her color was blue instead of red, the change appearing with chameleonic rapidity and being associated with the accession of blood to the skin. A white towel was stained blue by being rubbed over her skin. Other cases of skin discoloration are that of a man who became black in places and yellowish brown in others and that of an unmarried woman white until she was 21 and thereafter black as a Negro. The cause of this condition is unknown. Melanoderma, chloasma, and liver spots are terms applied to irregularly shaped yellow, brown, and black colorations of the skin. Some of these spots are due to scratching following the bites of body vermin, to prolonged pressure upon a portion of the skin, prolonged use internally of preparations of silver, to racial admixture, or to general diseases, such as cancer or tuberculosis. See Coloring Matters; Coloration, Protective.

MELANITE, a very black variety of garnet especially the lime-iron variety, in which lime largely preponderates in the protoxides. Melanite occupies a place midway between schorlomite and the garnets pure and simple; this is notably true of the sort containing the rare element titanite (q.v.). The group includes all the darkish garnets, with the exception of the precious garnet, technically the pyrolite, which varies from red to black. With the green demantoids the blackish melanites make up the greater part of Dana's second class of garnets, the iron garnets.

MELANORRHOEA, mĕl-ȧ-nŏ-rē'ȧ. See Varnish Tree.

MELASMA, a disease marred by discoloration of the skin. The term is rightly used in connection with a pigmentation of the skin, sometimes diffuse (color varying—dusky yellow, greenish brown, or even

black), and believed to be dependent upon degeneration of the suprarenal capsules or the semilunar ganglia. (See ADDISON'S DISEASE). Sometimes the term is applied to the conditions known as liver-spots and "moth-patches."

MELASTOMACEÆ. See DEER GRASS.

MELBA, Nellie, Australian prima donna: b. Melbourne, about 1860. She studied there in the Presbyterian Ladies' College; then took up music under Marchesi in Paris. On 15 Oct. 1887 she made her début in Brussels in 'Rigoletto'; at that time gave up her family name Mitchell and took the stage name Melba, which is said to have been suggested by the name of her native city; in 1889 she appeared in Paris at the opera, where she stayed for three years, during which she appeared in London in Italian répertoire; and after 1892 toured Europe and America. Her best rôles were Ophelia, Juliette, Lucia and Nedda in 'I Pagliacci.' She was created Dame of the British Empire in 1918. She published her 'Melodies and Memories' (1925). She died 23 Feb. 1931.

MELBOURNE, mĕl'bĕrn, **William Lamb,** VISCOUNT, English statesman: b. 15 March 1779; d. 24 Nov. 1848. Carefully trained by his mother, he entered Eton in 1790, Trinity College, Cambridge, in 1796, and Lincoln's Inn in 1797; studied law in Glasgow; was called to the bar in 1804; and in 1805 was elected to the House of Commons, where he followed Fox, leader of the opposition. He lost his seat in 1812 because of his vote for Catholic emancipation; was returned in 1816; served as chief secretary in Ireland in 1827; and in 1828 entered the House of Lords upon his father's death. Only then did he begin to figure in politics, and that only because of his popularity, for he had no official ability, being neither diligent nor brilliant. As home secretary under Grey in 1830 he was a failure; but in July 1834 the king induced him to form a ministry, and again in 1835, in spite of the king's effort to foist Peel on the country in November 1834, he became Premier. He remained in office until August 1841, thus covering the early years of the reign of Victoria, whom Melbourne ably instructed in the duties of her position. His tuition of the young queen seems, however, the only event of his long administration, and he must be classed rather as a politician than as a great statesman, since he was scarcely more than indifferent to the reform measures of the day. He was a man of much learning, of a rather attractive, though coarse and habitually profane, wit and of a strange admixture of constitutional conservatism and political liberalism. His wife, Lady Caroline Ponsonby, whom he married in 1805, was separated from him in 1825; she wrote several novels and was a friend of Lord Byron. See NORTON, CAROLINE ELIZABETH; and consult Torrens, W. M., 'Memoirs.'

MELBOURNE, Australia, the capital of the state of Victoria, the second largest city of Australasia, situated around Hobson's Bay, at the northern extremity of Port Phillip, 40 miles north of its entrance from the ocean between Points Lonsdale and Nepean. The city and its numerous suburbs occupy an extensive undulating area, with the Yarra River, a stream of no great size, winding through it. The central and most important business part of the city is on the north bank of the Yarra, two miles by a direct railway line from the river's outlet in Hobson's Bay, but nine miles by the meandering water route. The city is built on a rectangular plan with fine wide streets lined with handsome and substantial public buildings and residences. Numerous lines of railway connect with the interior and the extensive suburban districts, which include such important places as Collingwood, North Melbourne, Fitzroy, Carlton, Brunswick, South Melbourne, Richmond, Prahran, Saint Kilda, Port Melbourne, etc. The city is well lighted, and paved, and is abundantly supplied with water, while millions of dollars have been expended on a new and perfect system of drainage and sewerage.

The public buildings of Melbourne are noteworthy. The Houses of Parliament contain the State Legislative Assembly and Council. Government House is a palatial building, conspicuous from every part of the city, with a tower 145 feet high. Other public buildings include the law courts, forming an extensive square, the post-office, the custom-house, the treasury, the land and mining offices, the mint, the free library with some 300,000 volumes; the university, with an admirable museum belonging to it and a splendid hall (the Wilson Hall) in the Gothic style; the Ormond Presbyterian College; the town hall, with a large assembly room containing a splendid organ; the exchange, observatory, meteorological station, and athenæum. The ecclesiastical buildings include an Anglican Cathedral, a Roman Catholic Cathedral and the Scots church, with a fine steeple. There are several "sky-scraper" office and store buildings; many banks and business premises are attractive; and the Exhibition building deserves notice. At the head of the educational institutions is Melbourne University (with over 250 professors, lecturers, and teachers), with which are affiliated the four denominational colleges, Trinity (Episcopal), Ormond (Presbyterian), Queen's (Methodist) and Newman (Roman Catholic). Charitable and benevolent institutions are numerous. There are several parks and other grounds for public recreation, and among these the Botanic Garden deserves special notice on account of its extent (100 acres), its beauty, and the value of its collection of trees and plants. The beautiful Fitzroy Gardens also deserve special mention. Melbourne is the see of a Roman Catholic archiepiscopate and of an Anglican bishopric. The United States is represented by a consul-general. The chief industrial products of Melbourne are leather, furniture, clothing, flour, ales, cigars, ironware, woolens, etc. The shipping trade is large both in exports and imports, the chief of the former being wool and gold, of the latter manufactured goods. Most imports are subject to a heavy duty. Vessels of 26 feet draught can ascend the Yarra. Its navigation has been much improved, and the Coode canal shortens the passage. The largest vessels are accommodated at Port Melbourne and Williamstown, with depths of about 36 feet both on Hobson's Bay; Port Phillip Bay affords unlimited anchorage for the largest vessels. The tonnage of vessels entered 1936–37 was 8,173,042. Pop. of Melbourne, including the suburban municipalities, 1,000,000, more than half the population of the state.

The first settlements on the site of Melbourne were made in 1835, and a year or two

atter it received its present name, being so called after Lord Melbourne, who was then British prime minister. It was incorporated in 1842 and became a bishop's See in 1849. In 1851 it became capital of Victoria (then established as a separate colony), and received an immense impetus from the discovery of gold fields.

A centennial exhibition was held in 1888 in celebration of the founding (in 1788) of the Australian colonies. A great conflict between labor and capital took place in 1890, and a strike by the labor-unionists took place on a very extensive scale both in Victoria and New South Wales. In 1892–93 Melbourne suffered severely from commercial depression, financial crises and banking disasters. The first Parliament of the Commonwealth of Australia was opened in the Exhibition Building on 9 May 1901 by the Duke of Cornwall and York (afterward George V). Consult 'Victoria and its Metropolis, Past and Present' (1889); Gordon and Gotch, 'Australian Handbook' (1928).

MELCHERS, Paulus, German cardinal: b. Münster, Westphalia, 6 Jan. 1813; d. Rome, 14 Dec. 1895. He studied law at Bonn and theology at Munich and Münster; was ordained priest in 1841; in 1857 became bishop of Osnabrück, and in 1865 Pope Pius IX nominated him archbishop of Cologne. At first opposing the doctrine of papal infallibility at the Vatican Council, Melchers afterward accepted it, in agreement with the majority, and dealt severely with professors who sought to prevent its declaration. In the Kulturkampf (q.v.) his conspicuous activity brought him into collision with the representatives of government, and in 1876 he was removed from his archbishopric. His writings include 'Eine Unterweisung für das heilige Altarsakrament' (1878); 'Die katholische Lehre des Herrn' (1883), and 'Das Leben der allerseligsten Jungfrau und Gottesmutter' (1884).

MELCHITES, mĕl'kīts, those Christians of western Asia and of the Levant who acknowledge the supremacy of the Roman Pontiff and accept the dogmas of the Roman Catholic Church. The Syriac and Egyptian congregations of this name in the main belong to the Greek Church though in some unimportant matters of ceremony and discipline they take an independent course. They are, however, under a chief bishop of their own, who is styled patriarch of Antioch. The term Melchites is a nickname. It means «Royalists» and was given to them by the orthodox Greeks with the implication that they accepted the decrees of the Council of Chalcedon merely at the dictation or in conformity with the example of the emperor. Celibacy is imposed upon their bishops, but their priests are at liberty to marry. Their liturgy is in the Arabic language; they use unleavened bread in the Eucharist and in their monastic houses they follow the Basilian rule. There are said to be 100,000 of them. Consult Neale, 'History of the Eastern Church.'

MELCHIZEDEK, mĕl-kĭz'ĕ-dĕk («king of righteousness," that is, righteous king), in the story of Genesis, king of Salem and priest of «Supreme God." He met Abram on his return from the victorious expedition against Chedorlaomer, gave him his blessing and received tithes from him. The antelegal king-priest stands in Psalm cx as a figure typical of the Messiah the vicegerent of Jehovah, and in Hebrews vii, 3, of the kingly priesthood of Jesus. There are various views as to the identity of Melchizedek, as he is named in many ancient writings. Rabbi Kaufmann Kohler of the Hebrew Union College, Cincinnati, states in the 'Jewish Encyclopedia' that the personality of Melchizedek rests upon ancient Jewish tradition, and identifies him with Malki-Zedek, first king of Zedek, the ancient name of Jerusalem. Philo speaks of him as the «Logos»; others believe he was Shem, ancestor of Abraham. The chapter in Genesis containing his story is a unique passage of the Pentateuch, and according to Wellhausen is one of its latest additions. Ewald counts it the earliest portion of the history and based on old Canaanitish records; others, as Nöldeke, explain it as utterly unhistorical.

MELCHTHAL, mĕlH'täl, **Arnold von** (Arnold an der Halden), Swiss patriot. He is considered by some authorities to be a mythical character, but was supposed to have lived in the 14th century. He incurred the wrath of the governor and was compelled to flee to escape punishment, whereupon the governor seized Arnold's aged father and had his eyes put out. The son, enraged at this barbarity, with two friends planned a revolt against the Austrian power which they successfully conducted. Consult Ægidius Tschudi, 'Chronicon Helveticum' (1505–72).

MELDOMETER. See Melting Point.

MELEAGER, according to Greek legend, the hero of the Calydonian boar hunt. The earliest form of the story is found in the 'Iliad,' according to which Meleager is son of Æneus, a king of Ætolia, and Althæa, daughter of Thestius. When the boar had devastated the land Meleager gathered a band about him and after a great struggle and with considerable loss of life slew the monster. A quarrel over the spoils arose between the Ætolians and the Curetes, the latter being under the leadership of Meleager's maternal uncles. In the quarrel the latter were killed by Meleager, who was now cursed by his mother, who prayed the Furies and gods of the nether world to destroy him. The hero withdrew from the fight until the Curetes stormed the town when he launched forth to save his people and was slain, according to some, by the Furies, according to others by the hand of Apollo. Other versions of the story were current in later times, one of which is preserved in an ode of Bacchylides. The Calydonian Hunt was a favorite subject with artists from early times, and a copy of a work by Scopas, executed originally for one of the pediments of the temple of Athena Alea at Tegea, is now in the Vatican, Rome. In the Fogg Art Museum of Harvard University is an excellent replica of the Vatican copy.

MELEDA, Jugoslavia, an island off the southern coast of Dalmatia in the Adriatic. It is about 25 miles long and the Austrian name was Babinopolie. It is believed by some to be identical with Melita on which Saint Paul was stranded.

MELENDEZ VALDES, Juan, hoo-än' mā'lĕn'dĕth väl-dās', Don, Spanish poet: b. Ribera del Fresno, Badajoz, 11 March 1754; d. Montpellier, France, 24 May 1817. He studied law at Salamanca, where he attracted attention by his poems in the old ballad manner and was taken up by the poet Cadalso. In 1780 he received the first prize in a competition under the control of the Spanish Academy for his pastoral 'Batilo,' and, in 1784, his comedy, 'Las Bodas de Camacho,' won a prize from the city of Madrid, although unsuccessful on the stage. In Madrid he won the favor of Jovellanos, who appointed him professor of the classics in the University of Salamanca and urged him to enter upon an unfortunate political career; he became judge in 1789, a judicial chancellor at Valladolid in 1791, and fiscal in the Supreme Court in Madrid in 1797. He suffered brief exile after the fall of Jovellanos (q.v.) in 1798; but in 1802 returned to Salamanca. His sympathy with France, however, made him more than ever unpopular, and after the expulsion of Joseph Bonaparte, he went into exile in France. He was one of the most prominent figures in Spanish literary life during the 18th century.

MELETIUS, (1) founder of the sect of Meletians. He was bishop of Lycopolis in the 4th century, and antagonized Peter, patriarch of Alexandria, by refusing absolution and communion to the lapsed, that is, those who under the stress of persecution had renounced their faith. A schism resulted from the dispute and Meletius traveled through Egypt and Syria gathering thousands of followers, until the Council of Nicæa, 325, deprived him of authority and he died soon after, a merely titular bishop. (2) Another Greek ecclesiastic of the same name and century, who was made bishop of Antioch in 360, when the Arian controversy was at its height.

MELGAREJO, Mariano, mā-rē-ä'nō māl-gä-rā'hō, Bolivian soldier: b. Cochabamba, Bolivia, 18 April 1818; d. Lima, Peru, 23 Nov. 1872. He entered the army at an early age and by his courageous though somewhat unprincipled conduct in the many revolutions in his country, rose to be chief adviser of General Acha in 1862 and was made a general. In 1864 he turned against Acha who was then President, instigated a revolution and seated himself in the presidential chair. During a brief absence of Melgarejo the ex-President Belzu returned and reinstated himself in the presidency only to be shot by Melgarejo himself, who then became dictator. He crushed a revolution in 1866 and in that year formed an alliance with Spain against Peru and Chile. Revolutions followed and he was compelled to flee the country in 1871 and was killed in a quarrel at Lima.

MELIC GRASS (*mel,* honey), delicate genus of grasses growing in the shade of woods, of the order Gramineæ, having a lax panicle and spikelets of 2–5 awnless florets, of which one generally is imperfect. *M. uniflora* is of graceful and delicate appearance; cattle are fond of it. This species is common in Europe. *M. nutans* is common in the United States west of the Rockies. *M. altissima,* a Siberian species, growing to the height of three or four feet, has been introduced in parts of Europe, and yields a considerable bulk of herbage. It is perennial.

MELICERTES, son of Athamas and Ino. In fear of Athamas, whose children by Nephele, Phrixus and Helle, she had tried to kill, Ino jumped into the sea with Melicertes. She became the sea divinity Leucothea, he Palæmon, whom the Romans identified with their god of harbors, Portunus. Some identify him with Moloch. It is recorded that children were sacrificed to him at Tenedos.

MELICOCCA (*μέλι,* honey — *κόκκος,* berry), genus of trees or shrubs of the natural order Sapindaceæ, comprising about six species, one of which *M. bijuga,* native of the West Indies, is there universally cultivated for its fruit. It is called the honeyberry and the Jamaica bullace plum; by the Spaniards, Monos; by the Dutch, Knipnee. It is 16 to 20 feet high. The fruit has an agreeable flavor and varies in color from yellow to jet black. It is now grown in California and Florida. When roasted the seeds may be eaten after the manner of chestnuts. Some other species also yield edible fruits.

MELIHAH, the salting of meat according to Jewish ceremonial, that it may be without blood and ritually fit for eating, thus complying with the law (Gen. ix, 4).

MELIKOFF. See Loris-Melikoff.

MELILITE, or **MELLILITE,** a native silicate of sodium, calcium, magnesium, aluminum and iron. Potassium is also commonly present to some extent. Melilite crystallizes in the tetragonal system and has a vitreous or resinous lustre and usually a honey-yellow color, from which circumstance it derives its name (Greek, "honey"). It is brittle, translucent (at least in thin layers), and distinctly pleochroic. It has a hardness of about 5 and a specific gravity of 3. The mineral occurs in basic eruptive rocks and is also observed, quite frequently, in the slag from furnaces. It is sometimes called mellite.

MELILLA, Africa, a port of Spanish Morocco, about 150 miles east of the Strait of Gibraltar. Iron ore is mined and exported. A Spanish military command is located there, a wireless station and an aviation corps, the latter having a range of 320 miles. It has been used by Spain also as a penal settlement. Pop. about 60,000.

MELILOT, a genus (*Melilotus*) of annual, biennial and perennial herbs of the family *Fabaceæ.* The species of which there are about a dozen, are natives of western Asia and the Mediterranean region and have become widely distributed in temperate and subtropical climates. They are upright, alfalfa-like plants with small yellow or white flowers which are borne from late spring until frost. The pods are few-seeded and not twisted as in the closely related genus *Medicago* (q.v.). The two best known species are yellow melilot (*M. officinalis*), an annual, and white melilot (*M. alba*), a perennial, which are common weeds in waste places, the former especially upon dry, clayey soils, the latter in damp situations. Like other members of the genus they are sweet-scented, particularly while drying, and their flowers are used to some extent for perfumery.

MELINE, James Florant, American lawyer and author: b. Sacket's Harbor, N. Y.; d.

Brooklyn, N. Y., 14 Aug. 1873. He was graduated at Mount Saint Mary's College, Emmettsburg, Md., and went to Cincinnati, where he was one of the professors at the Athenæum, and, while teaching, studied law. He was also one of the editors of the *Catholic Telegraph*. After spending some time abroad in study and travel he returned to Cincinnati, was admitted to the bar and commenced the practice of law; later he relinquished his profession and established a banking business, also holding consulates for France and other nations. In 1860 his business failed and shortly afterward he enlisted in the Federal army. He served throughout the Civil War under General Pope, attaining the rank of colonel, and after the war was for two years chief of the Bureau of Civil Affairs in the third military district. At the end of that time he went to New York and devoted himself to literary work, writing for the *Galaxy*, the *Nation* and the *Catholic World*. In the latter periodical he first published the articles controverting Froude's statements and conclusions in regard to Mary Queen of Scots; these articles, which aroused wide interest, were afterward revised and published in book form under the title 'Mary Queen of Scots and Her Latest English Historian' (1871). He also wrote 'Two Thousand Miles on Horseback' (1867); 'Commercial Traveling' (1869), and 'Life of Sixtus the Fifth' (1871).

MÉLINITE, mā'lĭn-īt, an explosive employed by the French government late in the 19th century, in charging torpedo shells and in the preparation of rupturing charges for the use of the engineer corps and cavalry in effecting demolitions. As originally used it was composed of 70 per cent of picric acid mixed with 30 per cent of pyroxylin dissolved in 45 parts of acetone. Later it consisted exclusively of fused picric acid which was poured into the shell when in the molten condition and cast there in such a manner as to leave a central canal in the mass in which the fuse terminated in a mercuric fulminate detonator by which the charge was fired. By the use of this fuse the detonation of the charge was delayed sufficiently to allow the shell to penetrate armor and reach the farther side of it before the explosion. Mélinite was very thoroughly tested at Bouchet in 1892 to determine the degree of safety that it possesses when exposed to shocks, fire and the accidental rupture of receptacles containing it, and the results were most favorable. The name, like that of other explosives, is going into disuse because of the practice of describing explosives by their principal constituents.

MELIORISM (Lat., *melior*, better), the belief that the improvement of the world by human effort is possible, and implying also the further belief that the world is *de facto* being gradually so improved and that such improvement is a law of evolution. The term was used first in conversation by the novelist, George Eliot, who desired to formulate a *via media* between the views of optimism and pessimism so prevalent in her day. Sully adopted the term in his 'Pessimism' (1877), since when it has come into general use. By Sully meliorism is described as "the faith which affirms not merely our power of lessening evil — this nobody questions — but also our ability to increase the amount of positive good. . . . By recognizing the possibility of happiness and the ability of each individual consciously to do something to increase the sum total of human welfare present and future, meliorism gives us a practical creed sufficient to inspire ardent and prolonged endeavor." The opponents of meliorism have connected it with the theory of evolution. Evolution by them is presented in a semi-religious light, inasmuch as they believe in a gradual abatement of evil through progressive evolution. This view is not confined to philosophers of this school, however, but is now the view of many agnostics, who unwarily have assumed this unconsciously religious conception of the universe. Consult Fraser, 'Theism.'

MELISSA, a plant. See BALM.

MELISSUS, mĕ'lĭs-ŭs, Greek philosopher: b. Samos, about 480 B.C. He was the son of Ithagenes, and is said to have been a friend of Heraclitus and to have commanded the fleet opposed to Pericles in 440 B.C. in the Samian War. Some fragments of a prose work of his, written in the Ionic dialect, have come down and have been collected and published by Brandis and by Mullach (1846). From these he appears to have been a philosopher of the Eleatic school and to have reached more definiteness and consistency than Parmenides. He reasoned that being was eternal, and could not have a beginning, else it would start with non-being; by like reasoning, there can be no destruction of being, for it would have to become another and opposite thing. Void he holds to be nothing, which is not, and therefore unthinkable. He concluded that being was incorporeal, because a body has size and parts.

MELITA, mĕl'ĭ-tą, the island on which Saint Paul, on his voyage to Rome, was cast away. This has generally been considered to be the Island of Malta, the ancient name of which was Melita, and one of whose bays has from immemorial time borne the name of Saint Paul; but some critics have attempted to prove that it was an island, the modern Meleda (q.v.), on the coast of Dalmatia, in the Adriatic.

MELKART (Phœnician, "God of the City"), name of the presiding deity of the city of Tyre and of the whole Tyrian nation, namely, Baal (q.v.), the sun god. He is sometimes identified with the Heracles or Hercules of the Greeks. He was the patron god of mariners and the Phœnician colonies of the West, in Africa and Spain, were under his protection. To him has been ascribed the subjugation of the savage races who anciently peopled these regions and the building of early Phœnician towns. The institution of order and legislation in these cities was also said to have been his work. Many are the voyages which he is related to have made. One of his exploits was the rescue of Astarte from the darkness in which the moon had imprisoned her in the West; he afterward made her his wife. For an account of the Temples of Melkart at Tyre consult Jeremias, 'Tyrus bis zur Zeit Nebukadnezzar' (1891).

MELKITES. See MELCHITES.

MELL, Patrick Hues, American educator: b. Walthourville, Ga., 19 July 1814; d. Athens, Ga., 26 Jan. 1888. He was educated at Amherst and after teaching for several years was appointed professor of ancient languages at Mer-

cer University in 1842 and was also ordained a Baptist minister in that year. In 1856 he was appointed to the same chair in the University of Georgia, and in 1870 he became vice-chancellor, which post he resigned in 1872. In 1878 he was appointed chancellor and in 1880 was elected to the chair of metaphysics and ethics, which offices he occupied at his death. He held several pastoral charges and was president of different conventions in addition to his educational work and published 'Baptism' (1852); 'Parliamentary Practice' (1868); 'Church Polity' (1878).

MELL, Patrick Hues, American scientist: b. Penfield, Ga., 24 May 1850; d. 15 Oct. 1918. Son of the preceding, was graduated at the University of Georgia in 1871 and was State chemist in 1874–77. In 1878 he was called to the chair of geology and botany at the Alabama Polytechnic Institute and continued in that position until 1902, when he accepted the presidency of the South Carolina Agricultural and Mechanical College. In addition to his work in the universities he was connected in 1884–1902 with the Alabama Weather Bureau and the Agricultural Experiment Station and he invented a system of weather bureau signals which has been adopted by the United States Weather Bureau. He published 'Southern Soapstones and Fireclays' (1882); 'Study of Cotton Plant' (1890); 'Life of Patrick Hues Mell, Sr.' (1895); 'Biological Laboratory Methods' (1902); etc.

MELLILITE. See MELILITE.

MELLON, Andrew William, American public official: b. Pittsburgh, Pa., 24 March 1855. He was educated at Western Pennsylvania University, now the University of Pittsburgh and entered the banking house of Thomas Mellon and Sons, eventually becoming its president as well as director in many important business and financial corporations. In 1921 he became Secretary of the Treasury in President Harding's cabinet and held the same office under Presidents Coolidge and Hoover. He was responsible for a policy of reduction in the United State's national debt due to the World War. In 1936 he gave his magnificent art collection to the nation together with $10,000,000 for the erection in Washington of a gallery in which to house it. D. Southhampton, N. Y., 26 Aug. 1937.

MELLON INSTITUTE, at Pittsburgh, Pa., founded in 1913 by Andrew W. and Richard B. Mellon, to provide qualified workers with facilities for investigating thoroughly problems of major importance in the pure and applied sciences and especially in chemistry. The institution is primarily concerned in carrying on broad researches of postdoctoral character supported by persons or organizations interested in such studies. Before establishing the institute the Mellon brothers recognized the utility of scientific research for benefiting mankind by effecting improvements in or otherwise developing technology. They set up the institute for the purpose of extending this assistance to the industries, and the institution soon demonstrated the value of its research procedure, the Industrial Fellowship System evolved by Robert Kennedy Duncan. The founders then decided to broaden the scope of the institute's activities by making available provisions for investigations in the sciences having more definite relation to human welfare, which might likewise add to technical knowledge. This basic research was begun and the entire program has since been supported generously by the founders and their families. The industrial research of the institute is organized on a contract basis, the problem being set by a person, firm, or association interested in its solution, the scientific worker being found and engaged by the institute, and an industrial fellowship being assigned for a period of at least a year. All results obtained by a fellow belong exclusively to the donor of the fellowship. Since its inception over $16,000,000 has been contributed to the institute by industrial fellowship donors, and close to $1,300,000 is being expended annually in conducting pure and applied science research.

MELLONI, Macedonio, mä-chā-dō'nē-ō mĕl-lō'nē, Italian physicist: b. Parma, 11 April 1798; d. Portici, near Naples, 11 Aug. 1854. He became professor of natural philosophy at the University of Parma, where between 1824 and 1831 he taught hygrometry. Political events having compelled him in the latter year to expatriate himself, he went to Geneva, where he made several important discoveries respecting the radiation of heat, which he presented in 1833 to the French Academy of Sciences. Later discoveries won him the Rumford medal from the Royal Society of London. Through the influence of his friends, Arago and Humboldt, he was enabled to return to Italy, and was appointed by the king of Naples director of the meteorological observatory on Mount Vesuvius. Among the results of his labors at this institution was the discovery of heat in lunar light, which led to the determination of the analogy of radiant heat to light. Political troubles again interrupted his labors, and for his presumed sympathy with liberal principles he was in 1849 ejected from his post. In 1850 he published the first volume of a work entitled 'La termocrasi, o la colorazione calorifica,' containing an account of his theory of the «coloration of light,» and of his experiments on the diffusion of heat by radiation, and particularly of its transmission through transparent media. Subsequently he gave much attention to the study of electricity and combated the conclusions of Faraday with regard to the transmission of currents over submarine wires.

MELOCACTUS, a cactus typical of the tropical American melon-cactus family, *Melocactidæ*. It consists of a globose or conical stem, having rows of spines at intervals and flowers at the top on a hemispherical or cylindrical head. There are more than 20 species. *M. communis* of the West Indies is the Turk's, Englishman's or Pope's-head cactus. The head bearing the flower is red and like a Turkish fez in form.

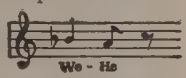
MELODEON, a musical wind instrument with a row of reeds and operated by keys. The rocking melodeon, known in America since about 1825, was unsightly, tardy in sounding and of harsh tone. Jeremiah Carhart in 1815 conceived the plan of acting on the reeds by suction instead of blowing, and reversed, to this end, the bellows and reeds, inventing the present instrument in 1836. He thus secured prompt sounding and a flute-like quality of tone; «voiced» the note by curving the reeds, and made many other improvements. In a single year 22,000 of these instruments were manufactured in the United States, and they

were popular until the cheap parlor organ displaced them.

MELODRAMA (from the Greek *melos,* song, and *drama,* action), originally and properly a half-musical drama, or that species of drama in which the declamation of certain passages is interrupted by music. It is usually a tragedy of common life, filled with surprises, acts of violence and all that excites and sustains the attention of the audience, mixed up with dancing and music and sometimes with scenes of a rudely comic character. Probability is freely sacrificed for the sake of striking situations. The object is to be sensational and to catch the applause of the gallery. See DRAMA, THE.

MELODY, *in music,* a succession of single tones so arranged as to express a musical phrase or thought. A solo for one instrument or voice with or without accompaniment is the most typical example of a melody.

Melody is one of the most comprehensive terms used in music, being properly applicable to as few as two notes or to as many as the entire principal vocal or instrumental part of a composition. An example of the first is the motif of woe in Wagner's *Der Ring des Nibelungen.*



On the other hand, the long, exquisitely mournful, unaccompanied solo for English horn in the third act of the same composer's *Tristan and Isolde,* played ostensibly by the shepherd on the stage (in reality, of course, by a member of the orchestra in the pit), is usually referred to as the shepherd's melody (or the English horn melody) from *Tristan.* Similarly the long and equally beautiful flute solo from Gluck's *Orpheus and Eurydice,* popularized by many violinists in a transcription, is universally known as the Gluck melody from *Orpheus.*

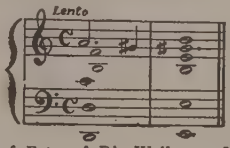
The term is also appropriately applied to a phrase, or portion of a phrase, in a part that has been subordinate to the principal one and which, for a moment, gains importance on account of its greater melodic significance. In concerted music, vocal or instrumental, the highest part is usually the melody, though as stated above, an inner one, or even one in the bass, may temporarily assume it. In polyphonic music all the parts may be equally melodic.

Melody is the outgrowth of the improvised recitative. The early Greek singer, standing before his audiences holding his four-stringed lyre or chelys, plucked a string and recited his poem on that note until fancy impelled him to change it. From this crude ancestor has sprung melody as we understand it today, which with rhythm and harmony (q.v.) form the great trinity necessary for the complete expression of music. Melody is the only one of the three capable of

suggesting enough of the other two to be satisfactory by itself. The folk song of old and the popular song of today may be sung by a single voice without any accompaniment and yet convey a very definite idea of the rhythm and something of the harmony that would naturally accompany the tune.

Melody is greatly affected by the harmony that the composer has wedded to it, and it is owing to this fact perhaps more than any other that composers continue to find it possible to write original music, for with but 12 different notes from which to form a melody it is evident that, even with all the variations that rhythm can add, the melodic material is capable of exhaustion in the enormous and growing number of compositions. The following phrases of melody, especially the first, have no particular suggestion played alone:

But with the harmony that the composers have added they have an entirely different significance,



Motif of *Fate,* of *Die Walkuere*—Wagner.

the one of great solemnity and foreboding; the other of harsh cynicism and sneering.

It is curious to note that when Wagner's music dramas were first performed, the most frequent denunciation of them made by contemporary critics was that they were "devoid of melody." By this, the critics meant that they missed the catchy "barrel-organ" tunes of the Donizetti, Bellini, and early Verdi school of opera. Some of the same critics eventually discovered that the tissue of Wagner's music was a tapestry of sound woven from much more beautiful melodies: it was literally, as the Wagner critic and biographer Henry T. Finck once put it, a case of not having been able to see the trees for the forest.

HENRY GORDON THUNDER,
Conductor, Choral Society of Philadelphia.

MELOIDAE. See BLISTER-BEETLE.

MELON-CACTUS, or **MELON-THISTLE.** See MELOCATUS.

MELONS, a popular name for several unrelated plants, but more particularly for two members of the family *Cucurbitaceae,* the muskmelon (*Cucumis melo*) and the watermelon (*Citrullus vulgaris*). The more important other fruits similarly known are the Chinese preserving melon (*Benincasa cerifera*) of the same family; the melon papaw (*Carica papaya*) of the family *Caricaceae,* and the melon-shrub or melon-pear (*Solanum muricatum*) of the family *Solanaceae.*

The muskmelon is an annual trailing herb which has been introduced by man into all tropical, subtropical and many temperate climates from southern Asia where it is native. The following are the principal varieties: Variety *cantaloupensis,* the cantaloupes, or rockmelons, which have hard, warty or scaly rinds more or less furrowed, and flesh of various colors from white to red, green or yellow. In the United States the name «cantaloupe» is loosely applied to horticultural varieties of

other groups. Variety *reticulatus* includes the nutmeg or netted melons which have softer rinds, sometimes smooth, but usually more or less netted. To this group belong the larger part of the so-called cantaloupes in American markets. Variety *saccharinus* comprises the pineapple-melons which have very sweet flesh, but are not clearly distinct from the preceding group. Variety *inodorus,* the winter muskmelons, which have less hairy, lighter-colored vines and foliage and whose long-keeping fruits are deficient or entirely lack the characteristic muskmelon odor. This group is less cultivated in the United States than in the Mediterranean region, but because the fruits can be kept until Christmas or later when properly grown, gathered before frost and slowly ripened in a cool, rather dry room, they should become more widely popular where the seasons are long enough to permit their reaching such a stage of maturity. Variety *flexuosus,* the snake-melons or cucumbers, have very long, narrow, greenish, contorted fruits, prized more as oddities than for economic uses, though often used for making preserves. They are distinct from the snake-gourds which belong to the genus *Lagenaria.* A variety *chito,* called orange-melon, melon-apple, garden-lemon and many other popular names, bears orange- or lemon-like almost scentless fruits with white or pale yellow flesh, which is grown to some extent for preserving. Variety *dudaim,* the pomegranate-melon, Queen Anne's pocket-melon, dudaim melon, etc., has small brown and yellow fruits valued solely for their exquisite perfume.

Melons are propagated wholly by means of seeds, which may be sown directly in the field or started under glass upon inverted sods, in flower-pots, berry-boxes, etc., and transplanted to the field as soon as danger of frost has passed. The former method is practised most extensively in the South and in other warm climates where the seasons are long; the latter in the North because the shortness of the season demands that the plants obtain an early start. The soil best suited to melons is a light sandy loam well drained, well exposed to the sun and well supplied with plant-food. It should be deeply plowed, thoroughly harrowed and kept clean of weeds, especially before the plants are set and until the vines cover the ground. After harrowing, the ground is marked in checks about five feet square and 10 or 12 seeds, or five or six plants, are set in each "hill," from which all but the two or three strongest vines are removed after the insects have had their share. Often, especially upon rather poor or tenacious soils, two or three shovelfuls of well rotted manure is mixed with the earth of the hills to give the plants a little impetus. The fruits are gathered when they will readily separate from the stems, preferably in the early morning.

During the closing decade of the 19th century the demand for highly flavored melons was greatly increased by the apperance in the eastern markets of the Rockyford melon, a small fruit grown in Colorado. Its appearance in large quantities drew public attention to numerous other high flavored melons grown in other sections. As a consequence many inferior varieties have nearly disappeared from cultivation. Besides the Colorado melon fields there are large areas devoted to melon-growing in New Mexico and California. New Jersey, Maryland and Delaware produce immense quantities, the first-mentioned State especially; and the product is consumed largely in the cities of Pennsylvania and New York. The Mississippi Valley States also send considerable quantities to Northern markets.

The watermelon is an annual trailing herb, a native of tropical and southern Africa, whence it has been introduced by man into all tropical, subtropical and many temperate climates for its watery sweet fruits, which sometimes weigh more than 75 pounds, but usually range between 20 and 50 pounds. The vines are more hairy, lighter green, longer running than those of the muskmelon and the leaves are deeply notched, in some cases approaching the compound form. Except for a horticultural group of firm-fleshed varieties known as preserving watermelons or more popularly as citrons, the watermelon seems to have no varieties worthy the name of sub-species or botanical varieties, and even this group appears not to have received such designation.

In general, the watermelon requires the same treatment as the muskmelon, the soil being, if anything, lighter and more sandy, and the distances between hills about double, except for the smaller growing sorts. The principal producing regions are Georgia and Colorado, but the watermelon is grown largely in all the southern States, and some of the short-season varieties as far north as Michigan and Ontario. The watermelon is more easily shipped than the muskmelon, since the tough-rinded kinds may be placed in cars two or more feet deep, the smaller specimens upon the bottom, and shipped long distances. Muskmelons, being more delicate, must be barreled or crated. The fruits are used exclusively in the raw state and have no by-products such as vinegar, sugar, syrup or brandy. The rinds, however, when deprived of the hard exterior, are often preserved with raisins, etc.

Both muskmelons and watermelons are subject to the attacks of several insects, among which the small, black, striped cucumber-beetle (*Diabrotica vittata*), the squash vine-borer (*Mellitia ceto*), the melon-caterpillar (*Margaronia hyalinata*), the cucumber flea-beetle (*Crepidodera cucumeris*), the squash-bug (*Anasa tristis*) and the melon-louse (*Aphis gossipii*) are the most important. Tobacco dust and plant protectors are largely used to prevent the attacks of the first, the adults of which feed upon the under sides of the leaves and the larvæ upon the roots. The melon-louse is fought with kerosene emulsion sprayed upon the under sides of the leaves or by fumigation with carbon disulphide. No effective remedy has been suggested for the borer. Arsenical sprays have been recommended for the caterpillars and other chewing insects. Since the insects are believed to spread diseases from plant to plant, melon-growers seek to prevent insect injury as far as possible and practicable. The diseases, of which a large number have been described, are much the same as attack cucumbers, and may be similarly controlled where control has been found possible. Some diseases, as wilt, have defied all tried remedies. This disease generally ruins the vines a week or 10 days before the fruits would be ready to harvest. Many of the complaints as to the

poor quality of eastern-grown muskmelons result from the sale of melons that have been gathered from blighted fields.

Consult Bailey, L. H., *Cyclopedia of Standard Horticulture* (New York 1944).

M. G. KAINS,
Crop Expert.

MELOPIANO, an invention by which sustained sounds can be produced on a pianoforte. It consists of a series of small hammers set into very rapid vibration by the winding up of a spring.

MELOS, mē'lŏs, **MILO,** or **MILOS,** island, Greece, in the Aegean Sea, in the southwest portion of the Cyclades, about 65 miles east of the mainland. Its length, east to west, is about 14 miles, and it is about eight miles in extreme breadth; area, 64 square miles. It is mountainous—Mount Ilias rising 2,533 feet—of volcanic formation, has hot mineral springs and mines of sulphur. The island was once famous for its riches, fertility and population, and corn, wine, cotton, oranges, and other fruits are still grown. Sulphur, manganese ore, millstone, gypsum, etc., are exported. Plaka is the principal town and nearby are the ruins of Melos, the ancient capital. Kastron is a large village on the north coast.

The island of Melos was first colonized by Phoenicians and afterward by Dorians. During the Peloponnesian War it was the faithful ally of Sparta until 416 B.C., when it was taken by the Athenians, and its inhabitants were massacred or sold as slaves. From 1204 until 1537 it formed part of the Venetian duchy of the archipelago. At the latter date it was taken by the Turks, with whom it remained till the epoch of Greek independence. Its ancient prosperity is claimed to be due largely to the fact that obsidian was found here, which was quarried and sold for making knives, hatchets and tools. In 1820 a peasant discovered here the celebrated statue known as the Venus of Milo, now in the Louvre at Paris; the Poseidon in the National Museum at Athens was also discovered here. There are numerous interesting archaeological remains, chief of which are those of the Hall of the Mystoe on the site of the ancient capital near the village of Klima, and those of prehistoric Phylakopi, which were excavated by the British School at Athens from 1896 to 1899. Pop. (1946) 6,045.

MELPOMENE, měl-pŏm'ê-nē, one of the Muses, daughter of Zeus and Mnemosyne. She presided over tragedy and was generally represented as a young woman with vine leaves surrounding her head, and a tragic mask covering her face.

MELROSE, city, Massachusetts, in Middlesex County; altitude 55 feet; on the Boston and Maine Railroad; 7 miles north of Boston. The surrounding area is largely industrial. Formerly Melrose had a number of factories, but is now primarily residential with few industrial establishments. It has a public library; parks and playgrounds; musical clubs; a soldiers' and sailors' memorial building; and, at the Mount Hood reservation, an annual winter carnival. Geraldine Farrar (q.v.) is a native of Melrose.

First setteld in 1629 and originally part of Malden, it became a separate municipality in 1650; was incorporated as a town in 1850, and became a city in 1900. It has mayor and council. Pop. (1940) 25,333; (1950) 27,750.

MELROSE, city, Minnesota, in Stearns County; on the Sauk River; altitude 1,211 feet; 97 miles northwest of Minneapolis; on the Great Northern Railroad. The surrounding region is principally agricultural, and butter, cheese, poultry and other farm products are processed here. Doors and sashes are made; also granite memorials. Melrose is a shipping and distributing point on the railroad. It was settled in 1868 on a ford on the Pembina Trail; was incorporated as a village in 1881, and as a city in 1895. It has mayor and council government, and owns its water and electric power systems. Pop. (1940) 2,015; (1950) 2,102.

MELROSE, village, Scotland, in Roxburghshire, on the south bank of the Tweed at the base of the Eildon Hills, two miles east of Abbotsford, the home of Sir Walter Scott, whose *Lay of the Last Minstrel* gave Melrose and its ruined abbey world-wide celebrity. The famous abbey, now the property of the Buccleuch family, is admitted to be the most beautiful of all the ecclesiastical ruins in Scotland. The architecture is in the late flamboyant Gothic style, and the chief remains are part of the nave, the transept, choir and the southern aisle with several chapels, of the abbey church and fragments of the cloister. The church originally was 258 feet long, with a width at the transepts of 137 feet. It was founded by King David I in 1136, destroyed by Edward II in 1322 and rebuilt by Bruce in 1326. It is the burial place of the heart of Robert Bruce, and contains tombs of Sir William Douglas, the knight of Liddesdale (1300–1353), and James, 2d earl of Douglas (1358–1388). It was partly demolished by the English in 1545. Pop. (1951) 2,146.

MELROSE PARK, village, Illinois, in Proviso township, in Cook County; altitude 617 feet; 10 miles west of Chicago; on the Chicago and North Western Railroad. It has some industries, but is mainly residential; many of its people are employed in Chicago and nearby industrial centers. The water supply system is city-owned. Pop. (1940) 10,933; (1950) 13,366.

MELTING POINT, the temperature at which the solid and liquid states of a body can coexist, without the fluid part of the mixture solidifying, nor the solid part melting. The melting point of a body which is crystalline in nature (like ice) is usually quite definite, and a body of this kind, when it melts, passes at once from a state of perfect solidity into a state of perfect fluidity. The melting point of an amorphous body, such as wax or pitch, is often very indefinite; and when a solid of this sort is gradually heated it grows soft and passes into the fluid state by a process which is practically (or even absolutely) continuous. The phenomena of the fusion and solidification of amorphous bodies like wax are not yet understood as well as those that attend the change of state of a crystalline body; and it is to be understood that what follows in the present article is stated with particular reference to the crystalline class of substances, in which the melting point is definite.

In general, solid bodies expand upon melting, the original solid having a greater density than the liquid that results from its fusion. In

the case of water, as is well known, the reverse is true; the fact that ice floats in water proving that the water is denser. The fact that the density of a substance changes upon fusion implies (as may be proved by the mechanical theory of heat) that the melting point of the substance cannot be entirely independent of the pressure. This fact was discovered in 1849 by James Thomson, who showed that the melting point of a substance like ice, which contracts upon melting, must be lowered by pressure; while the melting point of one which expands upon melting must be raised by pressure. These theoretical conclusions have since been abundantly verified by experiment. In the case of ice, for example, it has been found by Sir James Dewar, that the melting point is lowered by 0.0130°F. per atmosphere of increase of pressure, up to 700 atmospheres.

When a substance passes from the solid to the liquid state, it absorbs a very considerable amount of heat, which is known as the "latent heat of liquefaction"; and the liquid which is formed cannot be all reduced to the solid state again until an exactly equal quantity of heat has been abstracted from it. When heat is added to a mixture composed of a solid and its liquid (pounded ice and water, for example), it does not increase the temperature of the mixture, but merely causes a certain amount of the solid to melt. This continues so long as any of the unmelted solid remains; each addition of heat merely bringing about a corresponding amount of liquefaction, while the temperature of the mixture remains unchanged. It is only after all of the solid has melted that the further addition of heat will produce elevation of temperature. The melting points of compounds undoubtedly depend, in some manner, upon their molecular constitutions, but we have, as yet, no definite knowledge of the nature of the dependence. We know that in a homologous series of organic compounds, the melting points show a strong tendency to increase, as the molecular weights of the members of the series increase; but the change in the melting points is irregular as we proceed from member to member, and no law has yet been discovered which takes the changes fully into account. The melting point of a mixture (such as an alloy) is often lower than that of any one of the constituents, and the effect of the presence of an impurity in a given substance upon the melting point of that substance is often out of all apparent proportion to the quantity of impurity present. This fact implies that in the determination of a melting point it is highly important that the substance under examination shall be as nearly pure as possible. The presence of slight, unrecognized and apparently negligible impurities has sometimes led to entirely erroneous conclusions. In 1860, for example, Hermann Kolbe announced the discovery of an acid isomeric with benzoic acid, but having a lower melting point; but Friedrich Konrad Beilstein afterward proved that the substance in question was merely ordinary benzoic acid contaminated with a quantity of chlorobenzoic acid so small as to be barely recognizable by analysis.

For determining the melting point of minerals, the instrument devised by John Joly and known as the meldometer, is sometimes very convenient. It consists essentially of a strip of platinum foil, upon which small fragments of the minerals are laid. The platinum is then gradually heated by the passage of an electric current, until the mineral melts; the temperature of the foil being obtained by a calculation based upon the resistance of the platinum, the observed strength of the current and the rate at which heat is radiated from the foil, as determined by separate observations. This method is especially useful for minerals which can be had only in small fragments.

The term fusing point is often used instead of melting point, where a high temperature is required to melt. See also Freezing Point; Heat; Molecular Theory.

MELTON MOWBRAY, mĕl't'n mō'brā, urban district, England, in Leicestershire, 15 miles northeast of Leicester, on the right bank of the Wreak, at the junction of the Eye, 105 miles north by west of London. Melton Mowbray is famous for its pork pies and Stilton cheese. It owes its prosperity chiefly to being the seat of the Melton Hunt, which attracts the sporting world in great numbers during the winter months, extensive and luxurious hunting establishments being maintained here. Pop. (1951) 14,052.

MELTZER, mĕl'tsĕr, **Samuel James,** American physiologist: b. Kurland, Russia, March 22, 1851; d. Nov. 7, 1920. He received a general education at Königsberg, Prussia; studied philosophy and medicine at the University of Berlin 1875–1882 and removed to the United States in 1883, after which he practiced his profession in New York. From 1906 Dr. Meltzer was the head of the department of physiology and pharmacology at the Rockefeller Institute for Medical Research and consulting physician at Harlem Hospital. In 1917 he was commissioned major in the Medical Reserve Corps. Dr. Meltzer was a member of many medical and surgical societies. He published over 200 papers on biology, physiology, and scientific medicine.

MELUSINA, mĕl-ū-sē'nà, or **MELUSINE,** in French myths, a beautiful nymph or fairy, who is represented as the daughter of Helmas, king of Albania, and the fairy Persine; and as having married Raymond, Count of Toulouse, who built the magnificent castle of Lusignan. Like most of the fairies of that period, she was doomed to a periodical metamorphosis during which the lower part of her body assumed the form of a fish or serpent. On these occasions she exerted all her ingenuity to escape observation; but having been once accidentally seen by her husband in this condition, she swooned away, and soon afterward disappeared. Her form is said to be seen from time to time on the tower of Lusignan, clad in mourning and uttering deep lamentations. Her appearance was believed to indicate an impending calamity to the royal family.

MELVILLE or **MELVILL, Andrew,** Scottish reformer: b. Baldovie, near Montrose, Forfarshire, Scotland, Aug. 1, 1545; d. Sedan, 1622. He was educated at the grammar school of Montrose and the University of St. Andrews; studied two years (1564–1566) at the University of Paris; went to Poitiers to pursue his studies in the law; there became regent in the College of St. Marceon; and through the influence of Beza received an appointment to the chair of humanity in the academy of Geneva.

Returning to Scotland in 1574, he was at once appointed principal of the University of Glasgow, and in 1580 was made principal of St. Mary's College, St. Andrews. In 1582 he presented a petition to King James against the undue interference of the court in ecclesiastical affairs, for which he escaped imprisonment by going into England. Returning in 1585, he resumed his duties at St. Andrews, and was moderator of the General Assembly in 1587, 1589, 1594. In 1606 he was summoned to London by the king to confer on church matters, but because of his outspokenness he was committed to the Tower, and there remained until 1611. He was then released upon the solicitation of Henri de la Tour d'Auvergne (Duc de Bouillon), retired to France and became professor of Biblical theology in the University of Sedan.

MELVILLE, George Wallace, American naval officer and explorer: b. New York, Jan. 10, 1841; d. March 17, 1912. Educated at Brooklyn Polytechnic, he entered the navy as assistant engineer 1861, served through the war, and in 1879 accompanied George W. De Long's expedition on the *Jeannette* to discover the northeast passage. Of this party he was one of the few survivors; most of the others owed their lives to his indomitable courage and herculean strength—he carried a brother officer, weighing 175 pounds, upon his back, through ice and snow, at the same time superintending all movements of the crew and on occasion helping with the boat. He also commanded the subsequent search expeditions which recovered the *Jeannette's* records and De Long's body. In 1887 he was made chief of the bureau of steam engineering in the United States Navy, a post from which he retired in August 1903, having entirely reformed the service, put navy engineers on a professional rather than an artisan footing, introduced the triple screw on such successful ships as the *Columbia* and *Minneapolis,* saved the department a tremendous sum by his refusal to adopt a boiler which had proved unsatisfactory in the British Navy and designed 120 ships of over 700,000 horse power. Melville was made rear admiral in 1899, and retired in 1903. His book, *In the Lena Delta* (1885), describes his experiences in the *Jeannette* expedition.

MELVILLE, Herman, American author: b. New York, Aug. 1, 1819; d. there, Sept. 28, 1891. His grandfather, Major Thomas Melvill (original spelling of the name), was a member of the Boston Tea Party and prominent in civic affairs; in later life he became known as "the last of the cocked hats" and served Holmes as a model for "The Last Leaf." Gen. Peter Gansevoort, the maternal grandfather, successfully defended Ft. Stanwix during the American Revolution and was a leading citizen of Albany. Melville's father Allan conducted an importing business in New York which collapsed in 1830, after which the family moved to Albany, where the father died in 1832. Melville first attended the New York Male High School and later the Albany Academy, from which he withdrew after his father's death. He worked as a bank clerk, as a farm helper, and as assistant in his brother Gansevoort's fur factory, briefly attending the Albany Classical School. In 1837 he became a country schoolteacher at Pittsfield. He studied surveying and engineering at the Lansingburgh Academy in the hope of securing employment on the Erie Canal. Unsuccessful in finding a vocation on land, he went to sea in 1839 as cabin boy aboard the *St. Lawrence,* a New York to Liverpool trading ship. This experience gave him the framework for his later novel, *Redburn* (1849). Upon his return he taught school briefly in Greenbush and Brunswick (N. Y.), then traveled west as far as Illinois. In 1841 he sailed as ordinary seaman on the *Acushnet,* a Fair Haven whaling ship. After 18 months he deserted at Nukuhiva in the Marquesas Islands and spent a month among the natives of the Typee [Taipi] Valley, escaping to Tahiti on an Australian whaling ship. After further whaling experience, he enlisted in the United States Navy at Honolulu and returned home aboard the frigate *United States,* landing in Boston in 1844.

His voyages furnished materials for his best published works. *Typee,* his first book, appeared in 1846 and was greeted with an acclaim which caused him to decide on authorship as his career. In 1847 he married Elizabeth Shaw, daughter of the chief justice of Massachusetts, after publication of his second South Seas romance, *Omoo* (1847). They made their home in New York, where Melville vainly tried to secure a government appointment. After publishing *Mardi* and *Redburn* in 1849, he made a short visit to England and the continent. *White-Jacket* appeared in 1850. For financial reasons he moved in that year to "Arrowhead," a farm in Pittsfield, where he completed his greatest novel, *Moby-Dick* (1851). This was followed a year later (1852) by *Pierre.* In 1856–1857 he made a voyage to the Holy Land and then spent three seasons lecturing on the South Seas, classical art, and travel. Meanwhile, *Israel Potter* (1855), *The Confidence-Man* (1857), and several essays and short stories had appeared. After a voyage to San Francisco in 1860, he moved permanently to New York in 1863. From 1866 to 1885 he served quietly as district inspector of customs in that city.

Having turned from prose to poetry, he published *Battle-Pieces and Aspects of the War* in 1866 and *Clarel,* a long narrative poem of the Holy Land, in 1876. Two more books of poetry, *John Marr and Other Sailors* (1888) and *Timoleon* (1891) appeared in his lifetime. At his death he left among his manuscripts a beautiful short novel, *Billy Budd,* which was first published in 1924. Relatively neglected in his own day after the spectacular initial success of *Typee* and *Omoo,* Melville was rediscovered after 1919 and is now generally regarded as one of the half dozen greatest American authors. See also Moby-Dick; Omoo; Typee.

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MELVILLE, town, Province of Saskatchewan, Canada, a divisional point on the Canadian National Railway system 280 miles northwest of Winnipeg on the main line and about 90 miles north of Regina on the Melville-Regina branch. It is in a high but productive agricultural area

(elevation 1,810 feet), the leading local industries being a flour mill and creameries. There are four public and one separate school, a Lutheran college, a Roman Catholic hospital, three licensed grain elevators, and two banks. Pop. (1951) 4,000.

MELVILLE ISLAND, an island off the northwest coast of Northern Territory, Australia, at the entrance to Van Diemen Gulf, is 65 miles long and 40 miles wide; area about 2,400 square miles. It is hilly and densely wooded, especially with several species of eucalyptus. The earliest British settlement was made in 1824.

MELVILLE ISLAND, an island of Canada, in Franklin District, Northwest Territories, in the Arctic Ocean. It is the largest of the Parry Islands (q.v.). The island, 200 miles long and from 30 to 130 miles wide, is generally hilly, with several ice-covered areas in the interior.

MELVILLE PENINSULA, North America, a northeastern projection of Keewatin in the Northwest Territories of Canada, about 400 miles north of Hudson Bay; bounded on the north by Fury and Hecla Strait and on the east by Foxe Basin, it is about 250 miles long by about 100 miles broad. At the base of the peninsula is Repulse Bay trading post.

MEMBRANE, *in anatomy and physiology,* a thin sheet-like tissue, more or less elastic, varying in structure and vital properties. Membranes absorb or secrete fluids, connect certain parts of the body, separate, envelop or form certain organs or act as partitions between two fluids or gases, permitting them to mingle. Mucous membranes line the canals, cavities and hollow organs which communicate externally by different apertures on the skin; for example, the digestive, respiratory and genito-urinary tracts. These membranes are soft and velvety and have on their free surface cells for absorption or motion and in their substance follicles which secrete mucus for lubricating and other purposes. Such secretions are saliva, gastric juice and pancreatic juice. Serous membranes, such as the peritoneum, pleura, the unicæ vaginales and pericardium, facilitate the motion of the organs they envelop (abdominal digestive organs, the lungs and heart) by reason of the serum they secrete, and also maintain the shape of these organs. Allied to the serous membranes are the synovial membranes lining movable joints. By reason of their smoothness and by aid of their lubricating serum the ends of bones move readily upon one another. Fibrous membranes (for example, periosteum, dura mater and perimysium), not moistened by any particular fluid, augment the solidity of organs they envelop, retain them in position, favor their motion and form canals and rings for the passage of different organs. The membranes which envelop the brain and are extended to cover the spinal cord are called meninges. (See MENINGITIS.) The membranes enclosing the fetus are called the placenta. Other special membranes are Descemet's membrane, which is the fourth layer of the cornea of the eye, and Bowman's membrane, which is the second.

MEMBRE, mäN-brā', **Zenobius,** French missionary in America: b. Bapaume, France, 1645; d. Fort Saint Louis, Tex., 1687. He became a member of the Récollet Order; was sent as a missionary to Canada in 1675; accompanied La Salle in his western expedition; was with Tonti at Crèvecœur, where he helped bring about peace between the Iroquois and the Illinois; in 1682 went down the Mississippi with La Salle, and in the same year returned to France. For a time he was warden of a convent in his birthplace. But in 1684 he set out again with La Salle for the mouth of the Mississippi. He was left by La Salle at Fort Saint Louis and there massacred by the Indians. He wrote a description of his trip down the Mississippi, which was incorporated by his cousin, Christian le Clerq, into his *Etablissement de la Foi dans la Nouvelle France* (1691), and which was later unscrupulously copied by Hennepin (q.v.). This narrative has sometimes been attributed to La Salle.

MEMEL, mā'mĕl (Lithuanian KLAIPEDA; German MEMELGEBEIT or MEMELLAND), territory, on the east coast of the Baltic Sea, 70 miles north by east of Königsberg. It belonged to Germany but under the Treaty of Versailles was ceded to Lithuania Feb. 16, 1923. It was almost wholly destroyed by fire in 1854, and was rebuilt in modern style. It has a large harbor, and exports from Lithuania and Russia great quantities of timber, also flax and linseed, coal, manure, grain and herring; has also manufactures of brandy, soap and chemicals, sawmills, iron foundries, breweries and ship-building yards. Memel was founded in 1252 by the Livonian order, who gave it to the Teutonic Knights, by whom it was fortified in 1404. It suffered severely in the Lithuanian wars (13th and 15th centuries). Here in 1807 Frederick William III of Prussia took refuge and a treaty with England was signed. It was seized by Russia in 1812 and 1914, but on each occasion that country was obliged to give it up. It was surrendered to Germany by Lithuania on March 22, 1939, and was held until taken by the Russian armies in January 1945. It was then made a part of Lithuania under Russian control. Pop. (1939) 147,569.

MEMLING, mĕm'lĭng, or **MEMLINC, Hans,** Flemish painter: b. Mainz, about 1430; d. Bruges, 1495. He settled at Bruges 1478, of which town he was a prosperous citizen until his death. While all that is handed down of his biography is apocryphal, it is evident, from his works, that he was an imitator of Roger Van der Weyden, although he avoided the harshness and ungraceful drawing of that artist's style. He stood alone among the Flemish painters of his day in the religious tenderness of his pictures, their life-like expression, their exquisite coloring and modeling. His chief works are to be found in St. John's Hospital, Bruges, namely, the altarpiece, *Marriage of Saint Catherine* (1479); *Portrait of Maria Moreel as Sybilla Persica* (1480), and the 14 scenes illustrating the legend of Saint Ursula and the 11,000 Virgins of Cologne (1589). In the Academy of Bruges is a triptych of his in the central panel of which are Saints Christopher, Maurus and Aegidius, and on the wings, Burgomaster Moreel (who offered the picture) with his family. In the Royal Gallery at Turin is his *Seven Dolors of Mary*—a passion picture; in the Pinakothek at Munich a compan-

ion picture, 'The Seven Joys of Mary.' Consult Michiels, 'Memlinc, sa Vie et ses Œuvres' (1883); Wauters, 'Sept Etudes pour Servir à l'Histoire de Hans Memlinc' (1894).

MEMMI, měm'mē, **Simone.** See MARTINI, SIMONE.

MEMMINGER, měm'mĭn-jĕr, **Christopher Gustavus,** American politician, secretary of Treasury in the Confederate government: b. Württemberg, Germany, 17 Jan. 1803; d. 7 March 1888. He was brought to America in infancy, and was educated at South Carolina College. He studied law; began to practise in Charleston in 1825; entered politics as a leader of the Union party; attacked the States' Rights party in a satire called 'The Book of Nullification' (1832); reformed the public school system of the State, and for 20 years was in the State legislature, much of the time acting as head of the finance committee. In 1859, after John Brown's raid, he was commissioned by South Carolina to consult with other delegates in Virginia as to the best method of warding off attacks of Abolitionists. From the formation of the Confederacy until June 1864 he was Secretary of Treasury, and his mistaken policy in that office did much to ruin the Confederacy financially.

MEMNON, in Greek mythology, the son of Eos (Dawn), an Ethiopian prince, nephew of Priam, for whom he fought at Troy. After he had killed Antilochus he was defeated by Achilles. The post-Homeric legend adds that his mother wept bitterly for him, even after he had been made immortal. Memnon's kingdom was localized on the west bank of the Nile, and one of the colossal statues of Amenhotep III, as early as the 1st century A.D., became connected with the myth. It was said to portray Memnon, and the musical note emitted when the sun's rays struck the statue in the early morning (probably due to the action of sudden heat on the chilled damp stone) were explained as Memnon's greeting to his mother. The statue, rehabilitated by Severus, is still sonorous. The name Memnonium was applied in the Ptolemaic period not only to the west bank of the Nile, as «Memnon's land,» but to a temple near Abydus, excavated by Mariette in 1859, which contains the famous «gallery of kings.» This has a list of 76 Egyptian kings, and dates from the time of Seti I and his son, Rameses II. This Memnonium contains many other important sculptured documents.

MEMOIRS OF CARLO GOLDONI ('Mémoires de Carlo Goldoni'). This work is celebrated among the many of this class in literature, and yet, in a general way, is comparatively little known. The 'Memoirs' were written in French, when Goldoni was 80 years old, and first appeared in Paris in 1787 (3 vols.). An excellent edition, reproducing them entire and accurately, was published on the second centenary of the author's birth 1907, by the Florentine firm Barbèra, edited with Italian notes by Guido Mazzoni. It was in 1760, a year before Goldoni was called to Paris, that he conceived, as he states in the preface to the 'Memoirs,' the idea of an autobiography. On seeing that the first Florentine edition of his plays had become the subject of universal pillage, no less than 15 editions having been published without his knowledge and very incorrectly, he resolved to publish a second edition at his own expense and insert in each volume a part of his life, imagining that in this way the history of his person and his plays might be completed together. Moreover, it occurred to him that possibly a collection of his works might some day be discovered in a corner of some old library and awaken curiosity to know something about the writer who undertook to reform the Italian theatre and wrote 150 comedies of character and intrigue. But as the years rolled on and the work which was to extend to 30 volumes and become completed in eight years had only reached the seventeenth volume, Goldoni realized that his project would not be completed during his life. So setting to work six years before his death, abridging and translating into French the contents of the historical prefaces of his 17 volumes of the Venice edition of the plays which related mostly his early life, and continuing with an account of the reformation of the Italian theatre, due largely to the author's theatrical genius, he completed the first part of the 'Memoirs.' The second part gives an account of the composing, construction and outcome of his many plays, together with the criticism of them and rivalry excited by them. The third and final part of the 'Memoirs' relates the author's personal experiences in France from 1762 to their close in 1787.

The 'Memoirs' of Goldoni have been called his most amusing comedy and pronounced by no less a literary light than Gibbon, «more truly dramatic than his Italian Comedies.» They have been the subject of admiration of some of the most distinguished of litterateurs not only in Italy but in England, France and Germany, is proven by such testimony as that of Byron, Voltaire and Goethe. But to appreciate and enjoy Goldoni's entertaining personal reminiscences, no such extraordinary literary talent is necessary,— far from it, for the average reader can hardly fail to get enjoyment from them, especially if he be at all interested in 18th century life in Italy. As a faithful picture of the life of this period, especially the life of the humbler classes, the 'Memoirs' of Goldoni rival his plays and are unexcelled. The parts that relate to Venice, Chioggia and to life in the Italian cities where Goldoni had his many and varied youthful experiences have that genuine ring found in his best plays in Italian dialect depicting life among the common people. The portions relating to the author's life in France, although far from lacking in interest, have not the charm that the parts of the 'Memoirs' have which relate to Italy. There is an English translation of the 'Memoirs' by John Black (2 vols., London 1827). The same, abridged and edited, together with a luminous introduction by William Dean Howells (Boston 1877). For everything concerning Goldoni and his works, consult H. C. Chatfield-Taylor's masterly work 'Goldoni, a Biography' (New York 1913).

JAMES GEDDES, JR.

MEMORIAL ARCH, an arch usually built across an avenue or street, or at an entrance to a park, garden or other public place, to commemorate some person or event. The

Washington Arch in Washington Square, New York City, is a well-known American example of the memorial arch. It is built of marble and is adorned with elaborately carved figures.

MEMORIAL ARCHITECTURE. See SEPULCHRAL ARCHITECTURE.

MEMORIAL DAY. See DECORATION DAY.

MEMORY IN ANIMALS is to be studied in the light of comparative psychology, as between the human and the animal mind. To one class of thinkers this difference seems only one of degree; the mind of the animal to them is of the same nature as that of man, but is less developed by reason of limited experience, lack of stimulus because of comparatively small means of intercommunication of ideas, and general inferiority in complexity of brain structure. To another class of thinkers there is an essential difference — a permanent gulf between the mental processes and powers of brute and human beings. Memory is one of the most important attributes of mind and must vary with varying mental abilities. Thus it is hardly, if at all, perceivable in animals of low organization, but is more and more recognizable as we ascend the scale of animal organization, until at the top its operation is clearly visible. In studying it as regards animals we are met, however, with this initial and constant difficulty, that while we are able not only to question ourselves and report what we find for comparison with and discussion of the self-examination by other men, we cannot see into an animal's mind and must judge of its processes by their outward signs. Thus we may assure each other that we possess imagination, which is a high function of memory; but how are we to discover whether an animal indulges itself in such a mental exercise? When a horse goes slowly and with hanging head on an outward journey but becomes instantly animated and brisk in his gait when he is turned toward home, is that because he pictures in his mind the comfortable stable and good food awaiting him? If so, is that not an example of imagination? It has been customary to attribute all such acts as nest-building and the like to "instinct," but innumerable examples of both faulty and beneficial work of this kind discourage faith in so simple a solution; and when a bee ingeniously stays a falling comb by a new brace or guy of wax, or a beaver overcomes a change in his pond by altering the direction of his dam or by building another in a new place, must these creatures not exercise imagination in order to plan and carry out the new way of meeting an unexpected difficulty? Each is applying his experience, recalled by memory, in the way he pictures (must picture) to himself the result of what he purposes to do, or he could not carry out his intention. That the animals we know best, horses, dogs, cats and so forth, have a very retentive memory, at least in certain directions, every one knows. The theory of many students of the matter is that this is purely "associative," that something they see or smell or hear recalls a group of facts connected with it; and that it is impossible for them to recall this group without such a concrete suggestion. Much evidence may be produced throwing doubt on this limitation of their power.

ERNEST INGERSOLL.

MEMORY AND ITS DISORDERS. Locke has defined memory as "the power the mind has to revive perceptions which it once had, with the additional perception that it has had them before." Ribot distinguishes three functions of memory: (1) the preservation of certain states, (2) their reproduction and (3) their recognition. In view of the fact that the collection of gray matter in the cerebro-spinal axis below the cortex is capable of storing impressions and that probably all parts of the sensory nervous system are concerned in mind action and in memory, it will be necessary to speak not merely of memory but of memories, in the sense of reproductions of like sense quality with the original impressions. Modern psychology accepts the concept of unconscious memory, which would imply that all impressions upon all sense organs are permanently retained in the organism. In this case the question is not so much how we remember as why we forget. An answer to this question has been found by the present day analytical psychology of the unconscious. Up to the time of the acceptance of these views the determinants of memory were considered to be frequency of repetition of the stimulus, or its intensity, or its interest or a combination of these factors. From a purely mechanical point of view memory is interpretable as a result of a biochemical phenomenon. The sensory nerve cells, being acted on by certain stimuli, whether of touch, taste, hearing or sight, undergo certain molecular changes. Repetition of similar impulses induces similar reactions and a habitual response in the affected cells results. A line of least resistance is established and in these habitual responses the germ of the idea of memory is to be found.

From this point of view the nerve-cells retain something as a result of a previous experience, and the repetition of the stimulus finds the cells in a receptive state. Continued repetition of the stimuli constitutes a memory, and in this sense the training of a certain mechanism has bound up in it this mechanical theory of memory. Thus a muscular effort, as in tennis, or skating, or piano-playing, becomes by repetition remembered in automatic action, frequently without consciousness. It is the usual rule that many muscular acts which in their acquisition have called for conscious memories soon become automatic, and the effort no longer rises into consciousness, perhaps because of its diminished intensity. A similar point of view may be held for sound-impressions, for taste, for touch, for sight, in each individual case a different series of nerve-cells and nerve-fibres being involved. Thus the memory for a poem may mean a habit-response to a series of sight or sound impressions, or of the muscular memories of the speech mechanism that has learned to repeat the phrases. The actor who automatically says his lines, often not conscious of what he is saying, the pianist who mechanically plays, or the golfer who unconsciously drives true, all show the same class of memory adaptations, involving different nervous chains.

There are thus not only a visual memory, but an auditory memory, or memory for sounds, a gustatory memory for tastes, an olfactory for smells, and special memories for the other special classes of sensation. Older psychology

was concerned with the question as to the fidelity and longevity of these special memories or types of memory, as related to each other, and with the discovery of laws according to which they might be revived. (See MNEMONICS). But with the introduction of the unconscious as a dynamic factor, the recalling of a previous experience is explained on a new principle. Memories are thus seen in the form of ideas to be reproduced into consciousness by virtue of forces which are mainly unconscious, and over which consciousness has only an indirect control, and the study of memory as such retires to an importance secondary to the study of the causes why some things tend to be remembered and others tend to be forgotten. This trend or tendency on the one hand to be forgotten or on the other to be remembered is now known to be determined by the unconscious wish, a force which is termed the *libido* and which is the prime mover, although uniformly unrecognized, of all the activities of the ego, both conscious and unconscious.

The mental mechanisms by which the unconscious pervades and indirectly controls all the conscious expressions, whether activities or thoughts, will be discussed under the title PSYCHOANALYSIS. In connection with memory it is necessary here only to point out that what we remember is only the residua after the work accomplished by the processes of repression, during which most of our former experiences are forgotten. On the fundamental principle that what is unpleasant in experience is from earliest infancy rejected by the individual ego, and regarded as if it did not exist, we may regard the ego as similarly rejecting or repressing the memories of impressions associated with the unpleasant or painful incidents. This explains why some things are forgotten and others are remembered. The unconscious, which functions solely on the principle of accepting or striving for the pleasurable and rejecting or repressing the painful, therefore furnishes the motive force for injecting certain ideas into consciousness, and restraining other ideas from entering. On this fact depends the further phenomenon that the dynamic factor called the libido, in becoming attached to certain ideas which are thrust out of consciousness, may be *converted* and its force applied to vegetative functions of the body producing in many cases certain forms of disease. See MEDICINE AND PSYCHIATRY.

Memory, however, does not depend on repetition of stimulus alone. There are variations in intensity and duration of stimuli, modifications in plasticity of the nerve-cells themselves, the quality of attention, and above all the native individual character of health of the nerve-tissue itself—all of which factors enter into the everyday variations in memory that are familiar to all. The fixity and enduring quality of the memories of childhood are proverbial, and are due to the great plasticity of the youthful nerve-cells, as well as to the intensity of the early pictures. That one person should have a good visual memory and a poor auditory memory, and vice-versa, must naturally be interpreted as due to variations in individual capacity. Modern pedagogy has slowly recognized these variations, and the greater prominence given to play, and to methods of precision, be they manual, lingual, auditorial or visual, and less to distinctly formal methods of memorizing as a purely visual process from a printed page, may be regarded as evidence of this wider recognition that memory should be a generalized function, and not a pedantic cramming of any sort. A well-trained muscular system may be of far greater use to a man than any of his acquired knowledge. It is impossible to train certain children to do certain things, whereas in other directions training may result in great proficiency.

Disorders of Memory.— The classifications of disorders of memory into those of defect and those of excess is based on the old psychology which laid most of the defects to lesions in the cortex of the brain. The newer view, while admitting the loss of memory evinced by the physical defect in the brain or nerve substance, admits also a purely functional deficiency in various memories which is determined by the unconscious wish and is entirely independent of any organic lesion or defect. It is agreed by most psychologists that the native retentiveness in any given individual does not itself alter, although there may be in one individual a finer nerve and brain structure than in another, enabling one to perceive and therefore retain finer distinctions. But the ability to recall at will, which is the essential quality of a good memory in the ordinary sense, is dependent solely upon the proper alignment of the unconscious wish with the desires of the conscious life, which are determined by the social environment of the individual.

The general term for deficiency or loss of memory is amnesia, although this term fails to express the various distortions of memory, the illusions or slight absences; and there are no technical words to distinguish temporary or permanent, periodic or progressive stages of the amnesic process. Inasmuch as memory is not one thing, but a great assemblage of processes which reflect a vast variety of psychological functions, situated not in the brain alone, but almost anywhere in the nervous system, a "defect in memory," as defined by Jastrow, "is an expression of the incapacity of a group (or of certain groups) of centres to exercise their normal functions; or a tendency which they show to functionate in an abnormal manner." Defects of memory may be general or special. General defects may be due to an incapacity on the part of nervous centres to establish residua. This type is found in those people who never remember what they see, and, notwithstanding frequent repetition of an act, never acquire proficiency in it. Occasionally a reverse general condition is manifest wherein the power of memory is unduly exalted and impressions of past experience reappear with unusual brilliancy. Such states are known in fevers, in intoxications of various kinds as of alcohol, opium, etc., and in the hypnotic trance. Special defects may arise in which particular isolated experiences are cut out of the mind. Thus alcoholic amnesia, that may forget even a committed crime, is an illustration. Somnambulism and other hysterical states are characterized by defects of this special type. Another form of defect is observed when associated memory-groups are blotted out, as in the special disorder aphasia. (See APHASIA; SPEECH, DEFECTS OF). Memory may be falsely localized in time, or in order; imaginary additions to

real events may be present; or illusory remembrances of what has never been experienced occur. Disorders of memory are never primary conditions but depend upon either the physical nerve or brain defect for which there must always be a corresponding deficiency in memory or upon the psychological conditions referred to above, where the specific memories are inhibited by associations with unpleasant or painful situations. Through the technique of psychoanalysis a great amount of forgotten material can be restored to memory by means of living over again the situations in which occurred the events responsible for the apparent obliteration of the memory.

Psychologically considered, memory defects may occur either in the storing or retentive part of the nerve-cells, or they may involve the much more complicated and associated process of reproduction of the retained images. Both processes may be involved at the same time. In imbecility, idiocy, and dementia, a born or acquired loss of retentive power is present. In pianists—for example, Ignace Paderewski—or chess players—Paul Morphy, Harry Pillsbury, a state of localized hyperamnesia is present. This group would include all such prodigies. Occasionally one sees these two groups represented in one individual, as in an imbecile who has great power for mathematical calculation. A case of this kind proves that the old assumption of closely localized memory-centers is false. Memory may be said to reside in all parts of the sensory nervous system. In another group the ordinary amnesias may be placed. These vary with each individual and depend largely on the healthy tone of the nervous system.

A third group would include the paramnesias, or illusions of memory. In this condition: (1) there is a loss of distinction between memory of things which really did happen and an imagination of things which never did or could. The so-called "constitutional liar" is an example of this inability to distinguish between real and imaginary, and many types of insane persons are similarly affected in an extreme degree.

The reverse of taking an imagination for a real thing is (2) taking a real thing experienced for the first time as a memory of something experienced before—thought of having seen, heard or felt "just that same thing before," also called "deja vue." Such a feeling has nothing to do with native retentiveness, but only with the "feeling of familiarity," which is essentially the presence of an organic sensation which is absent in the simple paramnesia. In some insanities this form of double memory is very prominent and leads to the belief on the part of the person so affected that he is prophesying when he is only recalling what he experienced before.

(3) There is also an associated paramnesia in which things actually experienced suggest ideas falsely taken as memories of other things never experienced. This condition is seen in children and often leads to false testimony. It is also responsible for most "presentiments" or alleged antecedent knowledge of what has happened. Examples of such memories of the actually nonexistent are seen in the stories of faith cures, where all the healing is that of ills that never really existed, save as associated false memories. On these false memories is erected much of the complicated structure of spiritualism, second sight and other similar phenomena.

See also PERSONALITY, DISORDERS OF; SPEECH, DEFECTS OF; and RETENTIVENESS.

SMITH ELY JELLIFFE, M.D.

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MEMPHIS, měm'fĭs, an ancient city, Egypt (modern MIT RAHINA), near the apex of the Nile Delta, 14 miles south of Cairo, according to Herodotus, founded by Menes, the first king of Egypt. It was a large, rich and splendid city, and the second capital of Egypt. After the fall of Thebes it became the sole capital. Among its buildings the temples of Ptah, Osiris, and Serapeum, and its palaces were described as remarkable. At the time of the conquest of Egypt by Cambyses (524 B.C.) it was the chief commercial center of the country and was connected by canals with the Lakes of Moeris and Mareotis. With the rise of Alexandria the importance of Memphis declined, and it was finally destroyed by the Arabs in the 7th century. In Strabo's time (20 A.D.) it was, in population and size, next to Alexandria; in biblical history it is mentioned as Noph and Moph.

The name Memphis is a corruption of Mennofer, "good abode." Edrisi, in the 12th century, describes its remains as extant in his time. Among the works specified by him are a monolithic temple of granite 13½ feet high, 12 long and 7 broad, entirely covered within and without with inscriptions, and statues of great beauty and dimensions, one of which was 45 feet high, of a single block of red granite. These ruins then extended about nine miles in every direction, but the destruction has since been so great, chiefly for the construction of Fostat, an Arabic city on the opposite bank of the Nile, that although Pococke and Bruce fixed upon the village of Mitrahineh as the site (where prone on a mound are two colossal statues of Rameses II), this was not accurately ascertained until the French expedition to Egypt, when the discoveries of numerous heaps of rubbish, of blocks of granite covered with hieroglyphics and sculpture, and of colossal fragments scattered over a space of three leagues in circumference, decided the matter. The views of the great temple of Ptah, the palace of Apis, the sepulcher of the Apis bulls, portions of the White Wall and of pyramids have been identified.

MEMPHIS, city, Missouri, and Scotland County seat; altitude 796 feet; 45 miles west of Keokuk, Iowa; on the Chicago, Burlington and Quincy Railroad. The surrounding area is agricultural, and the city is a trade center for its own and adjoining counties, and a shipping point for farm and dairy products, and livestock. There are bituminous coal fields within the county. Pop. (1940) 1,935; (1950) 2,035.

MEMPHIS, city, Tennessee, county seat of Shelby County, altitude 274 feet; area 116.41 square miles, on the Mississippi River, is the largest city in Tennessee and the most important commercial center and distributing point between New Orleans and Saint Louis.

Communications.—Memphis has nine line railroad systems operating 17 divergent rail lines and consisting of the Illinois Central; Frisco Lines; Louisville and Nashville; Nashville, Chattanooga and Saint Louis; Southern Railway;

Missouri Pacific Lines; Rock Island; Gulf, Mobile and Ohio; and the Cotton Belt. Two railroad bridges span the Mississippi River at this point. One of these is a combined rail and highway bridge—the only toll-free bridge spanning the river between Saint Louis and New Orleans. Memphis is located on thirteen federal highways. Nine bus lines provide intercity highway transport between Memphis and other cities. Barge line transportation on the Mississippi reaches all river ports and provides an outlet for export trade through the port of New Orleans. The Federal Barge Line operates between Minnesota and the Gulf, while the Mississippi Valley Barge Line provides through service from Saint Louis and Cincinnati to Memphis and New Orleans. Service to the Pittsburgh area via the Ohio River is provided by the American Barge Line and the Union Barge Line.

Memphis has airport facilities sufficient to accommodate the largest flying ships under all weather conditions. There are 13 air lines. Service to the Atlantic and Pacific coasts and to the Great Lakes and Gulf areas is now provided in addition to service to the Florida Peninsula.

The city has six radio broadcasting stations.

Economic Resources and Development.—Memphis is located in the center of and serves the most rapidly developing agricultural section of the country. It is the commercial capital of the Mid-South area which embodies Southeast Missouri, Eastern Arkansas, Western Kentucky, and Tennessee, Northeast Alabama and the northern half of Mississippi. The center of cotton production is some 60 miles south of Memphis. This vast hinterland, some 200 by 300 miles in area, produces cotton, corn, rice, wheat, tobacco, soy beans, dairy products, fruits and vegetables. Considerable impetus has been given to livestock raising in recent years. Within this area are many natural resources from which are procured many diverse mineral products including coal, oil, natural gas, ball and kaolin clays, as well as stone and marble.

Memphis is the world's largest hardwood lumber market. Hundreds of square miles of hardwood forests lie in the Memphis area, and strict conservation practices assure the industry's supply.

By reason of its location on the Inland Waterways System, the cost of transportation on imports is very low. Memphis handles over 300,000 tons of steel annually. The city has over 700 plants engaged in manufacture, and is the center of a $2,500,000,000 annual market in wholesale and retail trade. Principal among these are automobiles, auto tires and tubes, auto bodies, furniture of many types, plywood and veneer, flooring, lumber, toys, mixed feeds, cosmetics, perfumes, toilet goods, food products, beverages, medicines, pharmaceuticals, batteries, piston rings, structural steel, automobile lifts, brick, roofing, asphalt products, meats, bakery products, bags, soap, mattresses, lubricants, tool handles, golf club shafts and heads, lard, paints, electric signs, ammunition, shuttleblocks, pulp for viscose rayon, cottonwood oil, railroad forgings, railroad brake shoes, sheet metal products, iron and steel castings and many other commodities. The city controls a trade area 71,326 square miles. Memphis has some of the strongest strictly wholesale firms in the country in dry goods, hardware, drugs, mill supplies, groceries, electrical products, and agricultural implements. Over 600 nationally-known manufacturers and wholesalers maintain their own warehouses or sales offices in Memphis. The city also has five large department stores and a mail-order house.

In addition to a branch of the Federal Reserve Bank, there are 6 banks and trust companies in the city. The total resources of these institutions (1949) was $492,672,439.

There are two daily newspapers, one daily and Sunday paper, and one weekly paper.

Public Improvements.—In recent years many improvements have been effected. These include great housing projects and the elimination of slum areas, the erection of Crump Stadium with a seating capacity of 25,000, Riverside Drive along the banks of the Mississippi, a public grain elevator, the elimination of grade crossings, etc. A new pumping station has doubled the city's water capacity. Buses have replaced the more cumbersome trolleys on a great part of the more important transit lines and new routes have been added. In 1939 Memphis completed negotiations for the purchase of the Memphis Power and Light Company, and immediately TVA power was brought to the entire city and power rates have been reduced an average of 37.9 per cent.

The new Memphis and Arkansas Bridge, a gigantic project, was opened to traffic in January 1950. It is a four-lane highway bridge.

A valuable addition to industrial Memphis will be the Tennessee Chute Project, on which construction was started in 1948. This $18,000,000 project will provide a dam that will connect a large island in the river, just south of Memphis, to the mainland. This will give Memphis a deep, still-water harbor and 9,000 acres for industrial development on the new waterfront.

Port Facilities.—Memphis has a total of 7.88 miles of waterfront on the Mississippi and Wolf rivers. Memphis has municipally owned river terminals, including a package car terminal, carload terminal and river and rail grain elevators.

Civic Conditions.—The city is well laid out, and its further development is guided by a City Planning Commission. The wide, well-shaded and well-paved streets, the fine public and private buildings, the parks with numerous large trees, all make the city most attractive. Shelby County, in which Memphis is located, has 3,200 miles of paved and improved roads.

Memphis has 425 churches representing 28 denominations. Its superior educational advantages include the schools of pharmacy, dentistry and medicine of the University of Tennessee, Memphis State College, Southwestern University, the William R. Moore School of Technology, and the LeMoyne College for Negroes, University of Memphis Law School, Southern University College of Law, Southern College of Optometry, and Siena College. Its college preparatory schools include Christian Brothers College and St. Agnes Academy. Musical education is provided through the medium of the Memphis College of Music, the Memphis Conservatory of Music and numerous private studios. Memphis has 70 public schools including 11 senior high schools and nine junior high institutions. There are nine parochial schools, with an enrollment of 6,800. The public school enrollment is 46,947 pupils. Memphis has 10 public libraries, with a total of 264,864 volumes. Foremost of these are the Cossitt Library and the Goodwyn Institute Library, the latter being an endowed institution with an auditorium and lyceum lecture course.

Memphis is one of the foremost hospital cen-

ters of the South, having a total of 21 hospitals with 10,007 beds. Notable among these with Class A rating of the American Hospital Association, may be mentioned the Baptist Memorial, John Gaston Memorial Hospital, Methodist, St. Joseph's Crippled Adults and Crippled Children's hospitals. In addition to these, a United States Marine Hospital is located here as well as a United States Veterans' Hospital Facility No. 88. Memphis is provided with numerous clinics and private hospital institutions, and there are four sanitariums located just outside the city limits.

Local welfare institutions include the Anne Brinkley Home for Girls, the Mary Galloway Home for Aged Women, the Sunshine Home for Aged Men, the Tennessee Home for Incurables, and the Young Women's Christian Association and Young Men's Christian Association organizations. In addition, the city has three white orphanages and one colored orphanage.

The city has a municipal auditorium. The leading downtown clubs are the Catholic Club and the Rex Club. Other clubs are the University Club and the Nineteenth Century Club, the latter being a club for women. There are several country clubs, private and public golf courses operated by the Memphis Park Commission.

The city has been known as one of the cleanest cities in the United States for many years and has won national awards for its health and welfare work, and its noise-abatement campaigns.

Parks, Public Buildings, etc.—There are 41 improved parks with a total area of 1,421.58 acres. Two of the major parks are connected by a 12-mile boulevard or parkway encircling the city. The largest park is Riverside Park on the east side of the Mississippi River, just south of the city, containing 427 acres, much of which is left in its state of natural beauty. Next in point of size is Overton Park, one of the most beautiful parks of the South, located in the northeastern portion of the city and containing 355 acres. Within its boundaries are located the Memphis Zoological Garden, one of the finest in the nation, the Brooks Memorial Art Gallery, and the Open Air Theatre where some of the finest musical productions are performed each summer season. DeSoto Park is named for Hernando DeSoto, Spanish explorer. In this park near a great Indian mound, is a memorial, consisting of a ledge of rough granite with bronze tablets thereon, containing this inscription: "Near this spot Hernando De Soto discovered the Mississippi River in May 1541."

Russwood Park is the home of Memphis' Southern League baseball team, and E. H. Crump Stadium is the scene of outstanding college football games.

Recreational facilities are provided through 29 playgrounds, three swimming pools, seven community centers, 10 golf courses, 19 wading pools, 60 tennis courts, an athletic building for indoor sports, two stadiums and 12 baseball diamonds. The Park Commission has 100 persons on its recreational and playground staff. Of the 12 baseball diamonds, seven are equipped for night softball games, attracting approximately 300,000 per year.

Memphis has many fine buildings including the Custom House and Federal Building, the Shelby County Court House, the Criminal Courts Building and the Central Police Station, all of which are the finest examples of architecture. The city enjoys the distinction of having the largest artesian water system in the world, obtaining its city supply from an inexhaustible vein which runs as far as the Cumberland mountains in Tennessee. The waterworks are municipally owned and operated, with a capacity of 105,000,000 gallons per day and with 906 miles of mains.

Modern sanitation methods obtain in its sewer system and $2,000,000 was expended in 1938 for improvements. Shelby County, in which Memphis is located, has one of the finest county hospitals in the United States which provides care for the indigent, sick and aged. Its Penal Farm is a modern institution in point of splendid facilities and methods employed. The Pink Palace Museum houses an attractive and extensive exhibit of mechanical arts. Memphis is the home of the Cotton Carnival, a week-long festival held each May, when the city honors "King Cotton" and his colorful court.

The Memphis Little Theatre presents a season of plays each winter, and the Memphis Auditorium books many famous persons from the theatrical world.

In writing of Memphis, one must not overlook Beale Street (or Avenue), where W. C. Handy wrote his immortal "Blues" songs. Modern Beale Street is now a far cry from the sinful street of the past—today it is a well-behaved, neon-lighted shopping district for Memphis' Negroes, but it is still a colorful and interesting street.

History.—The history of Memphis begins almost with the history of the United States. It was a landing and tenting place for the early explorers and missionaries. It was the home of the Chickasaw Indians, and the bluffs on which the city is located, 40 feet above high water and 80 feet above low water, have always been known as the Chickasaw Bluffs. Perhaps the first industry in America was established here in 1541 when DeSoto and his band of followers erected a shipyard for the construction of barges and piragues with which to cross the Mississippi River, then seven miles in width. In 1698 the French built forts on the site of what is now the city, and in 1794 the Spaniards erected forts at a time when Spain was claiming exclusive right to the lower Mississippi. Some of the foremost men in the United States owned lands in this vicinity and were interested in holding for their own country a right to free navigation on the Mississippi to the Gulf. Andrew Jackson, James Winchester and John Overton sent to Memphis in 1819 a small colony who established the first permanent settlement. In 1826 there were 500 persons in the settlement which was then incorporated as a town, and in 1849 a city charter was granted. The Union and Confederate forces tried to gain possession of the city at the beginning of the Civil War. On June 6, 1862 a Federal fleet under Commodore C. H. Davis conquered a Confederate fleet under Commodore J. E. Montgomery, thus placing Memphis in possession of the Union forces. General N. B. Forrest in command of Confederate forces entered the city in August 1864 and took several hundred prisoners. Memphis has always progressed commercially except during the Civil War, and when visited formerly by yellow fever epidemics. The great growth industrially has come within the last three decades. Its location has made the city a great railroad center; the surrounding forests made it a great industrial center; and the alluvial lands of the Saint Francis Basin, Yazoo Delta and the Valley of the Mississippi River will al-

ways make it a great commercial center. In 1855 yellow fever attacked the city, and again in 1867, 1873, 1878 and 1879. The epidemics of 1878 and 1879 so paralyzed the industries of the city that in 1879 Memphis was unable to liquidate the current indebtedness and the charter of the city was revoked. The former city was designated by the state legislature as "the taxing district of Shelby County." The control of the district was vested in a board of public works composed of five members, and a governing council composed of three commissioners. The council instituted the sewerage system, which practically eliminated the recurrence of yellow fever, improved civic conditions, liquidated the debts and in 1891 the place was reincorporated and again chartered as a city.

Population.—The growth of the city may be seen from the federal census reports. Pop. (1920) 162,351; (1930) 253,143; (1940) 292,942; (1950) 396,000. Only 1.5 per cent of Memphis' population is foreign born and 41.4 per cent is colored.

Consult Davis, J. D., *History of Memphis and the Old Times Papers* (Memphis 1873), most valuable for period prior to 1850; Williams, S. C., *Beginnings of West Tennessee, 1541–1841* (Johnson City 1930), objective; excellent background; Abernethy, T. P., *From Frontier to Plantation in Tennessee* (Chapel Hill 1932), best history, but ends in 1860; Hamer, P. M., *History of Tennessee*, 3 vols. (New York 1933), covers entire period; Capers, Jr., G. M., *The Biography of a River Town; Memphis: Its Heroic Age* (Chapel Hill 1939), excellent bibliography of primary and secondary sources, pages 269-279.

MEMPHIS (Tenn.), **Capture of.** At dusk June 5, 1862 the Union flotilla under command of Commodore C. H. Davis appeared near Memphis and anchored two miles above the city. The Confederate flotilla, Commodore J. E. Montgomery commanding, was lying at the Memphis levee. At daylight the Union fleet began to drop down toward the city, and the Confederates advanced to meet it. There were no troops protecting the city. The flotillas were composed of the following vessels:

Union	Guns	Confederate	Guns
Benton	16	Little Rebel	2
Louisville	13	Bragg	3
Carondelet	13	Beauregard	4
Cairo	13	Price	4
Saint Louis	13	Sumter	3
Queen of the West	ram	Lovell	4
Switzerland	ram	Thompson	4
Monarch	ram	Van Dorn	4
Lancaster	ram		28
	68		

Besides having more than twice the number of guns, the Union ordnance was much superior to that of the Confederates. The latter, however, made a desperate fight, which finally ended 10 miles below the city, with the result that the *Lovell, Beauregard* and *Thompson* were destroyed; and the *Little Rebel, Price, Sumter* and *Bragg* captured. The *Van Dorn* escaped. On the Union side only the *Queen of the West* was disabled.

Immediately after the fight the mayor, in reply to a summons to surrender, informed Commodore Davis that there were no troops with which to oppose him. The next morning detachments from troops under Col. C. N. Fitch, which accompanied the fleet, landed and took possession of the city.

General Grant arrived at Memphis June 23 and established the headquarters of the District of West Tennessee. He was recalled to Corinth July 15 and General Sherman was ordered to Memphis, reaching the city July 21. He restored the mayor and the city government, and made them responsible for civil order. He continued in command at Memphis until his forces left to joint General Grant in the final campaign for Vicksburg, having previously participated in the first move against that city.

The raid of Gen. N. B. Forrest, of Confederate cavalry fame, into Memphis occurred Aug. 21, 1864. The Union forces and commanding officers were completely surprised and barely escaped capture. Gen. C. C. Washburn, in command of the District of West Tennessee; Gen. R. P. Buckland of the District of Memphis, and Gen. S. A. Hurlbut were asleep in the city. General Forrest left the vicinity of Oxford August 18, with three brigades, making a forced march of nearly 100 miles. A strong detachment rode into the city at 4 o'clock in the morning, running over a regiment of 100-days men on picket, and capturing about 250 of them. This force divided into three and at once surrounded the quarters of the three officers named. Each, however, escaped.

MEMPHIS, city, Texas, in Hall County, altitude 2,067 feet, on the Fort Worth and Denver City Railroad, 85 miles southeast of Amarilla. Cotton processing is its principal industry. Pop. (1940) 3,869; (1950) 3,810.

MEMPHREMAGOG, mĕm-frē-mā'gŏg, **Lake,** in the southern part of the province of Quebec, Canada, extending into Orleans County, in Vermont. It is about 30 miles long, north and south, and from one to four miles wide. It is irregular in shape, and along its shores are several striking indentations, in some places low and in some other parts high and rocky. The land on the west shore is mountainous, the altitude of the highest points being about 2,800 feet. The outlet is the Magog River, which flows into the St. Francis River. Along the shore are a number of villages, and in summer a steamer plies daily on the lake, connecting the chief towns and villages.

MENA, mā'nä, **Juan de,** Spanish poet: b. Cordova, Spain, about 1411; d. Torrelaguna, 1456. He was educated at Salamanca and at Rome and afterward was appointed secretary and court historian to John II, king of Castile. His allegorical poems, *Coplas de los Siete Pecados Mortãles, Le Coronacion,* and *El Laberinto de Fortuna,* a poem founded on the *Divina Commedia* and published in the year 1496, all show the influence of Dante, for whom he held great respect and admiration. His collected works were published in 1528, entitled *Copilación de todas las obras de Juan de Mena.*

MENA, city, Arkansas, and Polk County seat; altitude 1,145 feet; 86 miles south of Fort Smith; on the Kansas City Southern Railroad. It is in a summer resort region of the Ouachita Mountains, is a shipping point for lumber, and the business center of a farm and dairy area raising truck crops, corn, peanuts, soybeans, berries and poultry. It has bottling works, flour mills, and manufactures of cream cheese, finished lumber. window sashes and doors, furniture,

wooden handles, slate roofing, headings and staves. Pop. (1940) 3,510; (1950) 4,445.

MENABREA, mā-nä-brâ'ä, Count **Luigi Federigo,** Italian soldier and statesman: b. Chambéry, in Savoy, Sept. 4, 1809; d. there, May 25, 1896. After completing a course in mathematics at the University of Turin and joining the engineers in the Sardinian army, he accepted the professorship of technical science at the military academy and at the University of Turin. Having been promoted to the rank of captain, he was used in the diplomatic corps for some time; was then elected deputy, serving both under the minister of war and the minister of the interior; and upon the outbreak of the war of Sardinia and France against Austria in 1859 he was appointed chief of the engineer corps. After Savoy was ceded to France, Menabrea was made a senator by Victor Emmanuel, and chief of the department of engineers, and as such planned the fortifications of Bologna, Piacenza and Pavia; in 1860 he was created a lieutenant-general, in that year laying siege to and after three months of fighting taking Gaeta. In 1861 he joined the Cabinet of Ricasoli as minister of marine; in 1862 he took over the portfolio of minister of public works. In 1866 he was Italian ambassador to the council which brought about the Treaty of Prague and ceded Venice to Italy. In 1867, when Rattazzi resigned, he formed a new ministry, himself becoming minister of foreign affairs. As premier he did much to place Italy in cordial relations with the outside world, and to settle internal dissensions, but his imprisonment of Garibaldi and the prevalent financial straits of the nation lost to him the confidence of the House of Deputies, and on Nov. 16, 1869 he resigned. In 1870 he became Italian ambassador at Vienna, was appointed to the same post at London in 1876 and in 1882 went to Paris, where he was stationed for 10 years.

The most important of his works are *Etudes sur la série de Lagrange* (1844–1847); *Le génie italien dans la campagne d'Ancone et de la Basse-Italie* (1866), and *République et Monarchie dans l'état actuel de la France* (1871).

MENAGE, mā-näzh', **Gilles,** French philologist and satirist: b. Angers, Aug. 15, 1613; d. Paris, July 23, 1692. After completing his early studies he became an advocate, practicing for some time at Paris, but, having conceived a profound disgust for that profession and all its adherents, he became an ecclesiastic, and for some time was a member of the household of the Cardinal de Retz, but subsequently took up his residence in the cloister of Notre Dame. A witty satire, entitled *Requéste des Dictionnaires,* published in 1638, and aimed at the *Dictionary* of the French Academy, prevented his becoming a member of that society.

His most important works are *Dictionnaire étymologique, ou Origines de la Langue Française* (1650–1694); *Origines de la Langue Italienne* (1669); *Miscellanea* (1652); *Poemata latina, gallica, graeca, et italica* (1656); *l'Anti-Baillet* (1690).

MENAGERIE, mē-näj'ĕr-ĭ, a collection of wild animals, exhibited in zoological gardens, in museums and by circus companies traveling from city to city. The term is now confined almost wholly to a collection exhibited in connection with a traveling circus, a permanent collection being styled a zoological park or "zoo." The menagerie of the typical circus is usually shown in a separate tent, so arranged that the public can make the round of the cages before taking their seats. The principal exhibits are usually elephants, a giraffe (when one is to be had), hippopotamus, rhinoceros, tapir, lions, tigers, bears, leopards (and others of the cat family), lynx, kangaroo, varieties of deer, monkeys, a few cages of snakes, and minor animals. See also Circus; Zoological Gardens.

MENAI STRAIT or **STRAITS,** mĕn'ī, the channel between Wales and Anglesey Island, is 14 miles long, and varies in width from 200 yards to ¾ mile. Menai Suspension Bridge and the celebrated Britannia Tubular Bridge connect Anglesey with the mainland. The tides and current are very strong at times, so that large vessels avoid the strait. See also Bridge.

MENAM, mă-näm', **MEINAM, MAE NAM, ME NAM, CHAO PHRAYA,** or **CHAO PHYA,** a chief river of Thailand, rising in the Laos country, and flowing generally southward to enter the Gulf of Siam below Bangkok. Its length is about 750 miles, although strictly the name applies only to the 160-mile lower course which begins at the junction of the Ping and Nan rivers. It is navigable for small craft. It is subject to periodical overflows on which the crops of the rice fields along its banks are dependent.

MENANDER, the name of two Greek writers:

Menander, the comic dramatist: b. Athens, 343? B.C.; d. there, ?291 B.C. He was the pupil of Theophrastus, himself the pupil and successor of Aristotle as head of the Peripatetics, and author of *Characteres,* a somewhat more literary and popular enlargement of some ruling ideas of the Nicomachaean Ethics; he was by such a teacher well trained for his dramatic vocation. He was, moreover, a friend of Epicurus from early life, and may thus have been imbued with that bonhommie which rendered him so genial an interpreter of manners. He wrote a hundred comedies which are distinguished from those of Aristophanes by their refinement, their freedom from personal and political virulence, and their graceful, sometimes beautiful, delineation of feminine character. He was, however, outrivaled in popular favor by his contemporary Philemon, whose ribaldry was irresistible to the Athenian playgoers. Only some fragments of his works survive in the original, the most important of these relics having come to light in Egypt (1898). He was, however, closely imitated by Plautus and Terence, and in the *Bacchides, Stichus* and *Poenulus* of the former, and the *Andria, Eunuchus, Heautontimorumenos* and *Adelphi* of the latter we have very good representatives of the Greek dramatist's method and spirit. A fine antique statue of Menander is to be seen in the Vatican.

Menander, a rhetorician who flourished in the latter half of the 3d century B.C. He has left the rhetorical treatise *De Encomiis,* and from his analyses of the orations of Demosthenes, most of the scholia on that orator have been compiled.

Consult (on Menander the dramatist), Guizot, *Ménandre* (1855); Horkel, *Lebensweisheit des Komikers Menander* (1857); (on Menander the rhetorician), Ritschl,

Der Rhetor Menander und die Scholien zu Demosthenes (1883).

MENARD, mā-nàr′, **Michel Branamour,** American pioneer: b. Laprairie, Lower Canada, Dec. 5, 1805; d. Galveston, Texas, Sept. 2, 1856. He was of French parentage, and after working some time for a Detroit fur-trading company entered the service of his uncle, also a fur trader, in Missouri. The Shawnees made him their chief, and he acquired great power among various Indian tribes. Soon after 1830 he went to Texas, where he continued fur-trading with the Indians, and also dealt with Mexicans. When the Texans revolted against Mexico he held the Indians in check and kept them from acting against the insurgents. As a member of the convention at which the Texans declared their independence, and afterward of the Congress of Texas, he exerted an influence in the formation of that state. The greater part of the site of Galveston was included in a purchase made by him in 1836, and of that city he, more than any other man, is to be considered the founder.

MENASHA, mē-năsh′ä, city, Wisconsin, and resort in Winnebago County; altitude 755 feet; on the navigable Fox River, at Lake Winnebago; 93 miles northwest of Milwaukee; on the Soo Line; Chicago and North Western; and Chicago, Milwaukee, St. Paul and Pacific railroads; immediately adjacent to Neenah with which it forms a continuous community. It has a tannery, printing plants, boiler works and manufactures of paper, paper products, and paper mill machinery, woodenware, pulleys, pumps and wire.

Menasha and Neenah were settled in 1843 on land ceded to the United States government by the Menominee Indians in 1836. Menasha received a charter to develop the water power and became the industrial center. Doty Island in the river belongs partly to each city; on the Menasha side, the site of Nicolet's landing in 1634 is marked. Pop. (1940) 10,481; (1950) 12,385.

MENCIUS, měn′shĭ-ŭs, the Latinized name of MENG-TSE or MENG-TZU, Chinese philosopher and recluse: b. province of Shan-Tung, c.372 B.C.; d. there, c.289 B.C. He was educated by his mother with such success that the approbation contained in the phrase "the mother of Meng" has become proverbial. Mencius was one of the greatest of the early Confucians. During his time the governments of China were oppressive, and Mencius for many years wandered about in search of a prince who would consent to govern in accordance with true and just principles. Failing to find any such, he retired to his former seclusion and spent the rest of his life in perfecting his system and training disciples. His works contain some enlightened views on man and society. He believed in the moral nature of man and had unbounded faith in the possibilities of progress under a good social and political system. He regarded all governments as from God, but at the same time he believed in the responsibility of rulers to their people and the people's right to depose or even put to death unworthy rulers. In a nation the people are the most important element, second comes the government and third the monarch. The aim of a government, according to him, should be the happiness and education of the people, and any ruler who was content to leave his subjects in ignorance and misery deserved to be deposed. The teachings of Mencius were written out by his disciples in dialogue form, under the title *Book of Mencius* which has been translated into Latin and into English.

MENCKEN, H(enry) L(ouis), American journalist, editor, essayist, and critic: b. Baltimore, Md., Sept. 12, 1880. After attending Baltimore Polytechnic Institute he entered newspaper work in Baltimore in 1899, was editor of the *Evening Herald* by 1906, and then joined the *Sun,* on whose staff he remained for the balance of his newspaper years. In 1908 he also became literary critic for *The Smart Set,* a magazine he served from 1914 to 1923 as part owner and joint editor with George Jean Nathan. From 1924 to the end of 1933 he was editor of the *American Mercury,* which he and Nathan founded.

Through his essays and criticism, H. L. Mencken exerted a powerful influence on American intellectuals during the decade following World War I. As literary critic he helped liberate American literature from academic, moralistic, and other restraints and assisted in bringing popular approval to such writers as Theodore Dreiser. As social critic he issued bristling attacks on America's vaunted traditions and satirized its delusions and weaknesses, in particular the imperfections of democracy. Everywhere he hammered at entrenched provincialism, complacency, cultural sterility, and vulgarity, with a style vigorous in its command of irony and invective and in the adeptness, vividness, and distinct freshness of its vocabulary.

Among Mencken's most influential volumes were *Notes on Democracy* (1926) and *Prejudices* (six series: 1919, 1920, 1922, 1924, 1926, 1927), while his most enduring work has probably been *The American Language* (1919; last of four revisions, 1936), with its two *Supplements* (1945, 1948) constituting a popular yet scholastically sound and careful discussion of the English language in the United States. Other Mencken works include *The Philosophy of Friedrich Nietzsche* (1908); *A Book of Prefaces* (1917); *Selected Prejudices* (1927); *Treatise on the Gods* (1930); *Chrestomathy* (1949); and his autobiographical trilogy: *Happy Days, 1880–1892* (1940), *Newspaper Days, 1897–1906* (1941), and *Heathen Days, 1890–1936* (1943).

MENDAITES. See NAZARENES.

MENDEANS. See NAZARENES.

MENDEL, měn′dĕl, **Gregor Johann,** abbot of Brünn, now known as the discoverer of the law named after him (see HEREDITY): b. Heinzendorf bei Adrau, Austrian Silesia, July 22, 1822; d. Brünn, Jan. 6, 1884. In 1843 he entered the Königinkloster, an Augustinian foundation in Altbrünn, as a novice; and was ordained priest in 1847. From 1851 to 1853 he studied natural science at Vienna; and, on his return to the cloister, taught in the Realschule. About 1869 he became abbot of Brünn; and later took part in the Ultramontane movement. It was in 1854 that he began those experiments, on *Pisum,* in the cloister gardens, that, after the lapse of half a century, have brought him posthumous fame. In 1865 he contributed his now memorable paper, *Versuche über Pflanzenhybriden,* to the Society of Naturalists of Brünn; and, in 1869, another, on *Hieracium* hybrids. After 1869 he seems to have discontinued his work in hybridizing, and died unrecognized by science. This seems inexplicable, as his researches were of a nature to commend them to his studious contemporaries, among them Darwin, who entirely missed his

contribution, even though the Brünn society exchanged with the Royal Society of London. But Mendel had the satisfaction of realizing that he had established a law in heredity as to the numerical ratios of the types developed in hybridizing — the grand fact for which we now prize his unobtrusive labors. His theories have given us the word Mendelism. He called himself a student of Kollar; and for some time he was president of the Brünn society. Since the verification of his experiments, simultaneously, in 1900, by De Vries, in Holland, Correns, in Germany, and Tschermak, in Austria, and of the translation of his paper appearing in the 'Journal of the Royal Horticultural Society of England' (1901), the literature has been full of "Mendel's Law." Consult Bateson, W., 'Mendel's Principles of Heredity' (Cambridge 1902).

MENDELEEV, myĕn-dyĭ-lyā'yĕf, **Dmitri Ivanovich,** Russian chemist: b. Tobolsk, Siberia, 7 Feb. 1834; d. St. Petersburg, 2 Feb. 1907. He studied at the Institute of Pedagogy, St. Petersburg, where he gave attention to natural science; in 1856 became docent at the University of Saint Petersburg; was at Heidelberg in 1859–61, where he published his monograph 'On the Capillarity of Gases,' soon followed by 'Organic Chemistry.' In 1863 he became professor of chemistry at the Saint Petersburg Institute of Technology, and in 1866 was appointed to a similar professorship in the University of Saint Petersburg. The results of his researches on the compression of gases, which he closely pursued from 1871 to 1875, were set forth in his work 'On the Elasticity of Gases.' He was commissioned in 1876 to report upon the petroleum industry in the Caucasus regions and in Pennsylvania. His 'Aqueous Solutions' (1886), a work on experimental chemistry, has taken its place among the most important contributions to that branch of science. In 1890 his 'Tariff Elucidated' presented the protectionist views of which he had already become a well-known advocate, and which, as a member of the Council of Commerce and Industries, he actively propagated. When the Chamber of Weights and Measures was established by the Department of Finance, in 1893, he was appointed conservator of the weights and measures. His proof of the periodic law (q.v.), first presented in 'Elements of Chemistry' (1868–70), is his crowning achievement in pure science. Consult Thorpe, 'Essays in Historical Chemistry' (1894).

MENDEL'S LAW, the law of heredity discovered by Johann Gregor Mendel (q.v.) and first published in 1865 under the title "Versuche über Pflanzenhydriden" in the *Proceedings* of the Society of Natural History of Brünn, Austria. Mendel made prolonged experiments in crossing varieties of the pea (*Pisum sativum*). His paper was overlooked until attention to his remarkable results was called by De Vries in 1900; he and also Correns and Tschermak at the same time independently rediscovered Mendel's law. Mendel selected seven pairs of characters, such as the shape of the ripe seed, of the cotyledons, of the seed-pod, color of the seed-skin, length of stem, etc. Large numbers of crosses were made between peas differing in respect of one of each of these pairs of characters. It was found, says Bateson, that in each case the offspring of the cross exhibited the character of one of the parents in almost undiminished intensity, and intermediates which could not be at once referred to one or other of the parental forms were not found. "In the case of each pair of characters there is thus one which in the first cross prevails to the exclusion of the other." This prevailing character Mendel called the dominant character, and to the other he gave the name of recessive character.

This law of dominance has been found by Bateson and by Castle to apply to animals as well as plants, and thus is a most important biological law. Thus when mating occurs between two organisms, whether vegetable or animal, differing in some character, the offspring frequently all exhibit the character of one parent only, in which case that character is said to be "dominant." For example, on crossing white mice with gray mice, Castle found that the offspring are gray, that color-character being dominant. The character which is not seen in the immediate offspring is called recessive, for though unseen it is still present in the young, white in the experiment being the recessive color.

The law of dominance has its exceptions; the hybrid often possesses a character of its own, instead of the pure character of one parent, as is true in cases of complete dominance. The hybrid form often resembles a supposed ancestral condition, when it is usually regarded as a reversion. Examples are the gray hybrid mice, which are indistinguishable in appearance from the house mouse; also slate-colored pigeons resulting from crossing white with buff pigeons.

One result of Mendel's discovery is the purity of the germ-cells. As stated by Castle: "The hybrid, whatever its own character, produces ripe germ-cells which bear only the pure character of one parent or the other." To breeders Mendel's law is of great importance because, as remarked by Castle, it reduces to an exact science the art of breeding in the case most carefully studied by him, that of entire dominance. "No animal or plant is 'pure' simply because it is descended from a long line of ancestors possessing a desired combination of characters, but any animal is pure if it produces gametes (germ-cells) of only one sort, even though its grandparents may among themselves have possessed opposite characters."

The bearings of Mendel's discovery, confirmed by De Vries' experiments, on the origin of species are most important. The problem is whether aberrations, sports or discontinuous variations may not sometimes result in the formation of new species and types, or whether species are all the result of slow, continuous variations. As stated by Castle, "A sport having once arisen affecting some one character of a species, may by crossing with the parent form be the cause of no end of disintegration on the part of any or all of the characters of the species, and the disintegrated characters may, indeed must, form a great variety of new combinations of characters, some of which will prove stable and self-perpetuating.

Mendel's discoveries also explain the principle that new types of organisms are extremely

variable, whereas old types are subject to little variation. A new type which has arisen as a sport will cross with the parent form. The offspring, says Castle, will then inherit some dominant character, others latent, and this will result in polymorphism of the race. Thus the suggestion of Galton that species may arise from sports is confirmed, while added cases are afforded by the recent remarkable experiments of De Vries, resulting in the origination of seven new species of primrose by sudden variations, or what he calls «mutations.» Consult Bateson, W., 'Mendel's Principles of Heredity' (Cambridge 1913); Castle, W. E., 'Mendel's Law of Heredity' (Cambridge 1903); Morgan, T. H., 'The Mechanism of Mendelian Heredity' (New York 1915). See HEREDITY.

MENDELSSOHN, Moses, měn'dĕls-sōn, German Jewish philosopher: b. Dessau, Germany, 6 Sept. 1729; d. Berlin, 4 Jan. 1786. His father, Mendel, a schoolmaster, though very poor, gave him a careful education. He lived several years on the charity of persons of his own religion, devoting his time to study, chiefly in Hebrew and Hebrew literature, but also in mathematics and modern languages. In 1750 he was appointed by a silk manufacturer named Bernhard, a Jew, tutor of his children. At a later period Bernhard took him as a partner in his business. In 1754 he became acquainted with Lessing, with whom he contracted a close intimacy, which had a great influence on his mind. Intellectual philosophy now became his chief study. His 'Briefe über die Empfindungen' were the first-fruit of his labors in this branch. Mendelssohn contributed to several of the first periodicals, and now and then appeared before the public with philosophical works, which brought him fame, not only in Germany, but also in foreign countries. The most celebrated of these is 'Phædon,' a treatise on the immortality of the soul, first published in 1767. It has been translated into most European languages. He established no new system, but was, nevertheless, one of the most profound and patient thinkers of his age, and the excellence of his character was enhanced by his modesty, uprightness and amiable disposition. He knew how to elude with delicacy the zealous efforts of Lavater to induce him to declare himself a Christian. To this encounter between Lavater and Mendelssohn German literature owes one of its greatest dramas, Lessing's 'Nathan der Weise,' in which the author, in the person of the hero, commemorates the virtues, the tolerant spirit and comprehensive mind of his friend Mendelssohn. His 'Jerusalem, oder über religiöse Macht und Judenthum' (1783) was much misunderstood, partly because he attacked many deep-rooted prejudices of his race. 'Morning Hours' (Morgenstunden) was published in 1785. The last work of Mendelssohn was in defense of his friend Lessing, of whom Jacobi had asserted that he was a Spinozist, was entitled 'Moses Mendelssohn und die Freunde Lessings' (1786). Consult Kayserling, 'Moses Mendelssohn' (1882).

MENDELSSOHN-BARTHOLDY, Jakob Ludwig Felix, German composer: b. Hamburg, 5 Feb. 1809; d. Leipzig, 4 Nov. 1847. The kindly influences which, like a halo, encircled the life of the illustrious man, are reflected in many of his best compositions. He was born in prosperity, reared in plenty and at nearly all times was surrounded by conditions conducive to success. It has been said that in no way was Mendelssohn's naturalness and naiveté more evident than in his constant reference to his own foibles; and further, that the hearty way in which he enjoyed idleness and boasted of it were delightful in a man who got through so much work, who was singularly temperate and whose only weakness for the products of the kitchen was for rice, milk and cherry pie. «I do not in the least concern myself,» said he, «as to what people wish or praise or pay for; but solely as to what I myself consider good.»

It is doubtful whether the history of any other great musician discloses so wide a combination of qualities. Some of his biographers have expressed the thought that his happy disposition prevented his work from attaining that degree of depth which it might have done had his genius been subjected to fiery trials. Be this as it may, the fact remains that among all the German composers there is not one who has enjoyed such universal popularity, certainly in America and England, as Mendelssohn. His oratorios, 'Saint Paul' and 'Elijah,' are sung everywhere, while his 'Hymn of Praise,' the 'Overture to the Hebrides,' his symphonies, sonatas, concert-overtures, settings for certain Psalms and 'Songs without Words' are familiar to all.

Seventy-two of Mendelssohn's numbered works were published before his death and 47 later, while 23 of his compositions, many of them including two or more pieces, had no «opus» numbers assigned to them. Six other of his published compositions have been recorded, while his unpublished pieces, mostly in autograph and principally composed before he was of age, are quite numerous, including 12 symphonies, several fugues, concertos, sonatas, studies, fantasias, etc.

Felix was the second child and eldest son of Abraham Mendelssohn, a Jewish banker of Hamburg, and Lea (or Leah) Salomon, a resident of Berlin, and a Jewish lady of considerable property and attainments, to whom he was married on 26 Dec. 1804. The grandfather of Felix was Moses Mendelssohn (q.v.), who settled in Berlin in 1762 and married Fromet, daughter of Abraham Gugenheim, of Hamburg. Moses' father was named Mendel, a poor Jewish schoolmaster of Dessau, on the Elbe. Thus the name Mendelssohn (son of Mendel) simply perpetuates the Oriental method of name-making.

When not three years old Felix was taken to Berlin, and five years later (1816) his father took him and his sister Fanny, four years the senior of Felix, to Paris on a business trip. While there they both received lessons on the piano from Madame Bigot, but it was not till after their return to Berlin that their systematic education commenced. Ludwig Berger became their piano instructor and Zelter taught them thorough-bass and composition. In 1824 Moscheles became acquainted with the family, and while he declined to accept Felix as a pupil consented to offer him suggestions and advice. In the same year Spohr visited Berlin and renewed his friendship with the family, which had been formed at Cassel in the summer of 1822 where the family had gone for

the purpose of introducing Felix to him. In his eighth year Felix played the piano with remarkable ability, and about a year later (1818) he made his first formal public appearance. This was at a concert given by Joseph Gugel, a virtuoso on the horn. At 11 he joined the Singakademie as an alto. In 1820 Felix commenced systematic work as a composer, although before that time he had written from 50 to 60 complete movements. The earliest date of which a dated autograph is preserved was attached to a cantata entitled 'In rührend feierlichen Tönen,' which he completed on 13 January of that year.

The following year was eventful. He composed five symphonies, nine fugues, several pieces for the piano, two operettas and a number of songs. It was in this year, too, that he visited Goethe at Weimar. The poet was delighted with his talent. While at Weimar he played before the Grand Duke and Duchess and improvised before the court and also before Hummel. His compositions in 1822 were very numerous, and during this and the following year he wrote six symphonies, five concertos, a piano quartet, a violin sonata, a Magnificat and Gloria, and an opera in three acts, entitled 'Die beiden Neffen, oder der Onkel aus Boston.' On 31 March he played for the second time in public, at Aloys Schmitt's concert, taking part in a duo for two pianos, and again, on 5 December, he played at a concert given by Madame Milder-Hauptmann, when he gave one of his own concertos. It was probably in this year, too, that the practice of having informal musical performances on alternate Sunday mornings at the Mendelssohn home was begun. Felix directed, his sister Fanny presided at the piano, his younger brother, Paul, played on the cello, and his second sister, Rebecca, sang.

In 1824 his musical genius showed marked advance, as evidenced in his symphony in C minor, composed between 3 and 31 March. In the summer he was taken to Doberan on the Baltic, a seaside resort, and there received the impressions which later found expression in his 'Meeresstille Ouverture.' His wonderful power of extemporizing and his readiness to play the music of other composers are noteworthy features, and Hiller, who was with him in Frankfort in 1825, was carried away with his performances. In this year he met Cherubini in Paris, whither he accompanied his father on a visit. Toward the end of 1825 Mendelssohn's father purchased a large mansion, surrounded by spacious grounds, and under the influence of this charming home he became more and more devoted to his work. The beauties of Shakespeare were here unfolded to him. Felix was especially charmed with the 'Midsummer Night's Dream,' and probably then conceived the idea of the exquisite composition bearing that name which forms opus 61 and was first produced in Potsdam 14 Oct. 1843. The overture to a 'Midsummer Night's Dream' appeared earlier, and as a piano duet, its first public performance being given at Stettin in February 1827. Either during this or the previous year, Felix entered the University of Berlin, where he showed evidences of decided literary powers. On his return from Stettin he made preparations for his opera 'Die Hochzeit des Camacho,' but owing to the opposition of the director, Spontini, it was performed only once at that time, although, strange to relate, a complete performance of it was given at Boston, Mass., on 19 March 1855.

The principal compositions during 1828 were a cantata for the Tercentenary Festival of Albrecht Dürer, a cantata for a Congress of Science, an antiphona for four voices, and a concert overture. He also completed his overture to Goethe's 'Calm Sea and Prosperous Voyage.' During this year he organized a choir of 16 voices for practising Bach's Passion music. The year 1829 was an important one for Felix. Hitherto his father had not permitted him to regard himself as a professional musician, but this now being determined on, arrangements were made for him to visit some of the great capitals, with a view of gaining materials for his greatest works. His first journey was to England, where he arrived on 21 April 1829. He was received with much enthusiasm and also scored a success in society. His delightful manners and unfailing animation charmed every one. In November he was again in Berlin, and during the winter he completed the 'Reformation Symphony' for the Tercentenary Festival of the Augsburg Confession. He declined the professorship of music in the university, preferring to carry out the program which his father had mapped out for him. In May 1830 he visited Weimar, where he again met Goethe, afterward going to Munich, and later to Italy. Preparations for his return began in June 1831, and after visiting many cities he arrived in Munich where his concerto in G minor was performed for the first time on 17 October.

Another visit to London was made in the spring of 1832, during which he composed with unabated vigor. Among the more important productions of this time were his musical representation of Goethe's 'Walpurgis Night,' and the 'Fingal Overture,' which was finished in Rome. Again in Berlin in July 1832, he gave several concerts, producing the 'Walpurgis Night' at one of them. His time was fully occupied in composing, playing and conducting. His 'Italian' symphony was completed in March 1833, and sent to London where it was produced on 13 May under his personal direction. Later in the month, we find him conducting the Lower Rhine festival in Düsseldorf, where, as a result of his success, he was engaged as director of "all the public and private establishments of the town" for three years with a salary of 600 thalers. He resigned, however, during the second year to accept the position of conductor of the famous Gewandhaus Concerts at Leipzig, then considered the highest position in the musical world of Germany. Thither he proceeded in August 1835, to make arrangements for the season which began on the 4th of October following. Seven concerts were given between that date and 20 November, when he was shocked by the news of his father's death which had occurred the day before. For the first time his radiant disposition forsook him and he fell into a despondent mood. During this season of sadness, however, he was able to finish the oratorio of 'Saint Paul' while he also maintained the excellence of the concerts for which he was responsible. The great oratorio was first produced at the Lower Rhine Festival at Düsseldorf 22 May

1836. About this time he took charge of the Frankfort Cäcilien-Verein during the illness of the director, and there made the friendship of Madame Jean-Renaud and her family. He became devotedly attached to her youngest daughter, Cécile, to whom he was married on 28 March 1837. Returning to Leipzig he conducted another successful season, closing with a performance of 'Saint Paul,' for the first time produced in that city. In August 1837, he left his bride for the purpose of conducting 'Saint Paul' at the Birmingham Festival. This was his fifth journey to England, and before he returned he held conferences with his friend, Klingermann, over the plan of a new oratorio having the prophet Elijah as the central figure. He reached Leipzig on 1 October in time to conduct the first concert of the Gewandhaus on the same evening.

The year 1839 was notable for the composition of the 'Ruy Blas' overture for the Leipzig Theatre and the setting of the 114th Psalm to music. In the following year the invention of printing was celebrated in Leipzig by a festival, and the 'Festgesang,' for men's voices, and 'Lobgesang,' or 'Hymn of Praise,' were composed for the occasion. During this year Mendelssohn accepted the direction of the musical department of the Berlin National Academy of Arts, but before entering his duties he made another visit to Birmingham to conduct a performance of the 'Hymn of Praise.' On his return he was installed as General-Musik-Director in Berlin, but having the privilege of living where he pleased, he returned to Leipzig. About this time he composed the music for the 'Antigone' and 'Œdipus Coloneus' of Sophocles, Racine's 'Athalie' and Shakespeare's 'Tempest' and 'Midsummer Night's Dream.'

Another sad trial now befell him in the death of his mother, 12 Dec. 1842, and in November of the following year he removed to Berlin. The king of Saxony had recently established a conservatory of music, a plan which Mendelssohn had long cherished, and he and Schumann were appointed professors of composition and the piano. Meanwhile the Gewandhaus concerts were left in charge of Hiller. In 1844 he visited London for the eighth time in response to an invitation to direct several concerts of the London Philharmonic Society. In October he resigned his position as General-Musik-Director in Berlin and took a much-needed rest until the autumn of 1845 when he again assumed charge of the Gewandhaus orchestra.

Early in 1846 he was back in Leipzig where he took charge of two classes in piano and composition, and among his pupils were Goldschmidt, De Sentis, Tausch and others. The season of 1845–46 was unusually brilliant in concert work and the program showed a great breadth of selection. At the eighth concert he brought with him Jenny Lind, who was then heard for the first time in Leipzig. On 5 Aug. 1846, a preliminary rehearsal of 'Elijah' was held in Leipzig and soon after he started for England on his ninth visit, the complete score having been sent over a month earlier for translation. First there was a rehearsal with piano accompaniment at Moscheles' house, followed by two full rehearsals at the Hanover Square Rooms, and later by rehearsals in Birmingham, where on 26 August the oratorio was performed for the first time in public. One of his biographers states that "there was a mad rush at the close of the performance to grasp the hand of the hero of the day, who thanked all present for their share in the performance with which he was so deeply gratified." Returning to Leipzig he remodeled the oratorio, however, making so many changes that scarcely a movement stands to-day as it was originally written. The complete edition was published in July 1847. The Sacred Harmonic Society of London now invited Mendelssohn to give a production of 'Elijah' in its revised form in Exeter Hall, and for the tenth and last time he visited London in April 1847. Four performances were given, Queen Victoria and the Prince Consort being present at the second of the series. After giving other productions of the 'Elijah' in Manchester and Birmingham, followed by a performance with the Philharmonic Society, he returned to Frankfort, weary and utterly worn out. To add to his now unhappy condition, his sister Fanny, whom he had loved devotedly, was stricken with paralysis and died 14 May 1847. On hearing the sad news he fell fainting and for several weeks was utterly prostrated. Seeking diversion, he revisited Switzerland during the summer, where, it is said, he applied himself to water-color painting and made excellent progress in that direction. Later he resumed composition, numbering among his productions at that time the beautiful quartet in F minor (Opus 80), and he also wrote some parts of a newly commenced oratorio, 'Christus,' which he left unfinished. He returned to Leipzig in September, but attempted nothing serious in a musical way. His spirit was broken and he dreaded to appear in public. The beginning of the end came on 9 October while calling on Madame Frege, whom he was accompanying in his last set of songs. She left the room to order lights, says one of his biographers, and on her return found him shivering and suffering violent pains in the head. He rallied somewhat, but another relapse occurred on 3 November and he never spoke again. He died the following day and on Sunday, the 7th, was borne to the Paulinen-Kirche, preceded by a band playing one of his 'Lieder ohne Worte' (Book V, No. 3), which Moscheles had scored for the occasion. Thence the coffin was taken to the Alte Dreifaltigkeits-Kirchhof in Berlin, where it was deposited in its last resting place.

A cross on the grave bears this inscription: "Jakob Ludwig Felix Mendelssohn-Bartholdy: geboren zu Hamburg, am 3 Feb. 1809; gestorben zu Leipzig am 4 Nov. 1847."

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Official United States National Museum until 1917. Bibliography brought to date by Americana Editorial Staff.

MENDENHALL, mĕn'dĕn-hôl, **Thomas Corwin,** American physicist; b. near Hanovertown, Ohio, Oct. 4, 1841; d. Ravenna, Ohio, March 23, 1924. He was educated in the public schools and by his own efforts obtained a knowledge of physics and higher mathematics. In 1873 he became professor of physics and mechanics in the Ohio University, where he remained until 1878, when he accepted a call to the chair of physics at the Imperial University in Tokio, Japan. There he founded a laboratory, an observatory, a scientific society, inaugurated a system of lectures, which work was highly approved by the Japanese government. In 1881 he returned to the Ohio University, and in 1884 accepted a position in the Signal Service at Washington. In 1886 he was elected president of the Rose Polytechnic Institute, but resigned in 1889 to become superintendent of the United States Coast and Geodetic Survey, and from 1894–1901 was president of the Worcester Polytechnic Institute. He published several scientific papers and a book entitled *A Century of Electricity* (1887).

MENDENHALL, Walter Curran, American geologist: b. Marlboro, Stark County, Ohio, Feb. 20, 1871. In 1895 he was graduated at Ohio Normal University; studied at Harvard in 1896–1897 and at Heidelberg, Germany, in 1899–1900. In 1894–1896 he was geologic aid, in 1896–1901 assistant geologist and from 1901 until his retirement in 1944, he was chief geologist of the United States Geological Survey. He had charge of the ground-water investigations of the survey in 1907–1910, from 1910 until 1922 served as chief of the Land Classification Board when he became chief geologist. He is the author of various memoirs and articles on professional topics.

MENDERES, mĕn-dĕ-rĕs', the ancient Maeander (q.v.), a river of western Turkey in Asia. Rising in the mountains west of Afyon Karahisar, it flows southwest and west for more than 200 miles, emptying in the Aegean Sea south of the island of Samos. Another river in Asiatic Turkey, likewise called the Menderes, is the ancient Scamander (q.v.) which rises in Kazdagi (Mount Ida) and flowing west and northwest for about 60 miles, after crossing the plains of Troy, debouches in the Dardanelles at Kumkale near the Aegean entrance.

MENDES, măn-dĕs', **Catulle,** (in full ABRAHAM CATULLE MENDES), French writer: b. Bordeaux, May 22, 1841; d. Paris, Feb. 8, 1909. His verse is marked by extreme devotion to form. He also wrote a great deal of prose—short stories, longer works of fiction, dramas. There is much affectation about them all.

Among his books are *Poésies* (1878); *Monstres Parisiens* (1882); *La Rose et le Noir* (1885); *Grande Maguet* (1888). Of his plays may be cited *Le Capitaine Fracasse* (1872) and *Fiamette* (1889).

MENDES LEAL DA SILVA, măn'dāsh lā-äl' dä sĕl'vä, **José,** Portuguese statesman and poet: b. Lisbon, Oct. 18, 1818; d. Cintra, Aug. 14, 1886. He was minister of the navy and of foreign affairs; ambassador to France, 1874–1883; and to Spain, 1883–1886. His vogue as a poet has been very great in his own country and his *Songs* (*Canticos*) were first collected in 1858. He wrote also a large number of plays, some of them very popular on the Portuguese stage as *Uncle Andrew from Brazil;* and *The Sportsman;* and also several romances. He became a member of the Portuguese Academy in 1845.

MENDEZ-PINTO, măn'dāsh pēn'too, **Fernao,** or **Fernam,** Portuguese traveler: b. Montemor-o-Velho, near Coimbra, Portugal, about 1510; d. Almada, near Lisbon, Portugal, July 8, 1583. He departed for the Indies in 1537, returning in 1558, and after his death a very curious account of his voyages, *Perigrinação de Fernam Mendez-Pinto,* appeared (1614), which was translated into French, English and other European tongues. Congreve, in his *Love for Love,* called him "a liar of the first magnitude," and from that time his narrative was considered as a romance; but his good faith and veracity are now generally admitted.

MENDIBURU, măn-dē-bōō'rōō, **Manuel de,** Peruvian soldier and historian: b. Lima, 1805; d. there, Jan. 21, 1885. While a student he joined the patriot forces in 1821, was captured by the Spanish and held prisoner till the close of the war. Among various civil and military posts afterward held by him were those of minister of war and finance.

He published a *Diccionario historico-geografico del Peru,* a work of great value and highly prized by scholars. The first part, in eight volumes, deals with the Inca and colonial periods, and its publication, begun in 1874, was concluded after General Mendiburu's death. The second part was not published.

MENDICANCY, mĕn'dĭ-kăn-sĭ. The experience of all countries has shown that mendicancy will thrive wherever indiscriminate almsgiving prevails. As early as 1351 France was compelled to pass laws against begging. England forbade it in the time of Henry VIII, and Italy in 1865. The local authorities in the latter country, however, are allowed to issue permits, and medicants abound. Seville is the only city in Spain where begging is not allowed.

In the United States, where work is, on the whole, plentiful, there is little or no excuse for mendicancy, and it is forbidden by law. Paupers are cared for in public institutions, and casual unfortunates by private charitable institutions. Yet there are professional beggars in nearly all the larger cities of the United States. See also MENDICANT FRIARS.

MENDICANT FRIARS, are religious orders which depend entirely on the alms of the faithful for their support. While no individual monk or nun can hold or use property for personal profit, most communities as such possess property in the form of endowments or commercial enterprises for their common support.

In the 13th century a new spirit of enthusiasm sprang up under the teaching of St. Francis and St. Dominic, and orders of friars were founded, which were forbidden to possess property in any form beyond the houses in which they dwelt. The most notable of these were the Carmelites, Franciscans, and Dominicans. The Augustinians soon followed their example; and in 1487 the Servites were also officially recognized as a mendicant order. At first the members of these orders actually begged their bread from door to door; but this soon ceased.

MENDIETA Y MONTEFUR, měn-dyā'tä ē mōn-tä-fōōr', **Carlos,** Cuban physician and provisional president: b. San Antonio de las Vueltas, Nov. 4, 1873. Joining the forces of Antonio Maceo in the 1895 revolution he rose to the rank of colonel. After Cuban independence he studied medicine at the University of Havana which awarded him the M.D. degree in 1902. A candidate of the Partido Liberal for the vice presidency in 1916, he was subsequently a political prisoner, then exiled. In January 1934 he was installed as provisional president by Fulgencio Batista (q.v.), but being unable to establish a stable government he resigned in December 1935.

MENDIVE, mān-dē'vā, **Rafael Maria de,** Cuban poet: b. Havana, Cuba, Oct. 24, 1821; d. Matanzas, Cuba, 1886. His first collection of poems (1847), entitled *Passion-Flowers,* is widely popular. Banished in 1869, he lived alternately in New York and Nassau, writing legends and stories in verse. He was one of the most notable of Spanish-American poets; and many of his verses received English, French and Italian translations.

MENDOCINO, Cape, měn-dō-sē'nō, the westernmost point of the coast of California, projecting into the Pacific Ocean in latitude 40° 26′ north and longitude 124° 25′ west. It has a very high lighthouse, 422 feet above sea level, with a flashing light.

MENDOTA, city, Illinois, in La Salle County, 83 miles west of Chicago; on the Chicago, Milwaukee, St. Paul and Pacific, the Illinois Central, and the Chicago, Burlington and Quincy railroads. The city contains the Blackstone School, the Lincoln School, a high school, and a parochial school, as well as a public library. Its manufactures include coal, gas and oil stokers, time controls, and automatic gluing and veneer presses, and it has a large-sized corn packing plant. The municipality owns the water-supply system and the sewage system. Pop. (1940) 4,008; (1950) 5,129.

MENDOTA, village, Minnesota, in Dakota County, across the Mississippi River from St. Paul and just below the juncture of the Mississippi and Minnesota rivers; altitude, 703 feet. Mendota was the first permanent white settlement in the state. Here Alexis Bailly of the American Fur Company traded with the Indians from before 1819, his trading post being known as St. Peter's. The permanent settlement dates from 1834 when Henry H. Sibley (q.v.) succeeded Bailly. Three years later the name of the village was changed to Mendota. Sibley's house, built in 1835, is preserved. Pop. (1950) 228.

MENDOTA LAKE. See FOUR LAKES.

MENDOZA, mān-dō'sä, **Antonio de,** Spanish administrator: b. about 1485; d. Lima, Peru, July 21, 1552. In 1535 he was appointed by the Emperor Charles V, with whom he was in great personal favor, viceroy of New Spain (Mexico), being the first of 64 viceroys, with the longest administration and that which shows the best record in the history of that provincial government. He made many reforms, especially in relieving the oppressed natives; developed agriculture and mining; established the first Mexican mint; founded the first college; and introduced the first printing press.

In 1551 he became viceroy of Peru, where he caused to be prepared a code of laws that has been the basis of the colonial and, to a large extent, of the present legal system of the republic. It was under Mendoza's administration in Mexico that Francisco Vásquez de Coronado (q.v.) undertook his famous exploring expedition.

MENDOZA, mān-dō'thä, **Diego Hurtado de,** Spanish author and statesman, great-grandson of the Marqués de Santillana (q.v.): b. Granada, about 1503; d. Madrid, April 15, 1575. He was educated, as a younger son, for the church, but, after studying Arabic at Granada and the humanities at Salamanca, entered the army and in 1525 fought at Pavia. He acted as Charles V's ambassador to England in 1537, to Venice in 1539; was representative at the Council of Trent (1545), governor of Siena (1547), and imperial representative to the papal see in Rome (1549). With Philip II he quarreled and in 1564 was interned in Granada, only returning to court in 1574, soon before his death. To his stay in Italy was due his influence in making the Spanish lyric thoroughly Italianate; and from Italy he brought an unusual knowledge of the classics as well as a fine collection of Greek manuscripts. Mendoza also perfected the Spanish poetic epistle. The famous romance, *Lazarillo de Tormes* (q.v.), has been ascribed to him. But his greatest work is his history of the Moorish insurrection, *Guerra de Granada,* a model of historical impartiality and on a theme for which knowledge of Arabic peculiarly fitted him. So impartial was this work that it was not published complete for many years.

MENDOZA, Pedro de, Spanish soldier, explorer, and colonizer, founder of Buenos Aires: b. Guadix, Granada, Spain, about 1487; d. at sea, 1537. He was a favorite of Charles V; fought bravely in Italy; and in April 1535 left Spain with 12 ships and 800 men, sailed up the Plata River in South America and founded the city then called "Nuestra Señora de Buenos Ayres." His further movements were unfortunate; Indians and disease attacked his men, three fourths of whom, including his own brother, were lost. The natives captured and burned the city, and Mendoza, rescued none too soon by his brother, who came with reinforcements, set sail for

home. But his health and reason were undermined and he died on board ship.

MENDOZA, Argentina, a province in the western part, on the eastern slope of the Andes Mountains; area, 56,502 square miles. Mount Aconcagua, 22,427 feet, is on the northwestern boundary. The western part of the province is mountainous, the eastern part pampa land and fertile where watered by the streams or by irrigation, but the climate is hot and dry. There are four important rivers, the Mendoza, Atuel, Diamante and Tunuyan. The Transandean Railway from Valparaiso to Buenos Aires divides the territory. There is also a railway to San Juan and San Carlos, and a southern line from San Rafael east. It is rich in minerals, especially silver and copper. Coal and petroleum abound. Grapes grow luxuriantly and a large quantity of wine is shipped to the other provinces. Cattle, hides and wool are the chief exports. Wheat and corn are increasing in importance. Pop. 496,000.

MENDOZA, Argentina, city, capital of the province of Mendoza, at the base of the Andes, on the eastern side of the mountains, on the railroad which extends from Buenos Aires to Valparaiso, Chile, about 600 miles west by north from Buenos Aires and 165 miles east of Valparaiso. It is about 2,400 feet above the sea. The city was founded in 1559. It belonged to Chile previous to 1776. In 1861 it suffered from an earthquake which killed about 10,000 people and destroyed a great part of the city. The Transandean Railway connects the city via Villa Mercedes with all the large cities of the eastern coast, also with Santa Fe and Corrientes. It has churches, banks, department stores and is an important trade centre. It is the seat of two national normal schools, a national college and an agricultural institute. Pop. about 82,000.

MENE, mē'nē (numbered); **TEKEL** (weighed); **UPHARSIN** (divided), the Chaldee words traced on the wall at Belshazzar's feast and significant of his impending doom (Dan. v). The astrologers could not read them, because they were written in antique Hebrew characters, but Daniel understood their awful meaning; and the same night witnessed their fulfilment.

MENEDEMUS, founder of the school of philosophy called Eretrian from his native city Eretria: b. about 351; d. about 277 B.C. Traditions vary as to whether he turned to philosophy under the influence of Plato, or under that of Stilpo of Megara, but his tenets seem to have most resembled those of the Megarian school.

MENELAUS, měn-ē-lā'ŭs, *in Greek legendary history,* the son or grandson of Atreus and brother of Agamemnon (q.v.). From his father-in-law, Tyndareus, whose daughter Helen he married, he received the kingdom of Sparta or Lacedæmon. Paris, son of Priam, king of Troy, having carried off his wife, Helen, with a part of his treasures and some female slaves, and conveyed them to Troy (q.v.), Menelaus, accompanied by Ulysses (q.v.), went thither to demand the restitution of his wife and property, and this being refused, he summoned the Greek princes to revenge the affront according to their promise. After the conquest of Troy, Menelaus took Helen to return with her to his native land. Eight years he wandered before he reached home. On the island of Pharos (q.v.) he surprised Proteus asleep and compelled him to disclose the means which he must take to reach home. See TROJAN WAR.

MENELIK II, měn'ĕ-lĭk, emperor (Negus Negusti—King of Kings) of Abyssinia: b. 1844; d. December 1913. The son of a king of Shoa, he secured the throne in 1889, in which year he signed the Treaty of Uccialli with Italy. He discovered some years later that by the Italian text of the treaty he was bound to conduct his foreign affairs through the Italian government, while the Amharic text made this optional. He accordingly wrote to Queen Victoria in 1893 and protested against the treaty as infringing upon his sovereign rights. In 1896 he fought a war with the Italians and severely defeated them in the battle of Adua. His complete independence was then recognized by Italy and the other European powers. He concluded treaties of commerce with Great Britain and other countries and co-operated with the British army against the Sudan dervishes. A humane and just ruler, he endeavored to apply the arts of civilization to his backward country. He was succeeded by his nephew Lij Yasu, deposed in 1916.

MENENDEZ DE AVILES Y MARQUEZ, mā-nĕn'dĕth dā ä-vē-lās' ē mär'kĕth, **Pedro,** Spanish captain, founder of the city of Saint Augustine, Fla.: b. Aviles, Austria, 1519; d. Santander, 17 Sept. 1574. In June 1565 he sailed with 1,500 men in 19 vessels to dislodge the French in Florida; landed there 28 August; and 6 September began a fort, the nucleus of the present town. He attacked the French garrison at Fort Caroline, during the absence of part of the force, which had set out to attack him but was storm-stayed and finally wrecked. Menendez slaughtered the remnant at the fort and those saved from shipwreck. He returned to Spain in 1567; visited America twice again, strengthening Saint Augustine in 1568, and in 1570 sending a party of colonists to the Chesapeake and up the Rappahannock, where they were massacred by the natives; and was recalled to Spain shortly before his death. During the last two years of his life he was governor of Cuba. Consult Winsor, J., 'Narrative and Critical History of America' (New York 1886).

MENENDEZ Y PELAYO, ē pā-lā'yō, **Marcelino,** Spanish critic: b. Santander, 3 Nov. 1856; d. there, 19 May 1912. He was educated at Madrid and Paris; in 1878 became professor of philosophy and letters in Madrid; three years later was elected to the Spanish Academy; and in the late nineties became director of the Biblioteca Nacional. He lectured often, especially at the Athenæum in Madrid. For several years he was dean of the faculty of letters at the University of Madrid, he served a term as senator, was counsellor of public instruction and chief of the board of archivists. He received many honors, including the grand cross of the Order of Alfonso XII. His literary style was finished and elegant and he was ever a staunch defender of Catholicism. He wrote 'Estudios criticos sobre Escritores Montañeses' (1876); 'Horacio en España'

(1877); 'Historia de los Heterodoxos Españoles' (1880–81); 'Calderon y su Teatro' (1881); 'Odas, Epistolas y Tragedias' (1883); 'Historia de las Ideas estéticas en España' (1884–91).

MENENDEZ PIDAL, Ramon, Spanish critic, philologist, educationalist and general literary man: b. Coruña, 13 March 1869. Educated at the universities of Madrid and Toulouse he became professor of Romanic philology at the former (1899). See PIDAL, RAMON MENENDEZ.

MENEPTAH, or **MERNEPTAH,** king of Egypt about 1250 B.C. He succeeded his father, Rameses II, and reigned for a period of 20 years. His reign was troubled by an invasion from Libya, but he succeeded in crushing it and thereafter set about the construction of numerous buildings and monuments, especially at Tanis. In 1898 his mummy was discovered at Thebes and now reposes in the Cairo Museum. Previous to 1896 it was thought that Meneptah was identical with the Pharaoh of the Exodus, but in that year an inscription was uncovered in which it was stated that Israel was settled in Palestine in the fifth year of Meneptah. This inscription is of prime historic interest as fixing the period of the settlement of Israel in Palestine and as the only mention of Israel on Egyptian monuments. For the inscription consult 'Der Sieges-hymnus des Meneptah auf der Flinders Petrie Stele' (in *Zeitschrift für ägyptische Sprache,* Vol. XXXIV, Leipzig 1896). Consult also Breasted, J. H., 'History of Egypt' (2d ed., New York 1909) and Budge, E. A. T. W., 'History of Egypt' (New York 1902).

MENES, mē'nēz, according to Egyptian traditions, the first king of Egypt. Herodotus relates that he was the founder of Memphis, which he built on a piece of ground which he had recovered from the Nile by altering the river's course. According to Diodorus, Menes introduced into Egypt the worship of the gods, as well as a more elegant style of living. He has been identified by some with the Mizraim mentioned in Gen. x, 6. A tomb supposed to be that of Menes was discovered near Nakâdeh by De Morgan in 1897. Consult Breasted, J. H., 'History of the Ancient Egyptians' (New York 1908). See EGYPT.

MENG CHIANG. See MONGOLIA.

MENG-TSE, měng-tsĕ'. See MENCIUS.

MENGER, Karl, Austrian political economist: b. Neu-Sandez, Galicia, 1840; d. 27 Feb. 1921. He studied at the universities of Vienna and Prague, giving special attention to law and political economy. In 1872 he began his long connection with the University of Vienna, being appointed full professor of political economy in 1879. He was created life member of the Austrian House of Peers in 1900. As an economist he was undisputed leader of the new school of economics in his country and was opposed to the traditional system hitherto followed. He published several important works, including 'Grundsätze der Volkswirtschaftslehre' (1871); 'Untersuchungen über die Methode der Sozialwissenschaften und der politischen Oekonomie insbesondere' (1883); 'Die Irrtümer des Historismus in der deutschen Nationalökonomie' (1884); 'Beiträge zur Währungsfrage in Oesterreich-Ungarn' (1892) and the article "Geld" (in 'Handwörterbuch der Staatswissenschaften,' 3d ed., 1909).

MENGS, Anton Raphael, German painter: b. Aussig, Bohemia, 12 March 1728; d. Rome, 29 June 1779. In early childhood his father, Ismail Mengs, a miniature painter of little talent, who was settled at Dresden, took him in hand to make a painter of him, and in 1741 carried him to Rome and set him to study the antique and to copy Michaelangelo and Raphael. He was compelled to do a certain task in painting every day; his day's work subjected to severe criticism; and he was even punished if it was not satisfactory. From this constant practice he early gained skill as an artist, and when he returned to Dresden his talent and proficiency were at once recognized by August III, who appointed him court painter and gave him permission to return to Rome. At Rome he attended the Academy and in 1748 produced a large and elaborate composition, 'The Holy Family,' taking as model for the Mother of Jesus a beautiful peasant girl, whom he afterward married. On his return to Dresden he was commissioned to paint an altar-piece, 'The Ascension of Christ,' for the high altar of the Chapel Royal, and was given permission to return to Rome for the purpose of doing so. A new academy of painting having been opened in the capitol he was appointed director and painted for the Celestines the ceiling of their church, San Eusebio, for Cardinal Albani the 'Parnassus' in the ceiling of his villa, and several oil paintings, including 'Cleopatra,' 'The Holy Family' and 'The Magdalen' for private persons. When King Charles III of Spain summoned him to Madrid he executed for him in fresco there 'The Assembly of the Gods' and 'The Descent from the Cross'; he also completed the altar-piece for Dresden. He returned to Italy in 1769, stayed eight months at Florence and painted for the Pope a ceiling fresco for the Vatican Library. In 1772 he went to Spain and produced for the king the fresco 'Apotheosis of Trajan,' his finest work, but returned to Rome in 1775. On his death the Cavalier d'Azara set up a statue to him and Catherine II of Russia raised a splendid tomb for him in Saint Peter's. He was certainly one of the most important painters of his day, and if he possessed none of the free and living originality of genius he was a master of noble composition and design. He was catholic in taste and eclectic in style, drawing inspiration from the antique, as well as imitating Raphael, Titian and Correggio, whose styles he tried to blend. Consult Woermann, 'Ismail und Raphael Mengs' (in the *Zeitschrift für bildende Kunst,* No. 5, 1893).

MENHADEN, a species of fish (*Brevoortia tyrannus*) of the herring family (*Clupeidæ*), appearing in vast schools along the Atlantic Coast of America. Owing to the large number of local names applied to this species much confusion concerning its identity and distribution exists in the minds of fishermen and others. The name "menhaden" (Indian) is used chiefly in southern New England. North of Cape Cod the fish is called pogy, or occasionally hardhead; in New York and New Jersey, bunker or marshbunker; the fishermen of Delaware

and Chesapeake bays know it as bay alewife, and in the latter region and southward also as bug-fish or bug-head; still farther south it becomes the fat-back, and so on. From the other herrings the menhaden is readily distinguished by its very large head, large mouth, complex gill strainers and crenulated scales. The body is deep, the fins small, the mouth toothless and the color bluish and silvery, with one large and several small black spots.

Like some other pelagic and migratory fishes the menhaden is exceedingly irregular in its movements and variable in abundance and distribution from year to year, but its general range is from Nova Scotia to Brazil and oceanward, so far as observed, to the Gulf Stream. In spring it approaches the coasts and extends northward with the alewives and other species, probably for the purpose of spawning in brackish water, though little is actually known of its spawning habits. In winter Cape Hatteras marks the northern limit of its abundance. The menhaden swims in compact schools of large size, the movements of which at the surface, or sunken to a greater depth, are extremely irregular.

These irregularities are owing, no doubt, to corresponding variation in its food-supply, which consists wholly of the minute organisms, both vegetable and animal (plankton), that are caught as the fish swims with open mouth, straining the water through its lips and gill-arches as it goes. Owing to its strong oily taste and extreme bonyness its value as human food is very slight, but as furnishing food for other fishes, as bait, and for the manufacture of oil, fertilizer and other products, it has a very great economic importance. Large companies control its capture for the latter purposes and, besides pound nets, utilize many steamers provided with purse seines and derricks, by means of which entire schools are taken at a haul and lifted on deck. The oil is extracted and the solid parts ground up for fertilizer at factories on shores. The product varies from year to year, but the total weight of fish taken runs into the hundreds of million pounds. The catch of fish and industries involved reached their highest level of importance in the latter part of the last century, since which both have much diminished, whether by reason of over-fishing or because the menhaden no longer come to the northern part of the coast in so great abundance, is not determined. Consult Goode, 'History of the Menhaden,' Report United States Fish Commission, 1879, and recent reports of the United States Bureau of Fisheries.

MENHIRS, elongated, rough-hewn monoliths standing with one end in the ground. They are found of various sizes, from about 6 to as much as 67 feet high, the latter being the height of that at Locmariaquer in Brittany. Singular superstitions naturally attach to some of them. See STONES, STANDING.

MENIERE'S DISEASE, a disease of the ear first described by the French physician, Emile Antoine Ménière, in 1861. It is one form of auditory vertigo and usually attacks persons of middle age. The principal causes are sunstroke, influenza, rheumatism, anæmia and venereal diseases. The attack is usually very sudden and appears to be due to hæmorrhage into the labyrinth. The seizures may occur at irregular intervals of days or even weeks. While the symptoms of dizziness, vertigo, nausea, etc., gradually disappear the deafness is generally permanent. Potassium iodide is most serviceable in reducing the dizziness. See EAR.

MENIN, Belgium, town in the province of West Flanders, on the Lys and on the Belgo-French frontier here demarcated by the river, seven miles southwest of Courtrai, and 30 miles southwest of Ghent. It contains lace and cotton mills, tobacco factories, etc. In the neighborhood there were extensive tobacco plantations previous to the war of 1914–18, in which Menin suffered severely. It fell to the Germans during the great rush of both armies northward to the sea; was taken by the British in a spirited attack, but was subsequently evacuated by them for strategic reasons. The British having noted a German concentration of troops and *materiel* in Menin made an aerial attack upon it which brought damage to a great number of buildings. Pop. 18,600.

MENINGITIS. The brain is enveloped by three membranes called the meninges. Next to the skull comes the dura mater, then the arachnoid and innermost is the pia mater. These three membranes are prolonged from the brain in three envelopes of the spinal cord. Meningitis is an inflammation of the meninges of the brain or of the spinal cord. It is very rarely a primary condition, but is usually secondary to infection from micro-organisms of many types, or results from chronic poisonings such as lead, alcohol, etc. Hence modern medicine speaks of various meningitides rather than one meningitis. When the surface of the brain is wounded by some object breaking through the skull, or a piece of broken bone of the skull, thrust inward by some blow, an artery is ruptured and the blood flows between the membranes. Such a condition is called *traumatic meningeal hæmorrhage.* When the dura mater becomes inflamed after a wound, or after inflammation of other parts of the head, as the ears, teeth, etc., there, results a condition called *pachymeningitis externa.* Inflammation of the meninges, however, is generally confined to the pia mater and the arachnoid and is then called *leptomeningitis,* Pachymeningitis, inflammation alone or chiefly of the dura mater, may extend to the other membranes. Inflammation of the cerebral meninges is *cerebral meningitis;* of the spinal meninges, *spinal meningitis;* of those of the brain and spinal cord together, *cerebro-spinal meningitis.* Ascending meningitis is a meningitis ascending from the lower part of the spinal cord.

Pachymeningitis has one form involving the external surface of the dura mater and resulting from blows or other injuries, and from osseous growths. There may be no well-defined symptoms, but usually is local headache and tenderness on pressure. The onset is usually sudden. Many cases of meningitis of the type called «serous» are not other than pachymeningitis. If the dura mater, which is normally free, is bound to the skull by fibrous exudation, and especially if pus forms and hæmorrhages occur, there are symptoms of pressure. Inflammation of the internal portion

of the dura mater may result from the extension of inflammation from adjacent parts, such as the ear, the frontal or the ethmoidal sinus; or it may attend cases of pernicious anæmia, chronic syphilis, tuberculosis and chronic infectious diseases. It occurs chiefly in old age, but has been seen in children. There are fibrinous deposits and extravasation of blood in cysts (hæmatoma), and occasionally pus forms. The brain is anæmic, sometimes softened. The symptoms are those of irritation — convulsions, vomiting, dilated pupils which are not affected by exposure to light, a slow irregular pulse, etc.—and those of compression or pressure—coma, etc. Pachymeningitis is usually fatal.

Cerebral meningitis (simple or cerebral meningitis), in the acute form, is not common, and is most apt to occur in men engaged in hard mental pursuits. It may be caused by injuries, by sunstroke, by spirituous liquors, etc., and is very dangerous, death usually occurring in from three to eight days. The brain is reddened and covered more or less with pus and coagulated fibrin or lymph, and its superficial layer is softened. There is almost always serous effusion into the brain-cavities. The symptoms are those of three stages: (1) Headache; (2) delirium; (3) coma. At first there may be slight fever, some photophobia, frequency and irregularity of the pulse and some contraction of the pupils. There is a disposition to vomit, a slowness in movements of the bowels and often hyperæsthesia. Then comes delirium, which may or may not be active; the patient talks much and tries to get out of bed; does not obey readily. There is more or less trembling of the limbs, with difficulty in moving them. One pupil is likely to be dilated. Sometimes strabismus occurs; the pulse is very irregular; and paralysis begins. Then follows coma, loss of sense, sensation and of voluntary motion; there is sighing, the pulse is frequent and weak, the pupils do not respond readily to light and the capillaries of the skin and eye are congested. Recovery from this disease rarely occurs after the period of coma begins.

Sub-acute or chronic cerebral meningitis is a secondary disease, sometimes associated with chronic syphilis, Bright's disease, alcoholism, etc., though the cause is not always ascertained. The lesions are similar to those of acute meningitis, but less pronounced. There is less of serum and pus, and the exudated fibrin is more circumscribed. The symptoms are insidious and vague. Headache, vomiting and photophobia are rare. The slight delirium is followed, it may be, by somnolency, irregular pulse, strabismus and sighing respiration. With coma the pulse is rapid, 120 or more, and the patient dies as in acute meningitis.

Tuberculous meningitis, also known as acute hydrocephalous, granular meningitis and basilar meningitis, is an acute tuberculous inflammation of the pia mater, caused by a deposit of miliary granules over the surface of the brain, but most numerous at the base, in the track of the cerebral vessels, and in their sheaths. There is a noticeable vascularity, especially in the ventricles. The pia mater is thickened and opaque and covered with a semi-purulent exudation. Serum fills the ventricles and formina, pressing upon the convolutions, and assists in softening portions of the brain. The lesions in this disease are rarely limited to the brain; tubercles are found in other organs, especially the lungs. The disease is a phase of that protean malady, tuberculosis, though the cerebral lesions may first be noticed. The primary causes are a hereditary diathesis (scrofulous or tuberculous), foci of caseous degeneration in some organ, a suppurating joint, or a scrofulous inflammation of bone. The physically weak children of tuberculous parents are most subject to this disease, and in cases where strong children are attacked there is generally found a tubercular relative. Though the disease is essentially a disease of early life (from nine months to 10 years), it also attacks adults. Most of those affected die in from two to six weeks. The symptoms may be classed under three heads: (1) Obscure symptoms; (2) those of rapid development; (3) those of coma. There are seen listlessness, loss of appetite, occasional vomiting, slowness of the bowels and somewhat frequent pulse. Sometimes there is headache, a remittent form of fever and then rapid development of diagnostic symptoms. The patient talks a good deal. One of the most important symptoms is a change in the disposition through which the child, although bright and lively before, suddenly becomes listless, or excessively emotional, a condition which may continue for several weeks. There are irregularity of the pupils and pulse, a sharp "cephalic" cry, severe headache, insensibility to light and sound, grinding of teeth, a flushed face in paroxysms, usually before convulsions, rolling and drawing back of head, urine scanty and high-colored, oscillation of the eyes, obstinate constipation, etc. With coma comes strabismus; the pupils do not contract under the influence of light, but will contract and expand when the bowels rumble or the patient is moved. There are convulsions, paralysis and automatic movements of the feet and hands, it may be for hours. The thumb may be turned in. There is a hollowed abdomen (boat-shaped) and congestion of the eyes, a puri form secretion sticking the eyelids together; involuntary discharge of bowels and bladder, are common. For treatment of this affection place patient in bed, in a quiet room; give easily digested food; apply an ice-cap to the head and warmth to the feet. Further treatment should be in the hands of a physician. Much can be done by parents and guardians to prevent the onset, by not developing the nervous system at the expense of the muscular and digestive systems. Precocious children are to be judiciously restrained, and outdoor life encouraged. Tuberculous meningitis in adults is commoner in men than in women, and most frequently occurs between 17 and 30. It is generally fatal in 2 to 14 days, about one in 200 cases recovering.

Spinal meningitis is not common; it is usually caused by infection, is liable to occur in children with spina bifida and is rarely amenable to treatment. Death occurs usually in from eight to 10 days, either from extension of inflammation to the brain and pressure there by fluid, or from asphxyia due to spasms of the respiratory muscles. The lesions are similar to those of cerebral meningitis. The chief symptoms are pain in the spine and extremities, increased by movements

of the body, great sensibility of the surface of the body, spasms of muscles, opisthotonos and dyspnœa.

Epidemic cerebro-spinal meningitis, or spotted fever, is due to a special micro-organism, the *diplococcus intra-cellularis*. Death frequently occurs in a few hours; recovery usually requires 30 or more days. The disease has spread over sections of this country two or three times, mainly in the winter and spring. The exact manner of its transmission is not known. One form is characterized by fever with no eruption; the other by fever and an eruption. The symptoms are a chill or chilliness, followed by nausea and vomiting, fever, violent headache, sometimes with pain down the spinal column, general hyperæsthesia, great prostration, vertigo, tetanic rigidity of muscles, irritability or apathy, delirium and other symptoms of meningeal irritation, followed more or less rapidly by those of coma. In the majority of patients if the head is raised when the patient is lying on his back, the knees are involuntarily flexed. When there is an eruption it usually appears early and consists of dark blotches, from the size of a pinhead to that of a nickel, and is not marked on the extremities.

Where death occurs within 12 hours from the time of attack only a congestion of blood-vessels of the brain and, it may be, of the spinal cord, is generally found. Almost always there is lymph or pus beneath the pia mater, and sometimes serous effusion in the pleura, pericardium or peritoneum. The blood undergoes a change, ecchymoses are found sometimes in the muscles, or in connection with the pericardium or pleura. This disease is treated with a serum, which was first produced in the monkey but now is successfully derived from the horse. The serum is given in frequent doses depending on the severity of the case, from 12 to 24 hours apart; this treatment has reduced the mortality to 30 per cent. In the chronic variety serum therapy is of no avail; the application of cold to the head should depend upon the desires of the patient. Pain has to be controlled by morphine. Sulfanilamide and related compounds have helped many of the patients with infectious meningitis.

SMITH ELY JELLIFFE, M.D.

MENIPPUS, mĕ-nĭp'ŭs, Greek cynic philosopher, a native of Gadara in Palestine, and supposed to have flourished about 260 B.C. His writings were chiefly of a satirical kind. Lucian styles him "the most snarling of cynics," and in two or three of his dialogues introduces him as the vehicle of his own sarcasms. It appears that his satires were composed in verse and prose, on which account those of Varro were denominated Menippean, and for the same reason the name of Satire Ménippée was given in France to the celebrated piece written against the League and Philip II of Spain, its head. His writings are lost.

MENKEN, Adah Isaacs (originally DOLORES ADIOS FUERTES), American actress: b. near New Orleans, La., 15 June 1835; d. Paris, France, 10 Aug. 1868. Making her début with her sister as danseuses, at the New Orleans French Opera House, she was received with marked favor and visited Cuba, Texas and Mexico. On her return to New Orleans, she published a volume of verse and taught French and Latin at a girls' academy in that city. In 1858 she appeared in 'Fazio' in New Orleans, and went to England in 1863–64, assuming the rôle of Mazeppa at Astley's which won her popularity. After 30 Dec. 1866 she played in Paris for 100 nights, and later in Vienna and London. Her last appearance was in Paris in May 1868. She was famous for her fine form, and many marriages and divorces; Alexander I. Menken, John C. Heenan, J. H. Newell and James Barcley being her successive husbands. Her mind seems to have been as winning as her physical beauty, for among her friends were numbered Charles Reade, Dickens, Swinburne and the elder Dumas.

MENNO SIMONS, Dutch religious reformer: b. Witmarsum, Friesland, 1492; d. Oldesloe, Holstein, 19 Jan. 1559. He was ordained priest in the Roman Catholic Church and took pastoral work in the village of Pingium (1524), and from a study of the New Testament, undertaken (1530) to solve his doubts about transubstantiation, he was induced to become an evangelical preacher and finally left the church of his ordination. The martyrdom of Sicke Snyder at Leeuwarden for Anabaptism impelled him to consider the Scriptural grounds for infant baptism. He was finally converted to the cause of the Anabaptists, but never sympathized with the excesses of Münzer and wrote a diatribe against John of Leyden (1535). In 1537 at the request of a number of Anabaptists of Groningen he assumed the functions of an Anabaptist preacher and exercised, by his moderation, a most salutary influence on his fellow-ministers. He now married, his change in faith having superseded his vow of celibacy, and began to travel as an evangelist not only in Friesland but throughout Holland and Germany as far as to Livonia. Being persecuted from place to place he finally settled in Oldesloe in Holstein, where he closed his ministry with the consciousness of having founded a large and flourishing sect, whose subsequent history is related under the title Mennonites (q.v.)

Views of Menno Simons.—Menno was rather a preacher of a system of personal sanctity than either a dogmatist or a violent fanatic like some of the Anabaptists. He was a man of pure moral and devotional enthusiasm, whose account of his own conversion reads like a passage from the 'Confessions' of Augustine. He sums up the results of his labors as consisting in the conversion and recovery of the wicked. Yet he formulated a somewhat vague profession of faith. He believed in the divinity of Christ, who was born on earth *in* Mary, that is without taking upon him human flesh and blood. He rejected infant baptism, and baptized those only who made a personal profession of faith in Christ. He particularly emphasized the power of excommunication possessed by the Church, without which "the spiritual Kingdom of God on earth cannot," he said, "exist in purity and piety." He believed in the coming millennium (q.v.); he excluded civil magistrates from church membership on the ground that the church was a theocracy whose magistrates were the ministers. He declared that war and all taking and administering of oaths were unlawful, and re-

garded human science as useless, even pernicious to a Christian. These decrees, however, as modified by the explanations of Menno, differed little from those generally promulgated by the Reformed bodies of his day. His principal teaching was of a moral and practical character. He was a meek, humble, noble-minded man, carried away with the spirit of his times, encouraging all that was good and pure among his followers, and sternly rebuking the guilty. The best edition of his work is 'Opera Omnia Theologica of al de Godgeleerde werken vann Menno Simonis' (1681). Consult Harder, 'Leben Menno Simons' (1846); Roosen, 'Menno Simons den evangelischen Mennonitengemeinden geschildert' (1848).

MENNONITES, a body consisting of a dozen or more branches of followers of Menno Simons, akin to Baptists in faith and practice: Menno Simons (1492–1559), a Holland Anabaptist, was not the founder of the body that bears his name, but was a convert to it several years after it began, and became its chief leader and author. He early left the priesthood of the Roman Catholic Church, espousing the views of the Anabaptists, but opposing the fanatical extremists of Münster. His books were his chief contribution to the movement, which really grew out of the division of Protestantism which is called by the name Anabaptist. The Anabaptists were opposed to the baptism of infants, baptizing only on confession of faith. The followers of Menno Simons became numerous in Holland, Germany and Switzerland, and thousands were persecuted to death, particularly in Holland, because of their views in regard to the temporal power. Rising in the first half of the 16th century (they were first called Mennonites in 1550, though the name was never generally adopted in Europe as it was in America) they increased under persecution and emigrated to Russia and the United States to escape it — to the former country near the close of the 18th century and to the latter from 1640 on, coming from Holland, and Germany to New York and New Jersey. They were drawn to Pennsylvania by William Penn's announcement that those settling in that colony would enjoy freedom in the practice of their religious faith. The Society of Friends in England assisted the Mennonites of Holland to emigrate. The first Mennonite colony was formed at Germantown, near Philadelphia, in 1683. Thence they spread to Lancaster, Bucks, Berks and other counties in Pennsylvania and from that State to other States and to the Canadian provinces. They came in constant contact, in colonial and post-colonial days, with the Indians, but like the Friends, being opposed to bearing arms and inclined to peace they suffered little from attacks by the savages. It is worthy of note that a Mennonite meeting at Germantown as early as 1688 adopted a protest against the traffic in slaves, saying that those «who steal or rob men and those who buy or purchase them» are all alike.

Though Mennonites are widely divided among themselves on questions of practice and principle, they are in substantial agreement in holding doctrines of the evangelical type, as expressed in a declaration of faith adopted at Dort, Holland, in 1632, which confession is generally accepted by the Mennonites of America. They adhere to the principles of autonomy of the churches, freedom of conscience, separation of church and state, adult baptism, non-resistance and practical piety. Baptism is administered on confession of faith, not by immersion, but by pouring, the candidate either kneeling or standing in water and the minister taking up water in both hands and pouring it upon the head, using the scriptural formula. In the ministry there are bishops, or elders, ministers, who are pastors or evangelists, and deacons, who are almoners and assist in administering the ordinances and take charge of congregations in the absence of bishop or minister. Ministers are selected by members of the church, who go one by one to a private room for the purpose. If more than one are thus selected choice between them is made by lot. A bishop has charge of all the churches in his particular district and ordains the ministers and deacons. He is selected in like manner as ministers and deacons. The Lord's Supper is observed twice a year, in the spring and in the fall, preceded by an examination of each member in faith and standing, and followed by the ceremony of feet-washing and the kiss of peace, the sexes separating for this purpose.

Mennonites are opposed to the judicial oath and many practise non-conformity to the world. Their polity provides for the autonomy of the churches, but appeals are taken to the conference. Decisions of conference are submitted to the churches for approval.

The 12 or more branches in America differ so little in some instances that it is difficult to distinguish between them except by name. The census of 1916 reported three bodies in the group not in existence, or not known, in 1906. The distinctive bodies are: (1) Mennonite Church; (2) Conservative Amish; (3) Old Order Amish; (4) Church of God in Christ; (5) Old Order Mennonite (Wisler); (6) Reformed Mennonite; (7) General Conference of Mennonites; (8) Defenceless Mennonites; (9) Mennonite Brethren in Christ; (10) Mennonite Brethren Church; (11) Krimmer Brueder Gemeinde; (12) Hutterian Brethren. There are besides small unattached bodies which may be grouped as miscellaneous, including the Kleine Gemeinde, Stauffer Mennonites, etc.

A historical distinction, which also marks a difference in doctrinal position, may be traced between two European groups and through their descendants in America: (1) Those of Holland, Switzerland and northwestern Germany, and (2) those of Prussia, North Germany and Russia. These emigrated from Holland and used the Dutch tongue until after the middle of the 18th century, when they adopted the German which they still employ. They are of the orthodox type. The first group became liberal or rationalistic and are not in fellowship with the representatives of the second group.

1. Mennonite Church.— This is the largest and oldest body of this faith in America. It is descended from the colony which settled in Germantown. In tendency it occupies middle ground between the stricter and the more liberal schools. Since 1896 it has had a biennial General Conference, composed of dele-

gates elected by the State conferences. The Amish body is represented in this conference—the two churches are practically one—and cooperates in the conduct of the general missionary, educational and benevolent work. The board of missions has missionaries in India and in America, with a department of city missions. The chief educational institution is at Goshen, Ind. In 1936 the total membership in Mennonite Church organizations (17 in number), was 116,655. This number included about 1,600 members under the age of 13 years. The number of ministers in all of the bodies was 1,752, who served 1,001 churches. The membership is largest in Pennsylvania and Ohio with representation in other mid-western States and in the South. *The Mennonite,* of Berne, Ind., is published in the English language and another paper printed in German is published at the same place.

2. Conservative Amish Mennonite Church.—This is a small body of the Amish type which has churches in Pennsylvania, Illinois, Ohio and Canada. The membership in 1936 totaled 2,281 served by 38 ministers in 18 congregations. The churches were combined in a single conference. The Amish settlement in Canada was founded in 1824 in Wilmot Township, Ontario, on land given by Christian Nafziger of Munich. The Amish Mennonites date from 1690, separating from the Mennonites in Switzerland and Alsace on account of their laxness of discipline. The name is derived from Jacob Ammon or Amen, who insisted that the doctrines set forth in the Dort Confession of Faith should be interpreted literally and accepted strictly. In late years this strictness has been relaxed and the main body of Amish is practically reunited with the Old Mennonites in the Mennonite Church.

3. Old Order Amish Mennonite Church.—This body represents the stricter descendants of Jacob Amen and the Swiss Amish of the 18th century. While the main body of Amish were approaching agreement with the main body of Mennonites, the stricter wing were holding the older position resulting in the organization in 1865 of the Old Order Church. This body is opposed to building churches, holding that one place is as sacred as any other and that separate church buildings savor of ritualism. They therefore hold their meetings in private houses, which necessarily makes their congregations small. A Sunday service usually continues about four hours, and is exclusively in German. They use the old hymnal, *Aus bund,* first published for the Swiss brethren in 1571 and reprinted many times in America. The tunes supposed to be the original have never been committed to musical notation and of course never printed. The sermon is without text, and traces God's dealing with the race from Adam down, setting forth the sinfulness of sin and God's love and care for his obedient children. On communion Sundays services are continued from morning till night without intermission, several ministers being in attendance to keep them going. There is no church property, except hymnbooks, plain benches and utensils necessary to the preparation of a plain dinner. Houses and clothing of families, who observe a sort of community life, are very plain, carpets, curtains and wall pictures being forbidden. They have a few Sunday schools and no missionary or benevolent societies, schools or periodicals. They use the ban in discipline, following the example of the original Amish, who in some cases use the extreme penalty of separation of husband and wife. The person against whom the ban was pronounced was cut off from social and family intercourse with all members of the church and was treated as an outcast. The census of 1936 credits the Old Order Amish Church with 8,600 members, an increase of nearly 3,000 in 10 years, 127 churches and 355 ministers.

4. Church of God in Christ.—A small body of reformers, led by John Holdeman who insisted that the Mennonite Church had forsaken its original foundations. It originated in Ohio in 1859. Holdeman revived the ban as formerly observed in Europe. The body had subsequently considerable accessions of Russian Mennonites, under whose influence the stricter views were gradually relaxed. The census of 1936 credits this body with 50 ministers, 26 churches, and 2,100 members. There has been little change in the first two items since 1906, but the number of members was doubled.

5. Old Order Mennonite Church (Wisler).—Jacob Wisler led a movement in opposition to innovations, such as revival meetings, Sunday schools, etc., which resulted in the organization, in 1870, of the Old Order Church. Other small bodies in Canada, Virginia and elsewhere, which occupied a similar position, joined with the Wisler movement, which holds strictly to the Dort Confession of Faith. The Church has 37 ministers, 23 churches and 1,848 members (census of 1936), each item indicating little change since 1906.

6. Reformed Mennonite Church.—This branch is also the result of a reform movement toward stricter regard for doctrine and discipline, led by Francis Herr and his son John. The Herrites have no fellowship whatever with other churches, and conduct no Sunday schools or missions. They are decreasing in number. In 1936 they had 25 ministers, 23 churches and 1,040 members, mostly in Pennsylvania.

7. General Conference of Mennonites in North America.—An attempt to unite various Mennonite bodies holding practically the same doctrinal views and observing the same practices, resulted in a general conference in Iowa, in 1860, and the organization of this body. Groups of Russian and German churches subsequently joined with it. It is active in missionary and educational work. There are boards of home missions, of foreign missions, of publication, of education and of emergency relief. Three colleges are maintained at Newton, Kan., Bluffton, Ohio, and Freeman, S. D. Several periodicals, including *The Mennonite,* weekly, are published at Berne, Ind. The General Conference accepts the Dort Confession, but does not observe the foot-washing ceremony in connection with the Lord's Supper, nor does it require the women to have a head covering during prayers and worship. Its platform of union is acceptance of the Dort Confession, salvation by grace through faith in Christ, baptism on confession of faith, refusal to take oaths, peace, non-resistance and practice of scriptural discipline. The General Conference, which is gaining in numbers, has, according to the census of 1936, 238 ministers, 138 churches and 25,780 members.

8. Mennonite Brethren in Christ.—This branch grew out of an evangelistic effort in Pennsylvania, in 1853. The first conference was formed in 1858. The movement spread and three groups came into existence, which united in 1879; subsequently other groups joined the body which took its present form and name in 1883. There is a general conference which meets every four years, and five district conferences in the United States and two in Canada. A weekly newspaper, *The Gospel Banner,* is published in New Carlisle, Ohio. The General Conference has 125 ministers, 125 churches and 9,000 members.

9. Defenceless Mennonite Church.—A small body of 1,500 members, which insists upon a definite experience of conversion, organized under the leadership of Henry Egli, in 1860, an offshoot of the Amish branch. It has a mission in Africa and is akin to the conference of Defenceless Mennonites known, until recently, as the Minnesota and Nebraska Conference of Mennonites and now affiliating with the Mennonite Church. (See 1. *Mennonite Church, supra.*)

10. Mennonite Brethren Church.—This body, which was not reported by the census of 1906, has three district conferences in the United States and one in Canada. It conducts home and foreign missions and has a college at Hillsboro, Kans., where it publishes the *Zion's Bote.* The census of 1936 gives this church 201 ministers, 62 churches and 8,200 members.

11. Krimmer Brueder Gemeinde.—A union of two bodies of Brueder Gemeinde, which came originally from Russia, where they separated from the main body of Mennonites, because they were thought to be lax in religious life and discipline. They differ from other Mennonites in baptizing by immersion and not by pouring, and they formerly differed among themselves as to the mode, one group baptizing with a forward, the other with a backward movement. There are 1,852 members, with 32 ministers and 16 churches.

12. Hutterian Brethren.—These are descendants of the Hutter Brethren of South Russia. Their leader was Jacob Hutter, who was burned at the stake at Innsbruck, in the Tyrol, in 1536. The Hutterian Brethren are not strictly Mennonites, but agree with them and are so classed. They formerly observed community life in South Dakota, and have sometimes been called Bruederhoef Mennonites. They have (census of 1936) 926 members, with 31 ministers and 12 churches.

The *Kleine Gemeinde,* the *Stauffer Mennonites* and the *Central Conference* are small groups, differing in minor particulars among themselves and from other Mennonite bodies. The Central Conference in 1936 had a membership of 4,500 in 25 churches served by 32 ministers. Membership in all of the Mennonite bodies is highest in Pennsylvania.

Consult Smith, C. H., *The Story of the Mennonites* (Berne, Ind. 1940); Klein, H. M. J., *History and Customs of the Amish* (York, Pa. 1946); Wenger, J. C., *Glimpses of Mennonite History* (Scottdale, Pa., 2d ed., 1947); *Mennonite Yearbook and Directory,* published annually (Scottdale, Pa.). HENRY K. CARROLL, *Author of "Religious Forces in the United States."*

MENOCAL, Aniceto Garcia, American civil engineer: b. Cuba, Sept. 1, 1836; d. New York City, July 20, 1908. He was educated in Havana and was graduated from the Rensselaer Polytechnic Institute in 1862. In 1863–1869 he was engaged as sub-chief engineer of the Havana waterworks and in 1870 returned to New York, where he was two years in the engineering branch of the waterworks department. He was chief engineer of all the surveys made for the Isthmian Canal by the United States government and was sent to Paris in 1879 as member of the Canal Congress He was a member of several scientific societies and published many of his official reports.

MENOMINEE, the French FOLLES AVOINES, a tribe of North American Indians of Algonquian stock, formerly known in upper Michigan and Wisconsin, along the Menominee River and Green Bay, and ranging west to the Mississippi and south to the Fox River. Their name signifying "wild-rice men," hence the French translation is derived from their use as a staple food of the abundant wild rice of the region. Their descendants numbering about 1,890, civilized and Roman Catholics, inhabit Keshena Reservation, Wisconsin.

MENOMINEE, mē-nŏm'ĭ-nē, city, Michigan, Menominee County seat, altitude 581 feet, at the mouth of Menominee River, on Green Bay, an arm of Lake Michigan; on the Chicago, Milwaukee, St. Paul and Pacific, and the Chicago and North Western railroads; opposite Marinette, Wis., and 100 miles in direct line south of Marquette, 46 miles northeast of the city of Green Bay, Wis. It has car-ferry service to Frankfort, across the bay and lake, steamboat connections with lake ports, and is a port of entry. It has a county airport.

Situated in an extensive lumbering region, industries include some having connection with lumbering, as the manufacture of furniture. Machinery, electrical goods, limestone products, beet sugar, meat products, beer, and paper are important manufactures. The industrial payroll in the city's industries runs to about $25,000,000 annually.

The city has a public library and a hospital. Settled in 1799, Menominee received its city charter in 1883. It has a mayor and council form of government. Pop. (1930) 10,320; (1940) 10,230; (1950) 11,107.

MENOMONIE, city, Wisconsin, Dunn County seat, altitude 807 feet, on the Red Cedar River, the Chicago, Milwaukee, St. Paul and Pacific, and the Chicago and North Western railroads, and on state and federal highways; 26 miles by rail west of Eau Claire. Formerly it was an important lumbering center, and now processes dairy products, flour, and feed. Its principal industrial output is Parker pen products. There are brickyards.

The public library is the Mabel Tainter Memorial. The city is the seat of Stout Institute, a state teachers' college since 1911. Settled in the 1840's, Menomonie received its city charter in 1882. It has a mayor, six councilmen, and a superintendent of public works. Pop. (1940) 6,582; (1950) 8,245.

MENOPAUSE, the cessation of menstrual flow in women; climacteric. This epoch is reached generally between the 45th and 52d years,

and is frequently marked by nervous disturbances. The power of child-bearing terminates at the menopause. It is popularly termed the "change of life." A woman who begins child-bearing early and gives birth to a large family usually has her menopause earlier than a childless woman. The approach of the menopause is marked by irregular—usually delayed—menstruation, and sometimes the latter flows are very profuse and weakening. See CLIMACTERIC.

MENOPOME, a giant salamander of the genus *Cryptobranchus* (formerly *Menopoma*). See HELLBENDER.

MENOTTI, mā-nôt'tē, **Gian-Carlo** jän-kär'lō, Italian composer and dramatist: b. Cadegliano, near Milan, July 7, 1911. At the age of eleven, he had written his first opera, *The Death of Pierrot,* and, along with the other nine children, participated in the family chamber music group. He attended the Milan Conservatory for two years and in 1928 came to the United States to study at Curtis Institute under Rosario Scalero. In 1933 he began work on the libretto and music for *Amelia Goes to the Ball* which was successfully produced at the Philadelphia Academy of Music in 1937 and at the Metropolitan Opera House the following year. The National Broadcasting Company commissioned him to write an opera for radio, *The Old Maid and the Thief,* which was presented in 1939. Among his other works are *The Island God,* another opera produced at the Metropolitan; *The Telephone* (q.v.), a burlesque of the Donizetti style which despite a melodic eclecticism developed a creative style of its own; *The Medium* (q.v.), a contemporary example of verism; *Sebastian,* a ballet; *Errand Into the Maze,* a ballet produced by Martha Graham; a Piano Concerto; a Pastorale for string orchestra; and *Variations on a Theme of Robert Schumann* which won the Lauber Musical Award in 1931. In 1946 he began work on another comic opera, *The Last Superman,* after winning the Guggenheim Fellowship award of $2,500. In the summer of 1947, he directed his own play, *A Copy of Madame Aupic,* at New Milford, Conn.

MENPES, Mortimer, English artist: b. Adelaide, South Australia, 1859; d. April 1, 1938. He went to London when 19, studied at South Kensington; spent three years in Brittany at Pont Aven; traveled throughout Europe, Asia, and Mexico; and wherever he went continued his early experiments in color and his attempts to reproduce the atmosphere of various localities. He revived the lost art of printing in color from etched plates; made some excellent dry point etchings, notably one of Hals' *Archers of Saint Adrian.* During 1900 he was war correspondent in Africa for *Black and White.* He also supervised the reproduction of *The Menpes Series of Great Masters.* Among his publications are *War Impressions* (1901); *World Pictures* (1902); *The Durbar* (1903); *Whistler as I Knew Him* (1904); *India* (1905); and *Sir Henry Irving* and *Thames* (1906).

MENSA, or **MONS,** *in astronomy,* one of the 14 constellations which Lacaille discovered at the Cape of Good Hope. It is named from the mountain which is a conspicuous feature of the landscape at the Cape. The constellation is a very inconspicuous one near the South Pole, its brightest star being only of 5.3 magnitude.

MENSTRUATION, the periodical discharge of the menses or bloody fluid from the female generative organs. In women it normally occurs at intervals of one lunar month, or 13 times a year (hence the use of the term *menses,* Latin plural of *mensis,* month). Its first appearance marks the stage of puberty, and is usually attended by definite changes—enlargement of the breasts, showing development of the mammary glands, growth of the ovaries, of the uterus and external genital organs, etc., and by other signs, physical and mental, of approaching womanhood and maturity. It usually begins in temperate climes between the 13th and 15th year; in hot climates it is apt to commence as young as 12 years, and in very cold climates as late as 17 years; its periodic recurrences continue until the menopause (q.v.) or final cessation of the discharge, which ordinarily arrives somewhere between the 45th and 52d years. The recurrent periods of its appearance, as well as their duration, vary with different females, and not infrequently in the same individual; the variations, however, not always indicating abnormal or pathological causes. The immediate cause of menstruation is the breaking away of an ova or egg from one of the ovaries. (See OVARY). Menstruation is often at first, and in many persons throughout the catamenial age, attended by characteristic pains and symptoms, with physiological and psychological conditions of disturbance or depression, which sometimes call for special hygienic treatment. During pregnancy (with exceptional cases) there is no menstrual flow, its cessation being one of the earliest signs of conception. Observance of wholesome rules of exercise, rest, etc., helps to maintain normal conditions of body and mind, the reverse of which, owing to neglect of such rules, so often makes the menstrual function a visitation of dread and distress.

Disorders of Menstruation.—These include amenorrhoea, dysmenorrhoea, menorrhagia and metrorrhagia. Amenorrhea is an absence of the menstrual flow from some cause other than pregnancy or the approach of the menopause (q.v.) or tardy establishment of the menstrual function. It is a symptom of anemia (q.v.), or may be due to a constitutional condition such as profound nerve-fag or tuberculosis. Strychnine, iron and ergot may be administered internally or the physician may apply local treatment. (See DYSMENORRHOEA). Menorrhagia is an abnormally profuse flow during the menstrual period, due to one of several conditions. If not checked by rest, a physician is necessary, as also in metrorrhagia, which is a sanguineous flow between the menstrual periods.

MENSURAL MUSIC. Mensural or measured music is a term applied to a historical style of composition in which the tones bore exact relations to each other in regard to length or time. Such a designation and the occasion for it may appear strange, as precise rhythm seems to belong to the essence of music. This, however, is not the case; there was a period when notes were not exactly measured, and mensural music is a subsequent development from this early practice.

All European music of a higher character

was originally cultivated in connection with speech or poetry. This is true of the music of the Greeks as well as the early Christians. But speech is not necessarily rhythmical. Ordinary speech is not so at all, and even poetry is not always characterized by the exact time relations typical of strictly measured music. A trochee can be delivered either in two or three part time, the accented syllable matching the unaccented in duration or requiring double as much time. And in impassioned utterance rhythmical relations are apt to be lost sight of altogether. Moreover, any rhythm which the accompanying tones may possess would be theirs only by virtue of the words to which they are added: it would be a rhythm of the poetry, not of the music.

Such was the case in Greek music. Although instrumental performances were also in vogue among the Greeks, music with them, as we have said, was primarily vocal. We know little of its exact character, but are probably justified in regarding it as a species of recitative, the words guiding the course of the tones. In Christian times the earliest fixed type of the art was the Ambrosian chant, formulated by Saint Ambrose of Milan in the 4th century. This, too, was similar to Greek music in its adherence to the rhythm of the words. A change was wrought by Pope Gregory the Great, two centuries later. What distinguishes his chant from the Ambrosian is supposed to be the uniform length of its tones, giving it a character similar to that of our choral. However, this is probably true only in part. According to the historian Ambros, the sections of the chant which were sung by many voices may have been measured and regular, but the utterances of the priest must have retained much rhythmical variety. The real difference is formulated by him as follows: "The Ambrosian chant was based essentially on the poetical metre, the Gregorian on the musical." Whatever the exact nature of the difference, however, there is no doubt that Gregory effected a liberation of the tones from the rhythmical shackles of the words. And this was a gain of far-reaching importance. Music had now won its independence, and the way was prepared for the development of mensural composition.

The more immediate occasion for this development was the introduction of harmony. Just as music had primarily been vocal, so also it had been unisonal in character. Though a second tone may occasionally have been added to the principal part, nothing like the later polyphony was attempted. In the 9th century, however, the so-called Organum of Hucbald makes its appearance. In this the theme is systematically accompanied by one, two or three other voices, singing intervals of a fourth, fifth and octave in parallel motion. The point was now reached beyond which no further advance was possible without an exact designation of the length of the notes. As long as the singing had been confined to a single person this was not necessary. Nor was it necessary in the case of several persons chanting in unison, if the length of the notes was regulated by the natural accent of the words, or if all the tones were of equal length. In the Organum, however, a certain care was already required. The singers had to stand so that they could see as well as hear each other, and one among them acted as leader, introducing the new notes at the proper moment. The Organum now developed in various directions. There was a more independent progression of parts, contrary alternating with parallel motion, and the tones no longer coincided with each other note for note, but one voice sang two or more tones while the other sang one. Manifestly this required an understanding as to the relative duration of the tones, and a method of designating the differences graphically. The first person to formulate the solution of this problem was Franco of Cologne, who lived about the year 1200. Previous to him tones of two lengths, the longa and brevis, had already been recognized. He also admitted the duplex longa or maxima,—twice as long as the longa, and the semi-brevis,—half as long as the brevis. The notes in question were represented as follows:

Rests were also indicated by Franco, by means of appropriate signs. The bar-line was not yet in use, but measure was recognized, being at first confined to triple or "perfect" time. Duple or "imperfect" time was only permitted at a later date.

There were many complexities in the system as promulgated by Franco and his followers. Thus the length of the notes was not only determined by their own character and appearance, but also depended on the neighboring notes. There were "alterations" and "imperfections," "prolations" and "ligatures," but space will not permit us to enter into all these involved details, which have only a remote historical interest. The rules governing mensural music were further elaborated—among other writers—by Marchettus of Padua, who lived about a century after Franco; and Jean de Muris, a celebrated theoretician of the 14th century. Notes of shorter duration were gradually introduced, such as the minima, semiminima, fusa and semi-fusa. And the notation too was modified, until it finally assumed the appearance to which we are accustomed to-day. Together with the Organum, mensural music furnished the basis for all subsequent advances in the art. It was the indispensable prerequisite for the growth of rhythmical and contrapuntal variety. It made possible the wonderful development in part writing which was soon to take place in the Netherlands, and which was eventually to lead to the glories of modern instrumental and choral music. In fine, it may be regarded as one of the two or three great elementary contributions to the art, on which the dazzling superstructure of modern beauty and inspiration has been erected.

ALBERT GEHRING,
Author of 'The Basis of Musical Pleasure,' etc.

MENSURATION. Mensuration is that branch of applied mathematics which treats of the metrical relations of geometric figures, in particular of the length of lines, the magnitude of plane and solid angles, the area of surfaces and the volume of solids. The term is used both for the act and for the art of measuring geometric magnitudes. Mensuration is not usually treated as a separate branch of mathe-

matics, but occurs as an integral part of various subjects, such as plane geometry, solid geometry, trigonometry and integral calculus. For a discussion of the measurement of plane, diedral, spherical and solid angles and of the relations between the sides and angles of a triangle (plane or spherical) the reader is referred to the article on TRIGONOMETRY. The present article will give formulas for lengths, areas and volumes of the simpler and the regular figures and methods of approximation for the more complex or irregular figures.

The measure of a geometric magnitude is its ratio to a fixed magnitude of the same kind selected as the unit of measurement. Throughout this article the unit of area is assumed to be a square each side of which is equal to the unit of length, and the unit of volume is a cube whose edges are likewise of unit length. The purpose of a formula is to show how one of these numbers (ratios) may be found from certain others which are supposed to be known or obtainable. Thus formula (XIX) says that the ratio of the area of a circle to that of a square each side of which is a foot long (that is, the area of the circle measured in square feet) may be obtained by multiplying together the ratio of the circumference to the unit of length known as a foot, the ratio of the radius to the same unit of length, and the number ½. It is important to recognize that in using any formula the units must all be of the same system. The number of acres in a field cannot be found directly from formula (X) by multiplying together the number of rods in two adjacent sides: this would give the number of square rods in the field. Nor is the number of gallons in a barrel given by formula (LXV) when the radii are measured in feet or in inches, but the number of cubic feet or cubic inches, as the case may be. In order to change any measure from one system of units to another the following table may be found useful:

To change		Multiply by	Inverse
in.	to cm.	2.53998	.393704
ft.	to m.	.304797	3.28087
miles	to km.	1.60933	.621377
sq. in.	to sq. cm.	6.45148	.155003
sq. ft.	to sq. m.	.0929013	10.7641
sq. ft.	to acres.	.0000229568	43560.
sq. yds.	to acres.	.000206612	4840.
sq. miles	to acres.	640.	.0015625
cu. in.	to cu. cm.	16.3866	.0610254
cu. ft.	to litres.	28.3161	.0353156
cu. in.	to gallons.	.004329	231.
cu. cm.	to gallons.	.000264184	3785.238

[in.= inches, ft.= feet, yds.= yards, sq.= square, cu.= cubic, m.= meters, cm.= centimeters, km.= kilometers].

(For other multipliers see WEIGHTS AND MEASURES). The second column of figures serves to change the unit in the opposite way to that indicated by the rest of the table: thus to change meters to feet multiply the number of meters by 3.28087; for instance, 10 meters is equal to 32.8087 feet.

In many cases the computation of area or of volume may be accomplished most easily by mechanical means. For the measurement of the area of plane figures ingenious and effective instruments known as planimeters have been invented. Two historic instances are the finding by Galileo of an approximate value for the area of a cycloid by cutting it out of a sheet of copper and weighing the model, and the discovery by Archimedes of a fraud in Hiero's new crown through measuring its volume by submersing it in water and measuring the water displaced. To apply this last method, multiply the number of ounces of water by 1.73, or less accurately by $\frac{7}{4}$, and the result will be the number of cubic inches in the object; or, measure directly the volume of the water displaced.

LENGTH OF LINES.

Circle.— The *circumference* of a circle is equal to the diameter multiplied by

3.14159265358979323846264338328 . . . . . .

This constant is usually denoted by the Greek letter π (pī) and is approximately equal to

$$3\tfrac{1}{7}, \quad \tfrac{8\,5\,5}{1\,1\,3}, \quad \text{or} \quad 3.1416.$$

Use the first if an error of one two-thousandth of the final result may be neglected, and the last if an error of one four-hundred-thousandth is negligible.

The above theorem may be written

$$l = \pi d, \qquad = 2\pi r, \qquad \text{(I)}$$

where l = length of circumference, d = diameter and r = radius.

The length l of the arc AMB in Fig. 1, in which MD is the perpendicular at the middle point of the chord AB, AE is tangent to the circle at A or perpendicular to the radius OA, OE is perpendicular to AM, the chord of half the arc or the angle AOE is one-fourth of the angle AOB, may be found by any one of the formulas

$$l = \frac{\pi}{180} dr, \quad \frac{\pi}{180} = \frac{1}{57} \quad \text{(error about } \tfrac{1}{3\,0\,0}\text{)} \qquad \text{(II)}$$

$$l = c + \frac{8}{3}\frac{h^2}{c}, \qquad \text{(III)}$$

$$l = 2k + \tfrac{1}{3}(2k - c), \qquad \text{(IV)}$$

$$= \tfrac{1}{3}(8k - c),$$

$$l = t + s, \qquad \text{(V)}$$

in which d = number of degrees in the angle AOB, r = radius OA, c = chord AB, h = height MD, k = chord of half the arc AM, t = length

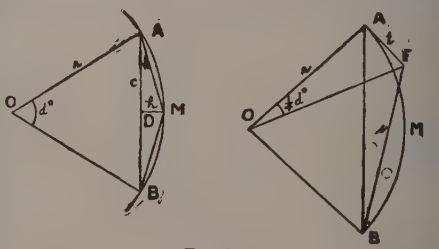

FIG. 1.

of AE, and s = length of BE. Formulas (III), (IV) and (V) are only approximate, the error being small only if the angle AOB or the ratio of h to c be small. Thus for an angle of d=90° the arc is 1.5708 . . . , whereas formulas (III), (IV) and (V) give 1.576 . . , 1.5696 . . , 1.5732 . . , respectively.

Parabola.—The length l of the arc AVB of the parabola in Fig. 2 is

$$l=\sqrt{y^2+4x^2}+\frac{y^2}{2x}\left(\log\frac{2x+\sqrt{y^2+4x^2}}{y}\right)\ldots, \quad \text{(VI)}$$

where $x=VD$, $y=AD$, and the logarithm is taken to the base e.

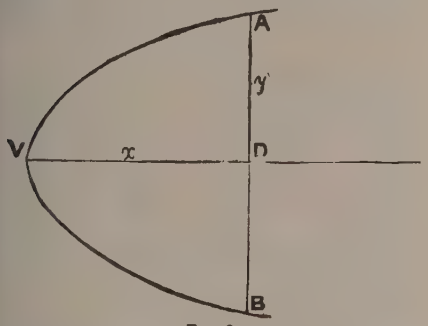

Fig. 2.

Ellipse.—The length l of the circumference $ABA'B'$ of ellipse in the next figure (Fig. 3), in which F and F' are the foci ($BF=BF'=OA$), is

$$l=2\pi a\left(1-\tfrac{1}{4}e^2-\tfrac{3}{64}e^4-\tfrac{5}{256}e^6\ldots\right), \quad \text{(VII)}$$

or approximately

$$l=\pi\sqrt{2(a^2+b^2)} \quad \text{(VIII)}$$
$$=4.443d;$$

where e is the eccentricity $\left(OF/OA=\frac{1}{a}\sqrt{a^2-b^2}\right)$; $a=OA$, one-half the longest diameter; $b=OB$, one-half the shortest diameter; $d=AB=\sqrt{a^2+b^2}$.

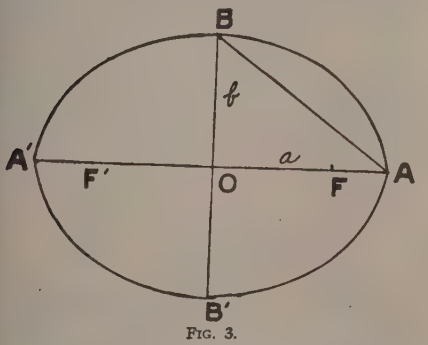

Fig. 3.

General Methods of Approximating the Length of Any Curved Line.—Divide the line into parts each of which differs but little

Fig. 4.

from a small circular arc. Then each portion may be found by any one of the formulas (III), (IV) or (V). A convenient method for the use of formula (IV) is indicated by the diagram herewith (Fig. 4) and formula (IX). The only restrictions upon the location of the points 1, 2, 3, 4, . . . in addition to that given above is that the odd-numbered ones must be half-way between the others and that there should be an odd number of points in all.

$$l=\overline{A1}+\overline{12}+\overline{23}+\ldots)+\tfrac{1}{3}[(\overline{A1}+\overline{12}+\overline{23}+\ldots)$$
$$-(\overline{A2}+\overline{24}+\overline{46}+\ldots)]. \quad \text{(IX)}$$

Area of Plane Figures.

Rectangle.—The area a of a rectangle, the lengths of two adjacent sides of which are b and c respectively, is

$$a=bc. \quad \text{(X)}$$

Triangle.—The area a of the triangle ABC (Fig. 5) is

$$a=\tfrac{1}{2}hb, \quad \text{(XI)}$$
$$a=\tfrac{1}{2}bc\sin A, \quad \text{(XII)}$$
$$a=\sqrt{s(s-a')(s-b)(s-c)}, \quad \text{(XIII)}$$

or

$$a=\tfrac{1}{2}b^2\frac{\sin A\cdot\sin C}{\sin(A+C)}; \quad \text{(XIV)}$$

where a', b, c are the lengths of the sides BC, CA, AB, respectively; h is the perpendicular distance (height) of B from AC; s is one-half of the sum of the sides: $s=\frac{1}{2}(a'+b+c)$.

If one angle of the triangle (say A) is a right angle, both formulas (XI) and (XII) simplify: namely, the era is one-half the product of the two sides which enclose the right angle ($a=\frac{1}{2}bc$). For a simple method of finding the area of an equilateral triangle ($a'=b=c$) multiply the square on one side by $\frac{13}{30}$ ($a=\frac{13}{30}b^2$, approximately), see formula (XVIII).

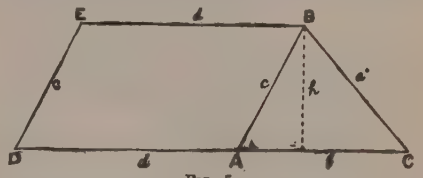

Fig. 5.

Parallelogram.—The area a of the parallelogram $ABED$ (Fig. 5) is

$$a=d\,.\,h, \quad \text{(XV)}$$

or

$$a=cd\sin D, \quad \text{(XVI)}$$

where c and d are the lengths of two adjacent sides, D is the angle between them, and h is the perpendicular distance between the two parallel sides whose length is d.

Trapezoid.—The area a of the trapezoid $CBED$ (Fig. 5), any four-sided figure with two of the opposite sides (BE and DC) parallel, is

$$a=\tfrac{1}{2}h(d+e), \quad \text{(XVII)}$$

where h is the perpendicular distance between the two parallel sides and d and e are the lengths of the parallel sides ($d=BE$, $e=DC$).

Regular Polygon.—The area a of a polygon bounded by n equal sides each of length s and having its n angles all equal is

$$a=s^2\times\frac{n\cot\frac{180^\circ}{n}}{4}. \quad \text{(XVIII)}$$

The following table gives (approximately) the value of the multiplier in the simpler cases:

NAME	n	$\frac{n \cot \frac{180°}{n}}{4}$.
Triangle	3	.433013
Square	4	1.
Pentagon	5	1.72048
Hexagon	6	2.59808
Heptagon	7	3.63391
Octagon	8	4.82843
Nonagon	9	6.18182
Decagon	10	7.69421
Undecagon	11	9.36564
Dodecagon	12	11.19615

Thus, for instance, if the side of a regular hexagon be 9 feet, its area is $81 \times 2.59808 = 210.4445$.

Irregular Polygon.— The area of an irregular polygon may be found by dividing it into parts each of which is a triangle, parallelogram, rectangle or trapezoid. Thus if we draw a system of parallel lines across the polygon, one through each vertex, each part will be a triangle or trapezoid and its area may be found by formulas (XI) or (XVI).

Circle.— The area a of a circle, whose radius is r and whose circumference is l, is

$$a = \tfrac{1}{2}lr, \qquad \text{(XIX)}$$

or $a = \pi r^2$. $\pi = 3.1416 = \frac{22}{7}$ (nearly). (XX)

The area a of the sector $OAMB$ (Fig. 1), in which l is the length of the arc AMB and d is number of degrees in the angle AOB, is

$$a = \tfrac{1}{2}lr, \qquad \text{(XXI)}$$

or $a = \frac{\pi}{90} dr$, $\frac{\pi}{90} = .034906585 = \frac{1}{28.6}$ (nearly).

The area a of the segment $AMBD$ (Fig. 1) is

$$a = \tfrac{1}{2}r(l - r \sin d°), \qquad \text{(XXII)}$$

$$a = \tfrac{2}{3}ch + \frac{h^3}{2c} \text{ (approximately)}, \qquad \text{(XXIII)}$$

or

$$a = \tfrac{2}{3}ch \text{ (approximately)}, \qquad \text{(XXIV)}$$

where r, l, c, h, d have the same meanings as in formulas (II), (III), (IV) and (V).

Parabola.— In Fig. 2 the area a of the segment $VABD$ with base $AB = 2y$ and height $VD = x$ is

$$a = \tfrac{4}{3}xy. \qquad \text{(XXV)}$$

Ellipse.— In Fig. 3 the total area a' of the ellipse $ABA'B'$, of which the length of the longest diameter $A'A$ is $2a$ and the length of the shortest diameter BB' is $2b$, is

$$a' = \pi ab, \quad \pi = 3.1416 \qquad \text{(XXVI)}$$

General Methods of Approximation.— Any plane area can be divided into parts each of which is a rectangle or differs from a rectangle in that one side is a simple curve as in Fig. 6. It is therefore sufficient to give methods by which an area, such as $ABB'A'$ following, may be measured.

1. The Trapezoidal Method.— Divide the base line AB into any number of equal parts, AP, PQ, QR, . . . , TB and erect the perpendiculars PP', QQ', . . . , TT'. Then if each portion $A'P'$, $P'Q'$, ... , $T'B'$ of the curve $A'B'$ is nearly coincident with its chord, the area a is

$$a = \overline{AP}[(\overline{PP'} + \overline{QQ'} + \overline{RR'} + \ldots + \overline{TT'}) + \tfrac{1}{2}(\overline{AA'} + \overline{BB'})]. \qquad \text{(XXVII)}$$

2. Simpson's Rule.— Divide the base line into any *even* number of parts (in Fig. 6 it is

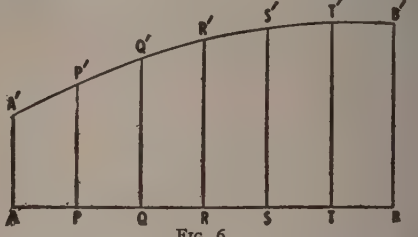

FIG. 6.

divided into six parts); erect the perpendiculars as before. Then

$$a = \tfrac{1}{3}\overline{AP}[\overline{AA'} + \overline{BB'} + 2(\overline{QQ'} + \overline{SS'} + \ldots) + 4(\overline{PP'} + \overline{RR'} + \overline{TT'} + \ldots)]. \qquad \text{(XXVIII)}$$

3. Weddle's Rule.— Divide the base into exactly *six* equal parts (as in Fig. 6), then

$$a = \tfrac{1}{10}\overline{AB}[5(\overline{PP'} + \overline{RR'} + \overline{TT'}) + \overline{RR'} + \overline{AA'} + \overline{QQ'} + \overline{SS'} + \overline{BB'}]. \qquad \text{(XXIX)}$$

SURFACE AND VOLUME OF SOLIDS.

Prism.— This includes any solid two of whose faces, known as the *bases*, are equal polygons situated in parallel planes and all the other faces, the *lateral* faces, are parallelograms. Thus in the following diagram (Fig. 7) the polygons ABC . . . and $A'B'C'$ . . . are the bases and the parallelograms $AA'B'B$, $BB'C'C$, . . . are the lateral faces. The edges AA', BB', CC', . . . are the lateral edges. The polygon UVW . . . lying in a plane perpendicular to one, and so to all, of the lateral edges is called a *right section*. The right section is equal to the base if and only if the lateral edges are perpendicular to the base.

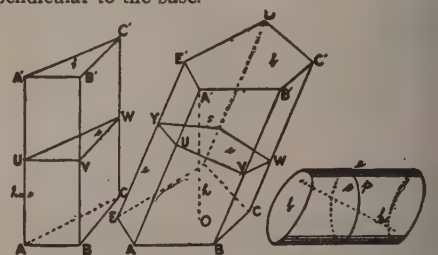

FIG. 7.

For the lateral area a which is the sum of the lateral faces $AA'B'B$, $BB'C'C$ . . . , and the volume v of a prism we have the formulas

$$a = e(\overline{UV} + \overline{VW} + \ldots), \qquad \text{(XXX)}$$

$$v = es, \qquad \text{(XXXI)}$$

$$v = hb, \qquad \text{(XXXII)}$$

in which e = length of a lateral edge (AA' or BB' . . .), s = area of a right section (UVW . . .), h = height, i.e., distance between bases, b = area of a base.

The volume v of a *truncated triangular prism*, that is one with three lateral faces and

whose bases are not parallel (therefore the lengths e_1, e_2, e_3 of the lateral edges not equal) is

$$v=\tfrac{1}{3}s(e_1+e_2+e_3). \qquad \text{(XXXIII)}$$

Any truncated prism may be divided into truncated triangular prisms and its volume thus found. For a four-sided prism whose opposite lateral faces are parallel this gives

$$v=\tfrac{1}{2}(e_1+e_2)s, \qquad \text{(XXXIV)}$$

where e_1, e_2 are a pair of opposite edges.

Cylinder.— This includes any solid having two *bases* which are equal plane figures bounded by curved lines (such as circles, ellipses or irregular figures), and situated in parallel planes, and the rest of the surface of the solid such that it may be thought of as consisting of an infinite number of parallel straight lines. If we call the length of each of these (equal) parallel lines e, the formulas for the prism given above (XXX, XXXI, XXXII) apply also to the cylinder, namely, the lateral area a and the volume v are

$$a=ep, \qquad \text{(XXXV)}$$
$$v=es, \qquad \text{(XXXVI)}$$
$$v=hb, \qquad \text{(XXXVII)}$$

where p is the length of the boundary, and s is the area of the section of the cylinder by a plane perpendicular to one of the lines lying on the lateral surface.

If the right section of a cylinder be a circle, the base, unless a circle, is an ellipse and its area is found by formula (XXVI). If in such a circular cylinder the bases are not parallel and the distance between the centres of the bases is l, then the area a and the volume v are

$$a=lp, \qquad \text{(XXXVIII)}$$
$$=2\pi rl, \qquad \text{(XXXIX)}$$
$$v=ls, \qquad \text{(XL)}$$
$$=\pi r^2 l, \quad \pi=3.1416, \qquad \text{(XLI)}$$

where r is the radius of the right section. These formulas are equivalent to (XXXV) and (XXXVI) when the bases are parallel, since then $l=e$.

Pyramid and Cone.— The volume v of any solid, such as those in Fig. 8, whose surface consists of a base, which is a plane figure of *any* kind, triangle, polygon, circle, ellipse, etc., and of triangles or curved areas which may be thought of as composed wholly of straight lines, joining the boundary of the base to some point (the vertex) not in the same plane as the base, is

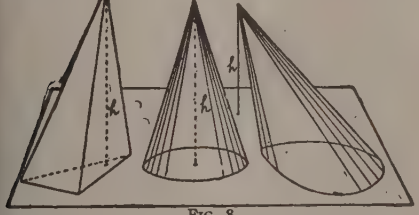

FIG. 8.

$$v=\tfrac{1}{3}bh, \qquad \text{(XLII)}$$

where b is the area of the base and h is the perpendicular distance (height) of the vertex from the plane of the base.

For a right circular cone, that is one in which the base is a circle and the line joining the vertex to the centre of the base is perpendicular to the plane of the base, the area a of the curved (lateral) surface is

$$a=\pi re, \quad \pi=3.1416 \qquad \text{(XLIII)}$$

where r is the radius of the base and e is the distance from the vertex to any point in the circumference of the base.

Prismatoid.— The volume v of any solid, whose total surface consists of two plane figures (the *bases*), of any character whatever, lying in parallel planes, and a lateral surface made up of triangles, trapezoids, or curved portions which may be thought as made up of straight lines joining the boundaries of the bases, is

$$v=\tfrac{1}{6}h(b_1+b_2+4m), \qquad \text{(XLIV)}$$

where h is perpendicular distance (height) between the bases, b_1 and b_2 are the areas of the bases, and m is the area of a section of the solid by a plane parallel to and half-way between the planes of the bases; or

$$v=\tfrac{1}{3}h(b+3q), \qquad \text{(XLV)}$$

where b is one of the bases and q is the area of a section parallel to and two-thirds of the way from, that base to the other.

Solids of Revolution. Sphere.— The area s of the surface and the volume v of a sphere of radius r are

$$s=4\pi r^2, \qquad 4\pi=12.56637\ldots \qquad \text{(XLVI)}$$
$$v=\frac{4\pi}{3}r^3, \qquad \frac{4\pi}{3}=4.18879\ldots \qquad \text{(XLVII)}$$

The volume v and lateral area a of a *segment* of a sphere (that is the part lying between two parallel planes) are

$$v=\frac{\pi}{6}h[h^2+3(r_1^2+r_2^2)], \quad \frac{\pi}{6}=.5236\ldots \qquad \text{(XLVIII)}$$
$$a=2\pi hr, \qquad \text{(XLIX)}$$

where h is the height of the zone (perpendicular distance between the parallel planes of the bases), r_1 and r_2 are the radii of the bases respectively, r is the radius of the sphere.

Spheroid.— For a *prolate* spheroid, that is the solid formed by revolving an ellipse about its longest diameter (in Fig. 3, about AA'), the area s of the surface and the volume v are

$$s=2\pi\left(b^2+\frac{ab}{e}\sin^{-1}e\right), \qquad \text{(L)}$$

or $$s=2\pi b(b+fa), \quad \text{(approximately)} \qquad \text{(LI)}$$

where a, b and e have the same significance as in (VII) and (VIII) and

$$f=1+\tfrac{1}{6}c+\tfrac{3}{40}c^2+\tfrac{5}{112}c^3+\tfrac{35}{1152}c^4+\tfrac{63}{2816}c^5+\ldots,$$

in which $c=1-\frac{b^2}{a^2}$. Or less accurately

$$s=\frac{\pi}{3}b\left[7a+b\left(6-\frac{b}{a}\right)\right], \quad \frac{\pi}{3}=1.0472; \qquad \text{(LII)}$$

$$v=\frac{4\pi}{3}ab^2, \quad \frac{4\pi}{3}=4.18879\ldots \qquad \text{(LIII)}$$

The volume v of a *segment* of a prolate spheroid (part cut off by a plane perpendicular to the axis of revolution) the height of which is h, is

$$v=\frac{\pi}{3}h^2\frac{b^2}{a^2}(3a-h), \quad \frac{\pi}{3}=1.047198\ldots \qquad \text{(LIV)}$$

For an *oblate* spheroid, that is the solid formed by revolving an ellipse about its short-

est diameter (in Fig. 3, about BB') the corresponding formulas are

$$s=\pi\left(2a^2+\frac{b^2}{e}\log\frac{1+e}{1-e}\right), \quad \text{(LV)}$$

or

$$s=2\pi(a^2+gb^2), \quad \text{(LVI)}$$

where

$$g=1+\tfrac{1}{3}d+\tfrac{1}{5}d^2+\tfrac{1}{7}d^3+\tfrac{1}{9}d^4+\tfrac{1}{11}d^5+\ldots,$$

in which

$$d=1-\frac{b^2}{a^2};$$

$$v=\frac{4\pi}{3}ba^2, \quad \frac{4\pi}{3}=4.18879\ldots \quad \text{(LVII)}$$

The volume v of a segment of an oblate spheroid is

$$v=\frac{\pi}{3}h^2\frac{a^2}{b^2}(3b-h). \quad \text{(LVIII)}$$

Paraboloid.— The volume v of the solid formed by revolving VAD in Fig. 2 about VD as an axis is

$$v=\frac{\pi}{2}xy^2, \quad \frac{\pi}{2}=1.5708\ldots, \quad \text{(LIX)}$$

which is just one-half the volume of the circumscribing cylinder.

The General Solid of Revolution.— The volume v of the solid formed by revolving any curve about a line lying in the same plane and not intersecting it, for instance by revolving $A'B'BA$ in Fig. 6 about AB as an axis, is

$$V=\frac{\pi}{3}.\overline{AP}[\overline{AA'}^2+\overline{BB'}^2+2(\overline{QQ'}^2+\overline{SS'}^2+\ldots)$$
$$+4(\overline{PP'}^2+\overline{RR'}^2+\ldots.)]. \quad \text{(LX)}$$

Or, as it is perhaps usually easier to measure the circumferences of the circles generated by PP', etc., than their diameters, if we denote the circumferences generated by A', P', Q'...., B' by a, p, q,..., b, respectively, the above formula may be written

$$v=\frac{1}{12\pi}.\overline{AP}[a^2+b^2+2(q^2+s^2+\ldots)+4(p^2+r^2+\ldots)],$$

$$\frac{1}{12\pi}=.0265258\ldots \quad \text{(LXI)}$$

The Regular Solids.— The area of the surface and the volume of the five regular solids may be found by means of the multipliers given in the following table:

NAME	Area = (edge)$^2\times$	Volume = (edge)$^3\times$
Tetrahedron	1.7320508	.1178511
Cube	6.	1.
Octahedron	3.4641016	.4714043
Dodecahedron	20.6457788	7.6631189
Icosahedron	8.6602540	2.1816950

(LXII)

General Method.— The volume of solids which do not come under any of the types treated above may be measured by an application of the prismatoidal formula (XLIV). Let $a_1, a_2, a_3, \ldots, a_{2n}, a_{2n+1}$ be the areas of a set of plane sections parallel to a suitably chosen base and dividing the solid into an even number ($2n$) of portions; a_1, a_{2n+1} being the end sections (that is, the solid lies wholly between a_1 and a_{2n+1}). The distance between consecutive cutting planes is to be the same throughout and to be taken so small that between the odd-numbered sections the solid is approximately a prismatoid. The area of a section may be found by surrounding it by a rectangle and measuring (by XXVII, XXVIII or XXIX) the portion of the rectangle outside of the section. If the distance between the sections be h, then

$$v=\tfrac{1}{12}h[a_1+a_{2n+1}+2(a_3+a_5+a_7\ldots+a_{2n-1})$$
$$+4(a_2+a_4+a_6\ldots+a_{2n})]. \quad \text{(LXIII)}$$

Barrel.— If d be the inside diameter of the end of a barrel, c the inside diameter at the middle, and l the length (or height) of the barrel, then the prismatoidal formula (XLIV) gives as the volume v

$$v=\frac{\pi}{6}l\left(\frac{d^2}{2}+c^2\right), \quad \frac{\pi}{6}=.5236. \quad \text{(LXIV)}$$

The following is said to be a better approximation:

$$v=\frac{\pi}{9}l\left(d^2+\frac{5}{4}c^2\right), \quad \frac{\pi}{9}=.349\ldots. \quad \text{(LXV)}$$

The volume v of the smaller portion of a partly filled barrel, that is, of the contents if the barrel is less than half full and of the empty portion if it is more than half full, is

$$v=.000472h(d^2+a^2+4b^2), \quad \text{(LXVI)}$$

where h is the distance of the surface of the contents from the nearest end, a is the diameter at the surface of the contents, and b is the diameter half-way between the surface and the nearest end.

WILLIAM FINDLAY.

MENTAL DEFECTIVES. See CHILDREN, DEFECTIVE; EDUCATION OF FEEBLE-MINDED OR MENTAL DEFECTIVES.

MENTAL DISEASES. Mental diseases may be of a great variety of types, of great variation in degree of intensity, ranging from harmless, senseless, such as, for instance, the celebrated saying of the Quaker to his wife, «All the world is queer save Me and Thee, and methinks at times Thee is also queer,» to the most destructive and violent of afflictions such as in mania, the epileptic furor, or the ecstasies of fanatical fervor. To describe them all would fill this volume.

Psychiatry is that branch of medical science that would study, organize that knowledge, and strive to modify, heal or stop mental disorders. It is a very old, possibly the oldest of the arts if not of the sciences, since distorted efforts at trying to modify nature were among the earliest functions of the primitive medicine man, the king or the priest, often combined in early history. Man and his Id have always worked on the pleasure principle. Pleasure is good, pain is bad. Dis-ease is some form of pain, hence bad, originally a foreign spirit to be exorcised, as by the primitive medicine man; today, some distortion of reality by a demanding Id impulse. The pathway travelled from ancient times to the present is worn, and beset with many conflicting ideas about mental disorders. Naturally this would be so when the complexities of mental functioning are taken under consideration. To one who would glimpse this history, the first warning is to be made aware of the tyranny of words. In logical science, it is the disease of nominalism. The Id, roughly analogous to the gasolene of a motor car, is the source of the main chief drives, for good or evil. This power needs to be regulated. Inhibited or repressed are words used

to designate this process, and the «Ego» the reasoning process having this variable function in hand. This is not the «Ego» or «Me» of the layman. Also another important check on the Id comes from an old and yet new source, the Super-ego, ancestrally learned and familiarly relearned principles. Everything we do or think is a balanced activity of these three sets of influences. When the «Id» will not give way to be controlled by the Ego and Super-ego, and gains its partial satisfaction through a *distortion of reality,* this, in the Freudian formulation, is a mental disease, a psychosis. Thus as an illustration, the psychosis known as «melancholia,» in which depression of mood, slowness of movement and ideas of guilt are the prominent signs. Psychoanalytic study has shown that the Id impulse that, for a variety of reasons, may be set in action, is one of hostility, or aggression, which could lead to murder (criminosis), but the Ego and Super-ego get to work, handling the impulse by a process of repressive incorporation. The love hate object, is incorporated, swallowed, *introjected,* as the breast was originally swallowed in nursing, and thus devoured. The Super-ego creates the sense of guilt. The Ego has distorted the real object of the ambivalent love and hate, the mother, after converting her into a holy image, even an hallucinatory angel with wings, etc. This is a complicated process. Simpler ones will be pointed out later.

That tendency to make a «word» stand for a «meaning»: the most significant of this type of difficulty is the word «insanity,» for instance, which has falsely come to be thought of as a synonym of mental disease, because of a 2000 year old faulty connotation. It started, Pliny the elder says, somewhere, with the property and imperial minded Roman lawyers. In those days they had the same difficulties with wills, contracts, murders, etc., etc., as we have today. Problems of responsibility, capacity to remember, etc., were then as now, and the doctors had to be consulted. These doctors were nearly always Greek, or Hippocratic in training. They followed the rules of analysis then as today. The patient was an individual, and he was so and so, or such and such, to which the terms anoia, paranoia, etc., were given. This was too much for the Roman lawyers. Away with your Greek subtleties! We will lump all these diseases and call them *insanities.* Thus today think most of the lawyers, and the courts of law and the whole machinery of medical jurisprudence. «Insanity,» psychiatry claims, is not a medical conception. It is a legal status made by a court of law. A person never is, but by reason of mental disease or defect «should be declared» to have a certain status before the law. Irresponsible for a homicide or theft, incompetent to know the extent of his property and the legal objects of his bounty, or whatever the specific question may be, instead of again using an anachronistic word, calling all of these various grades of social maladaptation, again by one word, insanity. This situation is one of the many that would support Charles Dickens when one of his characters states, «The law is an ass.»

In psychiatry as everywhere else in the growth, correlation and codification of knowledge, there is much confusion, overlapping, conflict and lag, but the main pathways through the jungle can be discerned and reduced to description.

As in all things of the spirit, the Greeks seemed to have been the harbingers of advance. Psychiatry began to be studied and understood by them. Some of psychiatry's most recent conceptions had definite and clear expression among the Greeks of the age of Pericles, even if the words used are not those of today. The poets and dramatists of Greece were the original psychiatrists, or as Whitehead puts it, «the ancient Greek tragedians, Aeschylus, Sophocles and Euripides, were the Pilgrim Fathers of the modern scientific imagination.» They used the word «Fate» where today science tries to use the word «law.» They stressed the innermost motives of many psychoses, and Freud's Oedipus complex conception had its first succinct expression in the dramas concerning the «House of Atreus.»

The Greeks, however, were not systematizers in those early days, but they distinguished and described certain forms of mental disease, which descriptions hold today in part, their ideas of causation apart. In rough terms anything then was «bile,» just as thirty years ago, everything was bacteria and toxins, and today it threatens to be endocrines and allergies. Every new discovery is the rallying point of a horde of devotees who spin off into a vortex of enthusiasm, rich in the gathering of new observations, and ultimately all fall back into the arms of the old Greek conceptions, the oneness of the body, and its wisdom.

Speaking very broadly, man's behavior, both within the organs of his body (organ behavior) and within his social setting (every day behavior) is a resultant of contradictory or limiting dynamic impulses. Man lives in a world of forces, he himself is a part of that world and only superficially separated from it. Through eons of time and by the process roughly understood as evolution he has come to be able to use for his own advantage and that of his neighbor, some of these forces that move him. Briefly they live within him and are active about him. Through evolution, *patterns of behavior of survival value* have been formed. Trial and error, have moulded these patterns, the good ones, so-called, survive, the bad ones are dropped but not all at once, nor in as sharp a manner as the phrases indicate. There is always a load of both to be managed. Thus man comes into the world with a long history of experience and with the possibility of a host of reaction patterns. Heredity is a name given to the more constant or stable patterns, whether they be organ patterns or social patterns. Thus one may speak of a «liver» as a bit of organized experience (Maudsley), which through eons of time of trial and error has stabilized its structure, learned its job and standardized its behavior. Every organ of the body can be so viewed. One organ of the body has grown as a sort of adjustor or regulator, or correlator of all the other organs of the body. This organ is the nervous system, made up of cells like other organs of the body, differing in structure and in function. The functions are, roughly speaking, to regulate and correlate the growth processes (metabolism) of the other organs of the body, to move and remove those organs of the body which have specific sensory and motor functions, and finally

through a process of abstraction to know or feel, or intuit the meaning of the environment, internal as well as external. This last function —a symbolic one—is called mental and by a mental disease, is understood a disturbance of the *meaning* of the environment, chiefly social.

Broadly speaking then three issues may be distinguished. There are diseases, solely or pre-eminently metabolic; these are mostly dealt with in the sphere known as Internal Medicine; there are diseases of the sensori-motor apparatus, these are mostly thought of as Neurological Disorders; and there are disorders of the symbolic functioning of the body, these are the Mental Disorders. There are very few disorders of the body however in which only one of these functional systems is alone involved. Even Socrates learned from the Thracians this important principle of the oneness of the body and its disorders.

When one comes to view the functioning of the dynamic symbolic systems, that is usually called the mind (statically), one gets insight into a definition of mental disease by a consideration of the Freudian formula of the relative energy activities in the instinct part of life —life and death instincts—love and hate if one will roughly speaking (creation or destruction) which in the formula is called the «Id.» The «Id» already likened to the gasolene of an internal combustion engine, supplies or is the reservoir of the creative power, the productive energy. That mental institution which has grown up to be a tester of the reality of the external world is called the «Ego.» Scholastic psychology has called it the Reason. Its chief function as a reality tester is to permit, or allow the energy coming from the Id to get its way, but an adaptive way, a useful way. It is a repressing mechanism and acts like a brake on the Id energies. To aid it the Freudian formulation adds another control mechanism, the Super-ego, which is largely built up on parental patterns and old survival values. It has been called «Conscience» in the older static psychologies.

When there is a conflict between the Ego and the Id and the forces of the Id are repressed one speaks of a psychoneurosis. In the hysteria psychoneurosis the repressed Id energy is drained through some bodily symptom —Conversion. In the compulsion neurosis a subsitution mechanism ensues. It is like a ritual. When however the Ego has to give way to the forces of the Id—the Ego then changes the environment. This is the formula of a definite mental disease, the psychosis. Psychoneuroses and psychoses are both mental disorders, but differ as to mechanism involved. There are mild recoverable psychoses and severe chronic psychoneuroses.

Classification.—Almost every psychiatrist of repute has attempted a classification of the mental disorders. The subject is one of peculiar difficulty, owing largely to the fact that our intimate knowledge of many of these various forms is far from complete.

A scheme of classification adopted by Jelliffe and White regards the diseases of the nervous system as falling into three general classes: (1) Those of the physico-chemical systems, affecting the neurology of metabolism, and expressed in visceral neuropathology and diseases of the glands with internal secretions; (2) those of the sensory-motor systems, including affections of the cranial nerves, the peripheral neurons, the spinal cord, medulla, cerebrum and cerebellum and the meninges, with syphilis of the nervous system, and (3) those of the psychical or symbolic systems (neuroses, psychoneuroses and psychoses). The last contains the manic-depressive group, the paranoia group, epilepsy, dementia precox, exhaustion and toxic psychoses and those associated with irreversible organic diseases, with senility, and finally idiocy, imbecility and feeble-mindedness. This last group are the mental diseases.

A most detailed elaboration of these appears as the 1935 classification of the American Psychiatric Association.

The methods of examination of the nervous system include a questionnaire covering the family history of the patient and his illnesses, and an elaborate physical examination of the vegetative nervous system, of the sensory and motor systems, followed by a thorough mental examination which in many respects is somewhat similar to the questions of the «intelligence tests» and qualification tests of the army. The psychiatrist comes in contact with a great many diseases whose mental element is very small, no greater in fact than that of the so-called physical diseases. The disorders in the physico-chemical systems produce diseases with mental aspects, but aspects no more mental than those of the diseases affecting the organs, muscles, glands, etc., to which those nerves go. It is only when we come to what are called the neuroses that we find mental behavior alone or predominantly disordered. These affections were called neuroses or «nerve troubles» on the supposition once accepted that the mental behavior was caused exclusively by some peculiarity, whether called abnormality or merely variation, in the structure of the nerve cells themselves. At the present time, however, scientific thought tends toward the conception that mental disease is determined by the loss of balance between the organism and its physical and psychical environment.

Thus there are nervous systems congenitally so weak that they are practically disintegrated by the conflict of the individual and society, a conflict which is, as often as not, absolutely unconscious, and which occurs in the simplest and least complicated social environment. In such natures mental disease at once appears because of the individual's inability to adapt himself to the rudimentary requirements imposed upon him from without. On the other hand, there are neural constitutions so strong or elastic that they are equal to a very severe strain of adaptation even to extraordinarily complicated environment. Such constitutions will naturally adapt themselves, retaining their own personal equilibrium and health, to conditions which would completely upset a weaker (that is, less adaptable) constitution. It may be here noted that the European wars brought out many such diversities of neural constitution in those subject to «shell shock» or other war psychoses, together with improved methods of testing for congenital neural weakness. These tests have resulted in putting in positions of less nervous strain those who are unable to stand the greater. A similar allotment of individuals to the various tasks of life would naturally result in less nervous disease. For it

is evident, when both factors are taken into consideration, the constitutional factor and that supplied by the environment, that mental disease is largely a matter of proportion between the nervous system and the load which is placed upon it. For example, a person who is not obliged to struggle for existence may never develop a mental disease which he would have developed, had he been subjected to the stress of adverse circumstances, while, on the other hand, his affluence may make him introversional, and, after the age of puberty, cause him rapidly to run counter to the demands of a true social existence.

The rôle of the unconscious in the etiology of mental diseases is a dominant one, and the comparative indefiniteness of the delimitations of the various types of mental disorders is due to the newness of any scientific knowledge concerning the unconscious portion of mental functioning. The neurologist should have, though unfortunately comparatively few do, as thorough a knowledge of the unconscious mental mechanisms as can be acquired, in addition to the medical specialist's knowledge of anatomy, physiology and histology.

But the conflict, conscious or unconscious, which occurs at the psychical or symbolic level of the Ego is manifested in predominantly mental modes in the so-called neuroses, psychoneuroses and psychoses. Of the psychoneuroses the commonest are *hysteria, compulsion neurosis* and *anxiety hysteria.* Of the actual neuroses there are *anxiety neurosis* and *neurasthenia,* while special cases present mixtures of these neuroses. As a mental disease, and not as popularly used to denote an uncontrolled emotional state, *hysteria* is now regarded as a partial dissociation of the personality, in which certain mental elements, namely, emotions and ideas, have been rejected from consciousness into the unconscious where they have an existence which is at least partly independent—an existence which is of vital importance to the welfare of the individual because it is an existence in which the split-off ideas and emotions have a growth or development of their own. This development is different in hysteria and in compulsion neurosis. In hysteria the mental elements, which are repressed from consciousness into the unconscious, direct or control a portion of the libido in such a way that its force has an incidence not upon the world of external reality, as is the case with the average person, but in the shape of work done in some shape or other. On the contrary the incidence of the libido falls upon the physiological functions themselves or upon certain of them through a variety of symbolic selection. This process, which is known as hysterical *conversion,* produces very many symptoms, mostly of a so-called bodily nature. There results from this a large number of disorders which the general practitioner is prone to regard as having only a physical cause, and he prescribes drugs, which rarely have the desired effect. Possibly the commonest form of this is the hysterical headache, which is rarely recognized of psychogenic origin, although it is so completely analogous to the «nine o'clock illness» of school children, who use this gentle form of unconscious malingering as a means for escaping their responsibilities. «An adult ought to make a call upon a recently bereaved friend.» This is recognized as a distinct obligation but the patient's infantile necessity of escaping reality and seeking pleasure makes the duty seem a very onerous affair. Thus arises a conflict between duty, born of conscious appreciation of the social obligation, and desire, born of the childish inability to make the necessary sacrifice of personal comfort. As a result the patient develops a headache and so, being ill, does not have to go. While the mechanism in other hysteric conversions is more complicated, it is no less clearly proved, so that the number of what are ordinarily taken as symptoms having a merely somatic cause, and which are through analysis seen to be merely hysterical conversions, is augmented daily. Disturbances of sensibility, such as hemianæsthesia or insensibility to touch and pain on one side of the body only, disturbances of motility such as choreiform movements, tics and certain occupation spasms, disturbances of speech, sometimes including stuttering, visceral disturbances showing vomiting and diarrhœa, vaso-motor disturbances and emotional disturbances, particularly in cases of great exaltation or depression, are all likely to be caused by the hysterical dissociation before mentioned, in which some mental factor is repressed and therefore driven outside the pale of conscious control.

In *compulsion neurosis* there is no conversion, which implies a shifting of the *libido,* i.e. energy from the external world, which is its natural goal, to the physiological processes of the individual; but there is another kind of shift, namely, from the external world to the mental states themselves. In this condition the numerous physical symptoms mentioned as being found in hysteria are generally absent, but their place is taken by variation from the conventional modes of thinking, Such variations to be sure are far from unpleasant, if they do not become too great, for they add much of piquancy and interest to a person's character. But when the departure from the conventional is excessive and both compulsive and unaccountable, the condition merits the term neurosis and requires treatment from the analyst. There are compulsive thoughts, compulsive doubts, fears, acts, rituals of dressing and undressing or eating for which this kind of neurotic can give no reason. He generally does not attempt to rationalize them but admits he does not know why he always has to act or think in his own peculiar way. Analysis has convinced Freud that «obsessions are always transformed *reproaches,* returning from repression, which always refer to a pleasurably accomplished sexual action of childhood» and that «the compulsive ways of thinking and acting are only substitutes for the reproaches which are symbolical distortions formed in order to prevent a recognition on the part of the patient of the real meaning, so as to keep from his consciousness a realization of the circumstances of his guilty conduct.»

Paranoia is a group of mental diseases containing the paranoia as defined by Kraepelin, and various mixed aberrant forms, some of which are called paraphrenias. In general it is a disease in which there are delusions of persecution that have been pretty well systematized. The disease progresses usually through four rather well-defined stages. In the first the patient is unduly concerned about his health,

and particularly about what goes on around him in relation to himself. That is, he considers more things are said and done with reference to himself than does the ordinary person, and he begins to reason it all out that there must be some agreement in the actions of persons or things around him, usually for his discomfiture or ruin. Hallucinations of hearing are common. The result of his thinking himself to be the victim of persecution is that he sometimes becomes very dangerous, and attacks the persons whom he regards as his persecutors. In advanced cases the system of ideas worked out in justification of the suspicions of persecution or conspiracy is very elaborate, and frequently includes falsifications of early memories, which contribute the grain of truth in some of the projected reproaches. Another classification of the paranoia group of mental diseases is that into two divisions, the *original* and the *acquired*, the first being the inevitable development of a character which was of such a constitution as to develop into exactly this form of mental disease, in spite of an environment even partly favorable to a wholesome life, and the second, the effect of an untoward environment upon a neutral constitution which might in more favorable circumstances have escaped this fate. According as hallucinations are or are not present, these groups are further divided respectively into *paranoia hallucinatoria* and *paranoia combinatoria*. Furthermore the individual cases are described as persecutory, expansive, querulous, litigious, inventive, reformatory, religious and erotic, according to the forms which the more prominent mental symptoms show. A third division of the paranoia group is into delusions of interpretation and delusions of revindication. In the first the erratic element is in the interpretation of the factors of the environment of the patient, who remains otherwise quite clear minded, and in the second there is a tendency toward the formation of a fixed idea, either egocentric or altruistic. As paranoia was considered an incurable, progressive and chronic disease, those cases which through analysis have been shown to have at the basis of them an idea that could be traced out and corrected, and which therefore have been called acute paranoias, necessitated a further reconstruction of the concepts underlying the classification. The result of this is that the content of the mental states in this form of disease is not now considered so indicative as the mental mechanisms involved. This implies again that it is not so much the delusion, or the suspicion itself, or any other of the symptoms, which used to be considered characteristic of the disease, but it is the inability on the part of the patient to adapt his Ego to those ideas which form the so-called content of the paranoid state. The delusion, for example, is found to have been made by the patient for the purpose of making a certain emotion tolerable which he could not get rid of. The removal of the delusion would not in such a case help, for another would have to be supplied in its place, to handle the original emotion, which would itself remain. The emotion or a lack of control over the emotions is thus seen to be the most fundamental cause of the disease. The explanation of paranoia consists, therefore, in the emotional lack of control, which fixes upon certain ideas and is unable to change them, and furthermore in an exaggeration of the mechanism of projection. (See MECHANISMS, MENTAL). Finally Sigmund Freud states that paranoia is dependent upon a homosexual fixation in the psychosexual development of the individual. Treatment of paranoia has been more earnest and determined of late, as more and more cases have been handled with greater success, but it is to be remembered that the curable cases are now by many regarded as only paranoid forms of other mental diseases, and that the true paranoiac is known as paranoiac virtually only by the failure of all efforts to improve him. Psychoanalysis is the only means by which any satisfactory knowledge can be gained of the unconscious mechanisms dominating any given case, and only by a thorough study can it positively be determined how much or how little can be accomplished in the way of therapeusis. Shock therapy is an aid.

Epilepsy and various convulsive types of reaction including the classical epilepsy, some attenuated forms such as affect epilepsies, and those of gross brain disease, constitute a class of mental disease in which there are well-known physiological and anatomical changes in the brain itself. The disease is apparently hereditary, in the sense that in the history of all epileptics there is usually to be found some taint in the family or in collateral branches. The epileptic convulsion of the classical type is a spasm with unconsciousness, preceded by a warning called the aura, and followed by a gradual wakening or a deep sleep. The variations are exceedingly numerous. Modern investigation has shown that there is some association between the epileptic fit and the gratification of unconscious wishes. Epileptics are likely to be of a low order of intelligence and their reactions to be analogous to those of children or infants. Some cases indeed do turn out later to be imbeciles. Treatment is not generally considered to be of avail, except possibly in psychogenic cases, where analysis can sometimes straighten out the complexes of the patient. The best care is secured in the colony plan where training in healthful outdoor occupation is possible.

The *Dementia Precox* (Schizophrenia) group of mental diseases contains the so-called dementia simplex, hebephrenia, catatonia, some paranoid forms and certain mixed or atypical states. The mental symptoms of the dementia precox group include an emotional dullness which is thought to be due to the fact that in this disease the patient shuts himself into his own thoughts and is therefore less moved by external occurrences than are ordinary persons. That is, his thoughts lose their reference to external reality and the result in the worst cases is that nothing in external reality can move or arouse the confirmed dementia precox patient. Another feature which is an outcome of this segregation from external interests is his so-called negativism, which is shown in his either refusing entirely to do what he is told or doing it as negatively as possible. Thus, if he is told to hold out his hand, he puts it behind his back; if told to stick out his tongue he shuts his mouth tight. This segregation of the behavior from all relations with external reality (and in the last analysis reality amounts to little more than the relations of the indi-

vidual with other persons), is a splitting of the personality, which is the reason for the alternate name of dementia precox: schizophrenia or «split mind.» The detailed features of this separation of the behavior from all that in the average man is in close connection with his behavior are as numerous as all the possible types of relation of the individual with his environment. Some of these are suggestibility, failure of voluntary attention, disturbance of orientation, disorders of memory. The delusions have been shown in many cases to be symbolizations of the conflict going on in the unconscious. The fact that the conflict is unconscious accounts for the difficulty of getting at it and of re-establishing satisfactory relations with the patient. Other symptoms are bodily such as the mannerisms, stereotyped modes of action, unusual words or expressions so frequent in dementia precox, and the rigidity and stupor which characterize some of the patients.

Whatever reactions to the environment remain in the patient are marked by an archaic or primeval character, such that in the evolution of human behavior the highest, most complicated and latest acquired types are those first to be lost. In the disease the individual reverts or regresses to a form of behavior which may possibly be supposed to have been valid and current in prehistoric ages. As behavior may be regarded as built outward from a central core, this form of psychosis is what is known as an introversional one, that is, one in which the libido introverts or regresses to a more fundamental and therefore more archaic form of gratification. There are other physical concomitants sometimes noticed, such as an unusually small heart or a tendency to pulmonary tuberculosis. The onset of the disease is either gradual or sudden. If gradual it may be mistaken at the beginning for other types of mental disease, such as the manic-depressive, hysteria, compulsion neurosis, etc. It is in this disease more difficult than in most others to make any satisfactory statement as to whether it has a physical or a mental origin. As the bodily changes so far discovered have been so few and their bearing so uncertain, it is more advantageous at the present time to explain the disorder on a purely psychological basis. The patient is faced with a situation in which the balance between environment and congenital ability to adapt to it is provisionally lost, whether because of the disproportionate burden placed upon him by his environment, or because of his innate weakness rendering him unable to support the average load. In this connection it is to be remembered that many ordinary persons declare their burden is too heavy for them to bear, and that few ever know their extreme abilities; consequently the loss of balance may have a purely psychical cause lying within the unconscious desire of the particular person. When a person says that something will drive him crazy, he is unwittingly expressing an unconscious desire, not to become ill mentally, but to receive the care and symbolic homage which is given to the mentally ill. The severity of the mental symptoms may be regarded as a measure of how far the unfavorableness of the environment has driven back the individual patient from reality. There are cases of moderate confusion which appear in almost all respects perfectly natural persons, and only later develop a disorder great enough to dissociate them from their fellows; while in the so-called catatonic cases the inability is generally complete. The cases which have subsequently become well have gradually made an adjustment to reality in some form, either indirectly through the formation of delusions, or directly by a final domination of the reality motive. Cases that do not get well tend to sink to lower levels till they reach one on which they can succeed in maintaining themselves with comparative steadiness. This is notably the case in institutions, while in the world of life such persons join the ranks of tramps, prostitutes and petty criminals, thus finding their appropriate level.

The treatment of the bodily signs as such is usually of no service; the treatment of the mental condition must take into consideration the involvement of the higher or psychological levels of the personality and give as much analysis as possible, in order to reconstruct the social relations if that can in any way be done. Prevention of this disease is one of the most important ends that could be achieved by civilization, and is primarily attained through eugenic methods, lacking which the only means at present known lie in the correction of all irregularities of character as early as they may be observed in childhood and an absolutely frank and scientific handling of the question of sexuality, the source of much that is anomalous in human behavior.

A division of infection and exhaustion psychoses comprises those resultant upon fever, exhaustion or collapse such as from typhoid fever. While all these diseases have mental aspects, the treatment of them is so essentially in accordance with the disease of which they are themselves virtually only the symptoms that they need not be described here in detail. There is a special form of mental reaction following the over-indulgence in alcohol, in opium, cocaine, bromides, carbon monoxide, lead, mercury or from uremia, diabetes mellius, pellagra and certain gastro-intestinal diseases. In none of the mental diseases is the matter of individual psychology more important than in alcoholism, as the reasons for drinking which are assigned by people in general are mostly rationalizations. (See MECHANISMS, MENTAL). The real cause why people drink to an extent which harms them is that their neural constitution craves the gratification which they get from this source alone. The very fact that a man or woman cannot stop drinking therefore stamps them at once as having a weakness in their mental organizations. The alcoholic takes his peculiar way in creating an artificial balance, so to speak, in order to make up for the loss of balance between his mental organizations and the demands made upon it by his environment. It is his way of taking the cash and letting the credit go. Alcohol is the quickest path for some persons to shut out the world of reality, which has been found too arduous, and to open up the world of fantasy, the fact that the individual is unable to face reality being the really important point. Accordingly it is not surprising to find that ordinarily the alcoholic is in other respects, aside from his alcoholism, an example of general inefficiency. His unconscious appreciation of his essential inferiority is partly what leads him to flee from the world

of reality to the world of intoxication fantasy. That alcoholism is an indication of a deep psychological weakness, too, is to be inferred from the high mortality in pneumonia and other diseases among alcoholics. There is the wish to die.

The same remarks could be made about the mental aspects of indulgence in opium, morphine, cocaine and other poisonings. The amount that any given individual can stand depends, as is well known, on the mental organization. The more he can stand, the stronger the mentality; but from another point of view, the greater need he has for some drug to change, through its effect upon himself, the nature of his relations with the external world, the weaker he is as a mechanism and the less suited he is for the field of activity in which he finds himself. In all of these drug indulgences the treatment of the patient by means of other drugs is merely palliative and does not go to the root of the matter. The only hope of doing this is through psychoanalysis, after the acute disturbance has ceased. There are psychoses, too, associated with organic diseases such as apoplexy, chorea, paralysis, multiple sclerosis, polyneuritis and heart disease; also with presenile, senile and arteriosclerotic conditions.

Finally feeble-mindedness, idiocy, imbecility, regarded as defects in personal endowment or development, have the mental aspect that they cannot live in society acceptably to the degree of being either self-supporting, or of supporting anyone else. The economic importance of these defective classes is being recognized and the more as psychological methods have been devised for grading all individuals into the classes which show characteristic differences parallel with the differences between children of ages between 1 and 14 years of age. Very extensive researches by Binet, Simon, Goddard and Terman have shown that the general intelligence grows steadily up to age 14, while above that age there are roughly three groups, the low, average and high adult intelligence. What is meant by feeble-mindedness, imbecility and idiocy can be given a very exact form in a table like the following:

Mental age	Capabilities	Class
Under 1 year.	Helpless.....	Low class idiot
1 year.....	Feeds self. Eats everything.....	Middle class idiot
2 years....	Eats discriminatingly....	High class idiot
3 years....	No work. Plays little...	Low class imbecile
4 years....	Tries to help.....	Low class imbecile
5 years....	Only simplest tasks.....	Middle class imbecile
6 years....	Tasks of short duration. Washes dishes.....	Middle class imbecile.
7 years....	Little errands in house. Dusts.....	High class imbecile
8 years....	Errands, light work; makes beds.....	Low class moron
9 years....	Heavier work. Scrubs, mends, lays bricks, cares for room.....	Low class moron
10 years....	Good institution helpers. Routine work.....	Middle class moron
11 years....	Fairly complicated work with only occasional oversight.....	Middle class moron
12 years....	Uses machinery. Cares for animals. No supervision. Cannot plan...	High class moron

The advantages of these so-called intelligence tests, so clearly shown in the organization of the national army, are of further advantage in finding out whether a mental defect is inherited or acquired, because in the inherited mental defects a termination of the individual's ability to go through the tests is quite even. He can do all of the tests of ages one to seven, for example, but cannot do any of those above that age. On the other hand the case is not so clean cut with acquired defects, the individual being able to do some but not all of those tests several years above his mental age and not all of them below it.

In conclusion it should be emphasized that the mind and the body are one unity and whatever affects the one is not without effect upon the other, that it is almost if not quite impossible to draw the line between mental and bodily disorders, and that the ultimate truth will be found in the statement that mind is but the function of body and body but the perceptible expression of mind. Therefore few diseases can be regarded as exclusively mental and but few as exclusively physical. Consult Jelliffe and White, 'Diseases of the Nervous System' (6th ed. 1935); Bleuler, 'Psychiatry' (trans. by Brill); Henderson and Gillespie, 'Psychiatry' (New York 1936); Menninger, K. A., 'The Human Mind' (1936). SMITH ELY JELLIFFE, M.D.

MENTAL HYGIENE. Hygiene has usually been conceived of as a system of measures for the creation of conditions *without* for the maintenance of the *bodily health.* Mental hygiene is an effort to create favorable conditions *within* which will make for *mental health.* Whereas hygiene heretofore has dealt with external conditions which are favorable to health, such as fresh air, sunshine, pure food, exercise, etc., mental hygiene deals with the principles of right living as they apply to the regulation of our thoughts, our feelings, our activities. In its practical applications mental hygiene attempts to deal with the problem presented by the tremendous demands of our fundamental instincts for adequate expression. It sees in human failures inability to adequately harness these instincts, while in success it sees them adequately expressed in activities that are at once creative and socially acceptable and valuable. The principles of mental hygiene receive their formulation as a result of an understanding of the development of the human mind from earliest infancy to adulthood expressed in terms of a constant interplay and compromise between instinctive desires and social repressions. These principles will receive their application along two main lines of endeavor. One by applying them to the scheme of education, modifying it and minimizing the severity of these conflicts, and secondly, in individual instances by an examination of the particular situations under which difficulties have produced disturbing symptoms in the individual.

As soon as the difficulties of the individual are seen as evidences of his endeavor to make his particular instinct-constellation fit in with the social requirements, it is seen that a vast amount of convention, particularly the criminal law, is the reaction of society against instinctive manifestions by an effort at forcible repression, and just as education would not be complete if it stopped wholly at efforts of repression just so mental hygiene points out that society's methods of dealing with its delinquents are not complete when measures of repression, censure and condemnation alone are used. As

in dealing with the child it is necessary to search for and help to develop all the positive characters of value, so in dealing with the delinquent it should be society's effort to search for and develop to their fullest extent all those strivings for better things which no one is without.

This new point of view is applicable to every relation which involves the individual and society, and its ideal must be to bring about a state of understanding rather than a blind clashing of instincts between these two. When this is done individual instinctive indulgence, instead of being met by blind social condemnation, will be met by an intelligent vision which sees the indulgence as a relatively infantile, undeveloped type of reaction and which sets about to bring to pass a different reaction formula by methods of repression where necessary and to the extent necessary carefully checked by adequate controls but which does not neglect those educational procedures without which no repression is safe.

The practical application of the principles of mental hygiene must come about as a result of a more complete understanding of the developmental stages of the human individual and this means specifically a more complete understanding of the development of the child. This is the "century of the child" and in many ways the advances that have been made in child study point the way toward an adequate hygiene of mind. This is so because in all of the defective and delinquent conditions, as we find them either in children or adults, we see evidences of defective psychological development either gross or in detail. In other words, the adult delinquent, or the mentally ill adult, presents distinct evidences of having been arrested at some point in his psychological development, so that in that portion of his behavior which is circumscribed by this limitation there are the outward appearances of infantilism or childishness. The moods, the grouches, the irritabilities, the petty dishonesties, lying and pilfering, the subtle cruelties and deceptions, selfishness, over-conscientiousness, prudery, emotionalism and a thousand other traits of character are all the better understood when they are seen to be childish types of reaction, and are almost immediately appreciated as such as soon as the analogy is suggested.

The immediate problem of mental hygiene as addressed to such character traits as have been enumerated above is to approach their study in the individual case with a view to unfolding the causative factors which have, within these certain areas of conduct, prevented the individual from progressing along the usual lines of development and having succeeded in this endeavor, helping the individual to find avenues of expression for this pent-up energy in more useful ways.

All these results have been made possible by a study of the development of the child and realization for the first time that the child is not simply a small adult, but has standards of conduct, points of view, attitudes of mind which it is extremely difficult, if not impossible, for the adult to feel himself into. An appreciation of these facts, together with an attitude toward the individual which is truly constructive, the parental attitude in the best sense, is what is needed. So that in the treatment of these sick individuals there is arising in society an attitude which is a development of the parental instinct as a result of better understanding.

The defects in the parental instinct have been that children have been considered the property of the parents, existing only for their use and satisfaction. This has been the history of the child throughout the ages. Now it must be appreciated that a greater sacrifice is demanded of the parent if the child is to grow up to successful adulthood. Only the interests of the child should be considered by the parent, and not the parent's personal desires. On the other hand the child should be weaned from considering that the parents belong to it and exist for its pleasure, otherwise a dependent attitude upon the love of the parents will persist into adult life. The basic necessity, therefore, for the healthy adult is a healthy relationship between parent and child which results finally in a normal, healthy emancipation of the latter, resulting in the greatest possible attainment of individual efficiency.

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MENTAL PATIENTS, Family Care of. The term *family care* as usually employed denotes the maintenance and oversight of an ill or dependent person by a private family for compensation. The less pleasing term *boarding out* is sometimes used as an equivalent expression.

Family care in the United States is best known in connection with the placing of dependent children in foster families by welfare officials. Such care has met with general approval and is fast replacing asylum care, which had previously replaced almshouse care.

Three rather distinct systems of conducting the family care of mental patients have gradually come into existence. First, the *colony* system, which originated at Gheel, Belgium; second, the *dispersion* system, which is used extensively in Scotland; and third, the *annex* system which is used in the United States, Germany, and several smaller countries.

The distinguishing feature of the colony system is a small hospital or community house center which gives temporary care to the mental patients that are to be placed in families. The center also provides headquarters for physicians, nurses, and social workers who look after the patients in the center and supervise those placed out in families.

Under the so-called dispersion system, as conducted in Scotland, mental patients are placed in families by welfare officers under rules promulgated by the General Board of Control of Scotland. Such board licenses the homes that may receive patients, passes on the eligibility of patients for family care and inspects, at irregular intervals, the homes caring for patients. The patients placed out have no connection with institutions at the time of their placement. They may, however, have previously been institution patients, and if they become unsuitable for family care, they may then be committed to a hospital or asylum.

The operation of the annex system is in charge of the hospital or other institution to

which the patients have been committed. The physicians of the institution select the patients that are deemed suitable for family care. Social workers inspect the homes of families who would like to receive patients and report thereon to the superintendent.

Variations of these major types of care are in use in different countries.

Family Care in Belgium.—The beginning of family care in Belgium is a matter of tradition rather than history. According to a legendary story, Dymphna, the daughter of an Irish king, was murdered by her father at Gheel in the latter part of the 6th century. Some years later she was canonized and her tomb became the shrine of Saint Dymphna. Among the worshippers at the shrine were many sick persons who came seeking relief from their illness. The miraculous cures reported caused pilgrimages to be made to the shrine from distant places. A small hospital was built by the village church but it soon proved inadequate for its purpose. The visitors, who also overtaxed the small inns of the town, were given accommodations in homes in the vicinity of the shrine. Some of the sick people stayed several weeks or months with the families that received them.

Family care of the sick gradually became a permanent feature of the town. As mental patients stayed longer than others, family care of such cases naturally predominated. After many years, family care came under local government regulations. In 1852, the communal facilities of the town became the nucleus of a national colony for mental patients. Ten years later an infirmary was built to accommodate 60 patients. Later the institution was enlarged to care for 100. In 1937, an additional hospital for 100 patients was opened. The colony is administered by a medical director who is assisted by physicians, nurses and social workers. The work of these administrators is supervised by a high commission and a permanent local committee. The high commission consists of the governor of the province, the King's attorney, the district justice of the peace, the burgomaster of the city and the curé-dean. This commission supervises employe personnel, the medical program, budget and material equipment. The permanent committee is composed of the local burgomaster, local judge, three members designated by the Minister of Justice, and the physicians of the colony. This committee has charge of placing indigent patients in boarding homes, and of maintaining general oversight of homes and patients.

From 1930 to 1939 the patients of the colony notably increased and in the latter year approached 4,000. Approximately 500 patients are admitted and discharged from the colony each year. The families caring for colony patients number nearly 1,800. As a rule each family cares for two patients, although some families may have but a single patient whereas others may have three. The inhabitants of Gheel have accepted the care of patients as a family and community duty. Instruction to young married couples in the care of mental patients is given each winter at the colony center by the psychiatrists on the colony staff. The families thus acquire a high degree of skill in managing patients and are able to care properly for patients of all classes whether insane, epileptic, or mentally defective.

The success of the colony of Gheel has been so remarkable that other countries have been influenced to adopt a like system or another system of family care deemed better adapted to local conditions.

A second colony for family care of mental patients was established in 1884 at Lierneux, a village in southeastern Belgium. This colony, which was patterned after the Gheel colony, has not attained large size but is giving excellent care of the Walloon patients to whom it ministers. In 1936, the colony was caring for 648 patients, half of which were in the infirmary, and half in families in the village and surrounding country.

Family Care in Scotland.—In Scotland, a supervised system of family care of mental patients was authorized by an act (25 Aug. 1857) regulating the care and treatment of lunatics. From that time to 1913, there was an irregular increase in the number of boarded-out cases, the number in that year reaching 2,909. During the years of the World War of 1914–18, there was a decline in the number of mentally ill patients cared for in families, and such decline has continued at a slow rate. On the other hand, the number of mental defectives placed in families has markedly increased. On 1 Jan. 1939 the number of so-called lunatics cared for in private dwellings in Scotland was 1,087. The same date shows that the number of mental defectives cared for in families was 1,584.

Although all certified pauper patients in Scotland are under the supervision of the General Board of Control, asylum treatment is practically separate from family care. Many of the patients in family care never see an asylum, and the asylum superintendent does not know of their existence. A superintendent may recommend some of his patients for family care, but after they are placed in family homes, his authority over them ceases.

The administration of the boarding-out system was formerly vested in parish councils, of which there were 875. In 1929, a new local government act was passed. This act, 15 May 1930, transferred to county councils and to town councils of large burghs the duties formerly exercised by district boards of control and by parish councils under the Lunacy and Mental Deficiency acts. Accordingly, county councils or town councils select the guardians and homes that are to receive patients.

Standards of care and administration, and rules pertaining thereto, are established by the General Board of Control, but the placing and oversight of patients devolves on the local officials. Moreover, the inspection by local officials is supplemented by visits of deputy commissioners representing the board.

As the success of family care depends fully as much on the guardians as on the patients, the former are chosen with great care. They must be substantial, intelligent householders of good character and habits. Their family life must be wholesome, and all adult members must have a friendly attitude toward the patient when received in the home.

A guardian must have a dwelling large enough to furnish comfortable quarters for the number of patients assigned him. There must

be adequate provision for heating, ventilation and light, and the customary home comforts. In addition, the guardian must provide suitable exercise, occupation, and diversion for the patients in his care. A guardian can care for but one patient unless specially licensed by the board to receive more. The maximum number permitted to a dwelling is four; the numbers most commonly found are one and two.

The cost of caring for pauper lunatics in private dwellings during the fiscal year ended 15 May 1938, averaged 13s. 7d. per week per patient as compared with 23s. 8d. in Royal asylums, 21s. in district asylums, and 18s. 5d. in lunatic wards of poorhouses.

Family Care in France.—The outstanding achievements of the family-care colony at Gheel attracted the attention of the Council General of the Department of the Seine in France which, in 1890, was seeking ways to reduce the overcrowding in the asylums of the department. Representatives of the council in that year visited the Gheel and Lierneux colonies in Belgium and inspected the family-care system of Scotland. In the session of 1891, the council decided to establish a family-care colony for women patients above the age of 50. After careful investigation, the city of Dun-sur-Auron in the Department of Cher was chosen as the site of the new colony. The people of the town heartily welcomed the project, and on 17 Dec. 1892 the colony was opened with Dr. August Marie as director. By the end of 1893, 108 patients had been transferred from the mental hospitals of the Seine to the new colony. Each year thereafter showed an increase until in December 1903, the number of patients in the colony reached 900. Since that time there has been an irregular upward trend. On 1 Jan. 1936, the number was 1,323. In 1939, it mounted to about 1,500. As the colony became larger, it was necessary to make placements in the villages surrounding Dun. On the above date, there were 679 patients in families in Dun, 89 in the colony center, 550 in families in eight nearby towns, and five on leave. The largest number of patients in any of the villages outside of Dun was 122, at Ourouër.

The development of the colony center has kept pace with the increase of patients. At first it consisted of small quarters which housed the administrative personnel, and an infirmary (D) with eight beds. Baths for patients were installed in the municipal washhouse. In 1897, a small pharmacy was installed; in 1898, Infirmary R with 16 beds was built; in 1899, Infirmary D was enlarged to accommodate 12; and in 1900, Pavilion Henri Le Roux was begun. This building, which was opened in 1902, was designed to care for about 70 patients. It was necessary to have such a ward for patients awaiting family placement and for patients returned by families. Other additions to the center, installed at various times, included an autopsy room, a laundry, a bathhouse, and an assembly hall.

The employed personnel of the colony in the beginning consisted of the medical director, a clerk, and two nurses. These proved sufficient to handle a patient population of 213. The medical and nursing personnel in 1936 comprised a medical director, a head physician, three medical assistants, eight visitors, two inspectors, two solicitors, and 16 nurses, a total of 33. The administrative personnel comprised, in addition to the medical director, nine clerical employes, two laundry employes, two gardeners, a coachman, a cook, a porter, an electrician, and a chauffeur.

The colony at Dun was established primarily for women patients above the age of 50. The age limit was later reduced. A few men are received from the hospitals of the Seine to help in the heavier work connected with the maintenance of the colony center and the cultivation of the gardens. On 1 Jan. 1936, there were 22 men patients on the colony rolls.

The colony receives both psychotic and mentally defective patients, and apparently makes no distinction between these classes when placing patients. Of the 152 admissions of 1935, 62 were classed as mentally defective and 90 as psychotic. Nearly all groups of mental disorders were represented. Care is taken to place patients in families where they will be happy and will receive the maximum benefit from their new life.

The colony center maintains close supervision over the patients in family care. «Free life with active and continuous medical supervision» is the governing principle in the management of the colony. Patients living in families are as free as members of the family. Houses are usually locked at night, but during the day patients may stroll at will through the streets and parks of the city. They may also go shopping or visiting. Of course, they are required to be home at mealtime and bedtime.

The maintenance cost of patients at Dun, including compensation to guardians, supervision, transportation, administration, and care of patients at the colony center, was about 40 cents a day in 1935. The average daily cost of maintenance in the mental hospitals of the Seine in the same year was about $1. Moreover, the annual per capita investment charge was much greater in the latter institutions. The guardians in Dun receive about 30 cents per day for the care of each patient. That this amount is deemed sufficient is indicated by the fact that the colony has a waiting list of 200 families who are ready to care for patients.

At Ainay-le-Chateau a similar family-care colony, designed to care for men patients only, was established in 1900. The colony replaced an annex of Dun, which accommodated 30 patients at the time.

Family Care in Germany.—Family care in Germany originated and developed as an adjunct of an institution. As early as 1764, Dr. Engelken, a former army physician from Holland, placed patients from his small private hospital in Rockwinkel, near Bremen, in families in Ellen and other farming communities in the vicinity of the hospital. At first the placements were made without careful selection of patients and guardians, and the care given patients was not well supervised. Family care, so inadequately begun, has continued in that region down to the present time. In the latter half of the 19th century, 15 German institutions introduced family care. These were followed by 45 others from 1901 to 1914. From 1914 to 1936, war, inflation, poverty, and changes in government seriously interfered with the progressive development of family care. On the other hand, the lack of funds for

the building of new hospitals has necessitated home or family care for many mental patients.

One of the most successful of the early German experiments in family care was that made by Ferdinand Wahrendorff, director of a private institution for mental cases at Ilten in the province of Hanover. This highly esteemed physician instituted a well-planned system of family care in connection with his institution in 1880. Beginning with four patients in three families, the system grew rapidly, until at the death of Dr. Wahrendorff in 1898, it comprised 140 patients who were living in congenial homes in neighboring villages. So powerful was the influence of Wahrendorff and so far-reaching were the effects of his experiment that he has been named «The Father of Family Care in Germany.»

Konrad Alt, after securing reports from all the mental hospitals in Germany, reported that there were 1,200 patients in family care in that country in 1902. A later canvass showed that the number had increased to 2,400 in 1906. From that day down to 1915, there was a gradual increase of patients in family care in Germany. The number in that year reached 3,815. A decline in family-care cases, which began in 1916, reached its low point in 1924 when there were only 1,511 patients so cared for. An upward trend in family-care cases, which commenced in 1925, continued to the opening of the second European war in 1939. The latest available figures (1932) show a total of 5,063 patients in family care.

The development of family care has proceeded unevenly in the several German states. Prussia exceeds all other states in the extent of use of family care, having fully nine-tenths of the total family-care cases in Germany.

Along with the development of family care in Germany there has been evolved a system which cares for patients in their own families under the supervision and care of the physicians and nurses of a neighboring hospital.

Family Care in Switzerland.—Family care of mental patients in Switzerland was begun in 1901. The first placements of patients in families were made in the canton of Berne. The experiment proving successful, other cantons introduced family care in the following order: Vaud in 1904; Schaffhausen in 1907; Zürich in 1909; Solothurn in 1925; Aargau and Basel-Stadt in 1929; St. Gallen in 1931; and Valais in 1934. Although the other cantons do not have official systems of family care, many of their patients each year voluntarily welcome such care. Placement of patients in families in all cantons that have organized systems is governed by special regulations. In most cases the patient is first admitted to a mental hospital and is under observation and treatment for a time before his placement in a family is considered. If eventually deemed eligible for placement, a suitable home is found for him. While in such a home, he remains a patient of the hospital and can be returned to it whenever conditions render it advisable. In the canton of Zürich certain mental patients are placed directly in families by the official inspector for family care. In several cantons, colonies which serve as intermediate stations between the institutions and family care have been established. These colonies are managed by nurses or attendants in the employ of the cantonal institutions. The colonies vary in size, accommodating between 12 and 30 patients.

In the canton of Zürich a special organization known as the «Institution des Inspektorates für Familienpflege» was set up in 1909 to manage and supervise the placement of patients in families. The head of this organization is a physician on the staff of the well-known hospital, Burghölzli, at Zürich. The inspector decides what families are eligible to receive patients and what patients may be placed in families. He supervises the assignment of patients, and their transfer and return when necessary. He also has charge of the financial arrangements connected with family care. In this canton, there were 407 mental patients in family care on 1 Jan. 1939. The annual placement in families in the entire country is about 400 per year.

Family Care in Hungary.—Family care of mental patients was begun in Hungary in 1905. At that time the institutions for mental patients were greatly overcrowded, and funds were not available for the construction of additional hospitals. The first family-care colony in Hungary was modeled in accordance with the Gheel plan and was established at Dicsöszentmarton. Later, other family-care colonies were established. These were closely affiliated with institutions in accordance with the annex plan. Care of patients in families proved popular and the colonies rapidly developed. At the time of the outbreak of the World War in 1914, there were about 1,800 patients in family care. These constituted 17 per cent of the mental patients committed to public institutions. During the war the colonies rapidly declined. They further suffered by the demoralized condition of the country after the close of the war. Some of the colonies were entirely abandoned and others had but few patients. The total number of patients in family care in 1923 was reported as 114. With improved economic conditions which followed money stabilization, the family-care colonies again grew, and additional colonies were formed in connection with state institutions. By January 1930, the patients in family-care colonies had increased to 2,267, which comprised 26.4 per cent of all patients committed to mental hospitals.

Family Care in the United States.—Family care of mental patients in the United States had its beginning in Massachusetts in 1885. In that year a law was enacted authorizing the State Board of Health, Lunacy and Charity to place in suitable families insane persons of the chronic, quiet class; the rate to be paid for the patients so placed was not to exceed that paid in the state lunatic hospitals. State patients in foster families were to be visited by agents of the board once in three months, and town and city patients in such families, once in six months. Pursuant to this act, the first patients were placed in families on 10 Aug. 1885. At the end of that year, 29 patients were in family care. Thereafter, the number gradually increased and reached 256 in 1905. A noteworthy change occurred in that year due to the enactment of a state law extending authority for placement to the state hospitals. In 1915, the board discontinued its own selection and placement of patients and transferred many of its family-care patients to

state hospital supervision. In response to the new legislation the number of patients in family care rose to 403 by the end of 1905. Since then the number has varied from year to year.

Notwithstanding the successful experience of Massachusetts, other states were slow to adopt family care to supplement institutional care. In New York State, mentally defective patients were first placed in family care by Newark State School in September 1931. The patients so placed were children that were capable of attending public school. In January 1933, the same institution began the formation of a family-care colony at Walworth, N. Y. Success having attended these efforts, other state institutions became interested, and the state legislature in its 1935 sessions made provision in the appropriation bill for the allocation of a sum not to exceed $20,000 from the maintenance fund of each institution in the State Department of Mental Hygiene for the purpose of establishing a system of family care for patients. In the year that followed, over 400 patients were placed in foster families by state hospitals and schools. By 1940 the number of patients in family care reached nearly 900.

Nine other states, profiting by the pioneer work of Massachusetts and New York, have adopted family care for a portion of their mental patients. Altogether there were about 1,600 mentally ill and 900 mentally defective patients in family care in the United States in 1940. It is now generally recognized that such care is beneficial to both patients and foster families, while constituting a substantial economy for the state. In general, family care has been found to cost about one half as much as institutional care.

Advantages of Family Care.—The advantages derived from family care are fourfold: Patients placed in suitable families resume a measure of community life with a natural environment and with more freedom than could be possible in a state hospital. The families receiving patients have an outlet for their altruistic sentiments and acquire a secure economic status. The state hospital, relieved of many of its custodial cases, can devote more of its energies to the scientific treatment of acutely ill and recoverable patients. The state, conducting an extensive system of family care, is relieved of the necessity of building new hospitals and has a better opportunity to treat its mental patients in accordance with their individual needs.

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MENTAL RETARDATES, Associations for Parents of. The organizational movement of parents with mentally retarded children to group together in associations for the purpose of being able better collectively to improve the welfare of their children began in the early 1930's. During the postwar period it expanded widely so that by 1951 there were more than 125 such groups in the United States and Canada, enrolling approximately 13,000 active members as well as several thousand others on an associate basis. Among the reasons contributing to this growth are the following: (1) evidence that institutions operating under state appropriations are limited in what they can do for the children; (2) increasing awareness that the usual public school programs are unsuited for such children; (3) more general dissemination of knowledge of advances in techniques relating to mental retardation; (4) rise of questioning and challenge of the validity of the finality implicit in the words: "Nothing can be done for your child"; (5) desire of parents to learn what more can be done for these children and to pursue projects in their behalf; (6) strengthening conviction that the responsibility is social—that, just as funds are raised and appropriated for the benefit of the physically handicapped, so also should money be provided for building a fuller life for the mentally handicapped; and (7) realization that it is not enough spiritually just to care for one's own child.

The activities of these associations cover a wide range, being influenced by needs and reflecting available facilities. Some organizations, interested in improving state institutions, seek larger appropriations so that there will be adequate staffs and equipment, at the same time augmenting current funds by donations and doing many little things that bring pleasure to the children. Others devote their efforts to providing various services for children at home or in schools, such as clinics for diagnosis, therapy, and guidance; play and therapy groups; classes for children ineligible for enrollment in public schools; social clubs; sheltered workshops; vocational training centers; contacts for placement in industry; and educational classes for parents. Funds have been created to establish permanent homes or communities, and in several states, with the sponsorship of parent associations, bills have been enacted providing local aid for educating mentally retarded children.

The associations are nonprofit and, except in a few instances, membership is open to all interested persons. Members participate in the activities and regular meetings are held, often with speakers professional in the field of mental retardation. Through discussions thus afforded, parents come to accept the underlying problems as general and of broad community interest, detached from their emotional and subjective elements. Each association plans and pursues its projects, supplementing them in many cases by issuing news bulletins and pamphlets and fostering public education.

To further the common objectives of these groups the National Association of Parents and Friends of Mentally Retarded Children was formed in September 1950. Its purposes embrace all such children of all ages wherever they may be located. It serves as a clearinghouse of information, sponsors research and the training of personnel, acts as liaison with other bodies in this field, and interprets the movement on a national level. See also MENTAL RETARDATION.

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MENTAL RETARDATION is a limitation of intelligence due to lack of normal mental development rather than to mental disease or deterioration. It may be of any degree from dullness to profound idiocy. While the term covers many persons with a moderate handicap, it is most often applied to those with marked limitation of intelligence, whose mental capacity when adult will not be above that of an average child of 12. This group, also described as mentally deficient, subnormal, or feeble-minded, includes some 1 to 3 per cent of the general population. Mental deficiency is found in all classes of society and in all parts of the world. It has been known since the earliest times. Physical injury of the nervous system accounts for some cases; inherited factors, such as biochemical deficiencies, for others. Medical care consists chiefly of correcting remediable physical defects and improving general health. This does not change mental capacity but may improve the patient's ability to utilize his resources fully. Research encourages the hope that causes of retardation may be found, and some progress has been made toward prevention.

THE NATURE OF MENTAL RETARDATION

Mental deficiency or retardation must not be confused with mental illness. The mentally ill, psychotic, or insane person is one who has been normal but, due to known or unknown factors, has become mentally unbalanced. A mentally retarded individual is one in whom there is and always has been a lack of mental development.

The attitude of society toward the feebleminded has progressed through the stages of abhorrence, rejection, and custody to sympathetic care. At present the emphasis is on suitable training and community supervision. The most highly developed program provides for the diversified needs of the group: (1) custody for those whose presence in the community would be inimical to its welfare; (2) specialized care for those whose needs cannot be met in the community; and (3) training for those who may, after the training period, take their places in the community with a minimum of supervision.

Primitive Attitude.—The mentally deficient members of early society were devoid of human rights and were left to fend for themselves. The Spartans disposed of them through abandonment, but Christianity preached tolerance toward all deviates, and similar attitudes of commiseration were a part of the teachings of other religions. The first recorded attempt to care for the feebleminded was that offered by the bishop of Myra in the 4th century. That only custodial care—and not training—was offered may have been due to the fact that only the more pronounced and easily recognized cases of subnormality were identifiable.

During the Middle Ages the mentally deficient were confused with the insane, and the attitude toward them ranged from solicitation to persecution. It is likely that some care was given them in Flanders during the 13th century, but it was in France during the latter part of the 15th century and the early part of the 16th century that specialized care was organized by St. Vincent de Paul.

Scientific Approach.—The scientific care and training of the mentally deficient dates from the controversy which arose after the presentation by J. E. Marie Gaspard Itard (1774–1838) of the "Savage of Aveyron" before the Academy of Sciences in Paris in 1800. This 12-year-old boy, perhaps abandoned by his parents or lost in the woods at an early age, was the object of considerable scientific speculation as to the cause of his subnormal intelligence. Itard contended that he was untaught, and because of this was an idiot. But Philippe Pinel (1745–1826) held to the point of view that idiocy was congenital. Itard sought to substantiate his point of view and began a program of training. Although the boy was able to learn to some degree, Itard was finally forced to abandon the project of making him normal.

The clinical teaching program developed by Itard had in it many fine suggestions, and Itard's pupil, Édouard Seguin (1812–1880), devoted his life to the education of the feeble-minded. His system of sensory-motor training is described in detail in many of his writings. He came to America in 1850 and was an important influence in the establishment of the country's first institutions for the mentally deficient.

Early research laboratories, such as those established at Vineland, N. J., in 1906, and at Faribault, Minn., in 1910, under the direction of Henry H. Goddard and Fred Kuhlmann, respectively, contributed greatly to the understanding of the problem and to the development of training programs. The pioneer work of E. R. Johnstone and Joseph Beyers with the Committee on Provision, the publication of Goddard's *The Kallikak Family* (1912), and the introduction at Vineland, N. J., in 1909, of the original Binet-Simon tests for the measurement of intelligence are prominent milestones.

Understanding Mental Deficiency.—Specialists in a number of fields have made important contributions to the understanding of this group. The pediatrician, endocrinologist, pathologist, anthropologist, roentgenologist, psychiatrist, sociologist, educator, psychologist and others—each has made a significant contribution.

It early became apparent that mental deficiency could not be "cured" in the sense that a disease can be cured. Medical science is continuing to study the condition and some day a cure may be found, but at the present time the outlook for an early remedy is not hopeful.

The educator has discovered that the subnormal child can be trained within the limits of his ability, and many significant and highly worthwhile training programs have been developed. The sociologist has found that many can be helped to adjust to community life. The psychologist has established that he can be studied objectively, and his findings have been of considerable value to all other specialists concerned with the problems of mental deficiency.

Etiology.—The etiology or causative factors of mental deficiency are not thoroughly understood. In the individual case it is frequently extremely difficult to identify with certainty the specific cause or, perhaps, combination of causes.

During the past decade or two there has been a marked change in the overall concept of causation. Earlier research suggested that faulty heredity was a prominent factor in producing mental deficiency, but authorities rarely adhere to that point of view. While it is likely that it is still the most prominent single cause, the percentage of cases in which neuropathic ancestry is now considered to be the cause is very much lower than was previously thought to be true.

Upon thorough study of the antecedents and the growth and development of the individual child it is generally possible to determine whether the causative factors are endogenous or exogenous or, in other words, whether it is an hereditary or nonhereditary case, a primary or secondary case. Endogenous refers to gene variation, while exogenous refers to some modification of the organism.

Perhaps 50 per cent, or less, of the mentally retarded cases are endogenous in type, while the others are due to factors operating upon the organism prior to, during, or immediately following birth. Because of the difficulty of obtaining a truly representative sampling of the mentally deficient population, no estimate of the percentage of assigned causes is acceptable. Among the factors which have been found are: (1) injury *en utero*—injury during the birth process—and, infrequently, injury immediately following birth; (2) somatic variations due to little-understood changes in the functioning of the glands of internal secretion of the mother during the period of gestation; (3) diseases in early childhood accompanied by a high temperature. Other studies have pointed out that therapeutic X-ray treatment in the pelvic region of the pregnant mother —when such treatment is of a specified depth and frequency—will produce the microcephalic child; that incompatibility of the Rh factor in the blood of the mother may be found with a greater frequency in certain types of mental deficiency; and that an inordinate number of cases of mentally deficient children have a history of whooping cough at an early age.

Some of the hitherto rather well accepted causes—such as a fall in early childhood, alcoholism in the parents, fright, improper nourishment, and others of similar type—are no longer accepted with much credence.

Classification.—Mental deficiency is a symptom complex and is not a condition, the determination of which is dependent upon simple mental test results or the derivative of a mental test, the commonly used IQ (intelligence quotient). While the IQ may be helpful, as is the thermometer to a physician in diagnosing a disease, it fails when most critically needed. The skilled diagnostician relies upon a careful evaluation of such factors as birth conditions, genetic development, the results of formal and informal teaching, motor and verbal skills, and other evidences of maturation and responsiveness. In other words, the classification of mental deficiency is dependent upon exceedingly careful clinical studies.

The mentally deficient person is usually classified as to degree or grade. In the earliest days the profound mentally deficient, or feeble-minded, individual, as they were then called, was classified as the idiot; the next higher grade, as the imbecile; and the highest grade, as the feeble-minded. Goddard overcame this confusion by giving the name "moron" to the highest grade. Now there is a tendency to abandon the use, at least by some authorities, of these terms and to classify the mentally retarded into three main groups: the severely retarded (the idiot); the middle grade (imbecile); and the high grade (moron). These names are just as descriptive, and perhaps more so, than the previously used designations, and the terms severely retarded, middle grade, and high grade do not carry with them unwarranted connotations.

The Severely Retarded.—The severely retarded mentally deficient person is generally the offspring of parents of healthy stock. The number of severely retarded individuals who come from poor stock—that is, the hereditary type—is relatively small. The condition is frequently recognizable at birth or at a very early age because of the unresponsiveness of the child to his surroundings, and readily recognized physical anomalies. At maturity the severely retarded mentally deficient individual is largely incapable of self-help, has little useful speech, is incapable of independent living, and is almost entirely dependent upon others for his comfort and welfare. This type of child at maturity rarely has a mental level in excess of three years and must be provided for throughout his entire life.

The Middle Grade.—The middle-grade child is not so easily detected at birth due to the fact that his retardation is less severe and is not particularly outstanding until perhaps the age of six months or a year. While this child can learn to take care of his bodily needs, be taught to perform many simple tasks, and move about quite freely in a limited environment, he is incapable, because of mental retardation, of managing his own affairs and, hence, is quite likely to become a social problem.

The High Grade.—The high-grade mentally deficient individual—and this group constitutes by far the largest number—is frequently unrecognized. He may be considered to be slow by his parents and teachers and "dumb" by his employer. The mental level concept is not of much help in classifying this grade. Indeed, clinicians adhere to the point of view that some individuals classifiable as normal may have a mental level as low as nine years and some high-grade mentally deficient individuals may have mental levels as high as 12 to 14 years. These individuals are very susceptible to training and, providing they have been in a situation and profited by a well-planned program, they may do much useful work. Because of their mental deficiency they always need some degree of external supervision. In many instances it is necessary to have this supplied by other persons, but it is possible to have it supplied by the situations in which they have been placed. Their scholastic potentials are not high, rarely exceeding the fifth grade; but in today's world there are a great many niches into which people may fit who are not able to read and calculate at high levels.

Clinical Varieties.—There are a number of clinical varieties, some of which are readily recognizable and occur with a frequency that is sufficient to cause mention to be made of them. The most frequently observed type is the Mongoloid type, miscalled because of the child's similarity in appearance to the child of the Mongolian race. Actually this type of mental deficiency appears throughout the entire world. It is reliably estimated that they appear two to three times in every 1,000 births. They are readily distinguishable by their slanting eyes, internal epicanthi, flat head, saddle-shaped nose, elongated and transverse-fissured tongue, short, stubby fingers, full and fissured lips, and general underdevelopment or hypoplasia. At maturity their mental level is generally between four and five years and rarely exceeds seven years. They have a sunny disposition and are playful and mischievous, although they can be outstandingly stubborn. They are the "aristocrats of the mentally deficient" because

they appear in the better families. There is no substantial agreement as to the causative factors, although it is possible that this condition may be due to a polyglandular disturbance operative at a vulnerable period during fetal development. Cases are reported in the literature of more than one appearing in a single family, but such instances are rare. In spite of considerable research and experimentation it has not been found that they respond to endocrine therapy.

Less frequently found but often confused with the Mongoloid is the cretin type. Cretinism is a clinical type caused by severe thyroid imbalance which produces characteristic physiological symptoms. They are short in stature, being of the dwarf type and frequently also confused with the achondroplastic dwarf. The latter is a type of dwarfism frequently found in mental deficiency, characterized by a shortening of the long bones of the body. The torso is more or less normal, but the arms and legs are short due to a lack of a development of the chondrus, or the cartilage at the ends of the long bones.

The most frequent anomalies observed are the variations in cranial structure. Microcephaly, or small-headedness, is present in a large number of cases as is hydrocephaly, or large-headedness, due to excessive fluid in the brain cavity. Other conditions, such as dolichocephaly (long-headedness), appear frequently enough to be interesting but are not of importance.

Specialized Care and Training.—It is probably true that undue optimism will always prevail regarding the possibility of remedying mental deficiency. It is safe to say that there is no known training program or medical treatment which will so correct the defect in a mentally deficient individual that he will operate at normal levels of efficiency.

The mentally deficient require specialized care and training in the home, school, and community. The history of specialized care for the mentally deficient in the United States begins with the establishment in 1828 of the first experimental school, with an appropriation of $2,500 annually, in the Perkins Institute in Boston. This institution was incorporated in 1850 as the Massachusetts School for Idiotic and Feeble-Minded Youth, and in 1891 was renamed the Walter E. Fernald School and relocated at Waverly. New York State followed in the establishment of an institution in 1851, Ohio in 1857, Connecticut in 1858, Kentucky in 1860, and Illinois in 1865. The first private school for the care and training of the mentally deficient was established in 1852 at Media, Pa., and is now known as the Elwyn Training School and is located at Elwyn, Pa. Special classes in the public schools for the mentally retarded followed at a much later date—Providence in 1896, Chicago in 1898, New York in 1900, Philadelphia in 1901, and Los Angeles in 1902.

At the present time, although several states provide more than one residential institution for the specialized care of the mentally deficient of all ages, not all states make separate provisions for this type of individual. Special classes in the public schools are still inadequate, although more are being established from time to time. A great many of the states are recognizing the need for a differentiated attack upon the problem. This includes home training for the homebound, community classes, residential institution classes, and special classes in the public schools.

During World War II, authorities were astounded by two factors. One was the success attained by a great number of previously trained, high-grade mentally deficient boys in military service, and the degree of success attained by other mentally deficient boys and girls, young men, and young women in the war industries. Since that time there has been a marked reduction in the number of high-grade mentally deficient individuals on the waiting lists for the residential training schools. This is, no doubt, largely due to the fact that industry has found it possible to use these hands in simplified, routine operations.

While it is true that the mentally deficient contribute more than their share of social ills, it is not true to the extent once believed. They are the last to be hired and the first to be fired. They do appear more frequently on the relief rolls, and the estimated 1,500,000 in the United States cost the taxpayers a great deal of money. A careful estimate in 1947 placed this relief figure at more than $2,000,000,000.

It is not true, however, that most crimes are committed by the mentally deficient. In New Jersey a study was made in 1937 of 32,000 admissions to the penal, correctional, and juvenile training institutions extending over an 18-year period. In each of the reporting institutions well-trained psychologists saw each individual, making careful clinical studies. Out of the 32,000 admissions approximately 9 per cent were found to be mentally deficient. This is considerably lower than figures previously reported. It ranged from between 25 and 30 per cent in the juvenile delinquents to about 5 per cent in the male adult group.

A comparatively recent movement of some importance in the field has been the development of groups composed of the parents and friends of mentally retarded children who are interested in the development of additional and more adequate facilities and the better understanding of the problem. More than 100 such groups had come into being in the United States by 1951.

The single organization in the United States devoted exclusively to the problem of mental deficiency is the American Association on Mental Deficiency. This organization, founded in 1876, numbers among its membership only those who are working professionally in the field or primarily interested in mental deficiency. The association publishes the *American Journal of Mental Deficiency* and the *A.A.M.D. News*. The International Council for Exceptional Children, composed largely of educators, is interested in the retarded child as one of several groups of exceptional children. The National Association for Mental Health, primarily interested in the mentally ill, devotes some attention to mental deficiency. The National Association of Parents and Friends of the Mentally Retarded (see MENTAL RETARDATES, ASSOCIATIONS FOR PARENTS OF) is a lay organization in the field.

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(L.N.Y.).

HOME CARE FOR THE RETARDED CHILD

Good home care is the greatest help for the retarded child. The first signs of retardation may be delayed teething, walking, and talking; lack of interest in the environment; and persistence of infantile habits. As soon as parents are aware that the child is not developing at the usual rate, advice should be sought from a specialist in this field or from a child-guidance clinic. A diagnosis indicating the degree of retardation is essential to good home management. Knowing the child's maximum possibilities, the parents should aim at helping him realize them and make the most of whatever ability he has. In daily training the chief consideration is to keep in mind the mental age of the child and manage him according to his capacity rather than according to his actual age. A subnormal child develops as other children do, but at a slower rate, so that when he reaches maturity and mental growth ceases he has not acquired average adult intelligence.

In general, all methods that benefit normal children will benefit the subnormal child if they are modified according to his ability to understand. Another general principle is that the family must be thought of as a whole, and a balanced family life maintained, without lavishing the means and time of the parents on the subnormal to the detriment of the normal. If the child requires so much attention that it is not possible to have a fairly normal home life, it may be desirable to seek institutional care.

Special measures will partly offset the special handicap. Retarded children sometimes have less than average resistance to disease, and precautions for maintaining health should be continuous. Even more important is the development of wholesome personality. In emotional stability retarded children vary as much as the normal. Some are very stable, others highly unstable. The backward child, however, is subject to emotional stresses not usually met by others. Ingenuity and patience may be needed to counter them. Security in the affection of parents, necessary for all children, is especially needed by the retarded, who suffer many rebuffs and disappointments outside the home.

Parents will do well to give constant evidence of affection and, while not indulging the child, give enough attention so that he has a feeling of personal recognition. To assure him the confidence and satisfaction that come from achievement, it is desirable to arrange chance for success through games and small tasks that are within his ability. Failures are to be avoided insofar as possible, and praise for accomplishment, however small, should be generous. The retarded child is often rejected by playmates of his own age, but he may play happily with younger children near his mental age. If he has brothers and sisters, they should be accustomed to including him in their pastimes, but not to a point where they feel him a burden or are denied the usual contacts with other children. Planned group play and simple outings are other devices for providing companionship and variety. Opportunities should be made for using all the faculties that are normal—for example, ability to sing.

When the child passes infancy, training toward self-help is begun. It is useless to attempt habit training until there is enough physiological development to enable the child to control functions, but it should begin as soon as practicable and continue until he can attend to personal needs. He can be encouraged to feed and help dress himself as soon as he has sufficient muscular coordination. Such training requires much patience, but it is very valuable to the child, besides relieving the mother of unnecessary work. Less important habits deserve consideration. Attention-getting devices, unpleasant mannerisms, or awkward gait and posture should be overcome if possible, since they mark the child as different from others. Indirect methods, such as imitation and suggestion, usually give better results than direct commands, which may make the child self-conscious.

Discipline should approximate that for normal children, but be adapted to the slower rate of learning. To be effective, discipline does not have to be severe, but it must be consistent. The subnormal child is somewhat more suggestible than the normal and has less sense of the consequences of his actions. Parents will therefore want to guard against undesirable friendships, especially as the child grows older and spends more time away from home. Reliable measures against making wrong associations are to provide companionship of the right kind, and to plan for plenty of occupation that holds the interest.

All but the most severely handicapped are capable of useful work. Mental defectives are found in a great variety of occupations but are best fitted for unskilled labor under supervision. In most cases, partial self-support is all that can be expected, but some are entirely self-supporting and even help relatives. The degree of deficiency roughly determines earning power, but other factors, such as stable personality and good work habits, influence employability. Preparation for the future begins in childhood. For those of very limited capacity, it is directed toward the maximum of self-help and usefulness, for those of higher intelligence to employability. The home program does not attempt to develop skills, but rather such habits and attitudes as courtesy, punctuality, self-confidence, feeling of responsibility, and ease in getting along with other people. Beginning with simple duties like dusting, washing vegetables, and feeding pets, the child shares in the activities of the home, at first with supervision, later without. If coordination is poor, work involving the large muscles is to be preferred. As he grows older, harder tasks, such as doing errands and making beds, are assigned. Proficiency compatible with increasing ability should be required. The child may be expected to do his share of repetitive jobs, like washing dishes, but he should not be made a household drudge. His activities should be varied and gradually broadened in scope, both inside and outside the home, and if there are any special aptitudes, they should be cultivated for possible economic value, but in any case for the satisfaction they give.

Often overlooked are the possibilities for usefulness of those too handicapped to be employable. By taking a large share of home duties, they sometimes free another member of the family for paid work, or add to the family income by acting as assistants. A measure of appreciation for such services goes far toward their contentment and happiness.

The care of a retarded child makes heavy demands on the family. Anxiety is often a chief part of the burden. Parents may find it a relief to give up specific objectives which may be unattainable, and set themselves a goal which it is possible to reach—namely, making the child as happy and as useful as his limitation permits.

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THE RETARDED PUPIL IN SCHOOL

In the schools of the United States there are many nonacademic pupils—those who, at the age of 15, will be unable to read at a sixth-grade level with interest and with profit. Such pupils should be considered in four categories: (1) the socially handicapped; (2) the socially maladjusted; (3) the clinical academic cases; and (4) the mentally deficient.

Socially Handicapped Pupils.—These are the children who are not working at normal grade level because of improper or insufficent instruction, physical defect, or poor home or neighborhood conditions. Such children are capable intellectually of doing normal or superior work. They are not doing such work because of external factors.

It is the business of the school with children in this category to see that, insofar as possible, every remediable physical or social handicap is removed or alleviated. Simultaneously the school must see, through proper guidance, that such pupils are started on an educational program that will aid them to realize their potentialities. The same program will not benefit all socially handicapped pupils. For those who have learned incorrectly a remedial program will be necessary. Those who have learned insufficiently will require a make-up program which will enable them to acquire the essential learning tools without being denied too much of the content appropriate for their social age. In both remedial and make-up programs, however, the teacher must face the fact that some content or cultural material must be eliminated in order to ensure the acquisition of the learning tools. Otherwise the pupil will be asked to do the impossible, and failure—emotional, social, physical, academic, or vocational—will result. For some socially handicapped pupils, therefore, a different developmental program must be provided. No socially handicapped pupil should be permitted to enter a remedial or make-up program unless it is reasonably certain that: (1) he will attain an actual sixth-grade proficiency by the end of his fifteenth year; or (2), being of college caliber, he will be given the sustained economic and emotional backing necessary to permit him to complete professional training. It is the business of the school to ensure sustained backing for pupils capable of utilizing it.

No one knows the incidence of the socially handicapped. Speaking from his experience in Delaware, George H. Henry wrote in *Harper's Magazine* (January 1946):

"By testing any graduating class of any high school in the country, the skeptic can see for himself what is an old story to teachers: that a third of the high school cannot read on a fifth-grade level or write a coherent paragraph reasonably free of errors. . . . The pupils who compose this lower one-third are not to be confused with the mentally backward (a far smaller group comprising only about five per cent of a school or less)."

The important thing to remember is that 90 per cent of the pupils in an average school are capable of achieving sixth-grade proficiency, not mere certification, before 16, provided that two steps are taken early enough: (1) their remediable handicaps are removed; and (2) they are placed on realistic, functioning educational programs.

Socially Maladjusted Pupils.—These children have an emotional disturbance which keeps them from doing the work of which they are capable intellectually. The disturbance may have come originally from defective environment, from defective physique, or from defective mentality. In any case the deviation has resulted in a pattern or habit of action which these individuals cannot change without help.

The school has the same responsibilities toward the socially maladjusted as toward the socially handicapped: (1) to see that handicaps are removed or minimized; and (2) to make sure that the children have worthwhile school programs. But these responsibilities will entail different timing and methods than those employed for the socially handicapped.

For the socially maladjusted, whatever the primary cause or causes of the maladjustment, the emotional disturbance must be given precedence in treatment. And the treatment of this disturbance may, and probably will, so interfere with the school program that only a different developmental program can be expected to be of benefit to them either as children or as adults. This, of course, is equally true for a second reason. Although the fact is seldom or never mentioned in popular treatises, the general intellectual level of caught delinquents is exceptionally low: the lowest 10 per cent of the population intellectually furnishes about 50 per cent of the caught delinquents.

The different developmental program must be purposeful, however. Although relationship emphases will vary, the same educational goals or objectives that apply to all other children apply to the socially maladjusted. These children have the right to leave school capable of meeting adult responsibilities through contribution at the level of their potentialities.

About 1 out of 200 children is grossly maladjusted socially, and another 5 are in need of modified treatment. Both groups need the aid of clinical experts, but provision of functional school programs will help to arrest deterioration and prevent its onset. Schools, therefore, have three responsibilities with respect to the socially maladjusted: (1) to provide sufficient expert clinical service; (2) to provide different yet purposeful developmental school programs for the two groups of grossly maladjusted; and (3) to provide realistic school programs for all children as a preventive measure.

Clinical Academic Cases.—These are children who suffer from some specific defect in learning patterns, such as seeing words in reverse. Some experts feel that the basic cause is physiological; others, that it is emotional. Whatever the cause, a child should be turned over to an academic clinician as soon as such a handicap is discovered, since it is extremely important that the wrong pattern not be deepened. As with all nonacademic pupils, however, the real cause of the defect must be ascertained. A child may be learning ineffectively because of any one of a number of reasons: (1) a lack of concepts around which to build learning; (2) emotional blocking connected with learning; (3) emotional blocking not so connected, economic and cultural causes being especially important; (4) physical defect, particularly one due to dietary, glandular, visual, or auditory causes; (5) mental defect; (6) emotional defect; (7) poor or inadequate guidance; (8) incorrect curriculum; (9) insufficient teaching; (10) poor teaching; (11) poor learning; (12) clinical academic defect.

After the cause has been ascertained, a complete program should be outlined. Such a program would provide the following: (1) prognosis; (2) plans for amelioration or sublimation

of the handicap, if possible; (3) educational plan; (4) guidance plan for child and family; (5) administrative plans to mesh subprograms and contributing personnel and to ensure that the program is carried out; (6) plans for continuous evaluation and replanning; and (7) plans for refitting the individual into society, where necessary or possible. The prognosis must be as honest as the diagnosis. A reading defect might require the services of an academic clinician, an ophthalmologist, a psychiatrist, a teacher of Braille, or a teacher of the retarded. And a reading deficiency might necessitate the initiation of a school program emphasizing long-time academic proficiency or vocational proficiency. Once started, however, an honest and intelligent program should be continued until some better program becomes apparent. Standards of promotion from one level to another within a school program, for instance, should be strict and honest. If a child cannot master a given curriculum, he should not have it. There is no education by osmosis, and there should be no planning by default.

At most there are very few true clinical academic cases. A somewhat larger number function in this way. For both groups, academic clinicians must be provided.

Mentally Deficient Pupils.—Technically, the terms "subnormal" or "inferior" are applicable to persons with below-average intelligence, and thus to about one fifth of the general population. The term "feeble-minded" has been pre-empted, though not technically, for use with individuals so defective intellectually that they will never be able to manage themselves or their affairs without a large amount of supervision. The terms "mentally deficient," "retarded," "mentally retarded," and "mentally handicapped," which can be used interchangeably, designate a smaller group than the subnormal or inferior, but, in common parlance, a larger group than the feeble-minded.

Of the one fifth of the general population that is below average in intelligence, the great majority can profit in reasonable degree from a modified regular school program, but some must be on a separate curriculum because their power of adjustment is limited. In other words, under fortunate circumstances the majority can profit from a modified regular program; under unfortunate circumstances they will need a different program. For those more grossly limited in power of adjustment—the mentally deficient—no degree of modification of the regular curriculum will provide profitable schooling. They cannot profit from a remedial or make-up program, either of which, ostensibly, would return them eventually to a regular program. The mentally deficient require a different developmental program.

Among the mentally deficient are the feeble-minded. These include the idiots, who cannot guard themselves against physical injury; the imbeciles, who are capable of a measure of self-help, ordinarily within an institution; and the low-grade morons, who often are capable of maintaining themselves in private competitive enterprise, provided they have constant supervision. Also included among the mentally deficient are many individuals who, under fortuitous circumstances, are capable of managing their affairs in adulthood without supervision, provided they have special education in childhood. These are the high-grade morons and certain borderline cases.

All inferiors are limited by constitutional defect. This limitation results, and is manifest, in a circumscribed power of adaptation to circumstances. For a given individual, inferior as well as normal and superior, happiness in a particular situation will result if the power of adaptation, internal and external, is equal to the demands of circumstance, internal and external. As a result, individuals reasonably similar in power may lead lives varying greatly in happiness or success. But no retardate is capable of getting enough from ordinary schooling to enable him to meet satisfactorily the demands of living. This is the distinguishing feature of mental deficiency.

Implications of Mental Deficiency.—Mental deficiency is actually a physical defect, but since it is not always apparent, it mistakenly is classified under a separate category. Moreover, since society for some reason has greater feelings of guilt about amentia than, for example, about dementia or blindness, persons with mental deficiency are accorded less consideration. We are sympathetic toward the blind child shown on the screen; we laugh at the comedian who imitates a moron. Many intelligent people who would be among the first to demand special service for the crippled, the blind, or the deaf would deny special service to the mentally deficient. Such people might put the idiot out of sight in an institution, but they would not give the more capable defective the special education that would enable him to keep out of an institution.

Mental deficiency has definite implications, many of which are unknown to the general public. A weak mind, for instance, is not accompanied ordinarily by a strong back. It is accompanied by a weak back, and physical defects are more than twice as frequent among the mentally deficient as among the normal. Moreover, the defective generally does not adjust easily to repetitive work, particularly on an assembly line. He works best in small groups where there is some change of operation and some personal contact with an overseer. Mental deficiency, especially among certain types, does not guarantee placidity. Not only does the lower intellectual group furnish a grossly undue proportion of caught delinquents, but the defective in the classroom is about five times as liable as the normal child to need specialized help with personal problems.

These characteristics have definite vocational implications. Only in the most unusual cases is the retardate able to maintain himself without supervision in semiskilled work; and studies, as distinguished from generalizations based on a few exceptional cases, repeatedly have shown that the retarded do best in unskilled work. Even here, however, they are competing with their more capable fellows, since about 20 per cent of the work in the United States falls at this level. Low-level jobs are terminal and not interim jobs for the mentally deficient, and yet such individuals often leave school without the necessary intensive preparation for the lowest-level jobs. By the very nature of mental deficiency, a boy so handicapped will not learn the required work casually. Thus, when the time of employment comes, the normal boy will get the job instead of the boy who is mentally deficient, not because the latter cannot do the work, but because he has not received the extra training that he needs in order to have equality of opportunity for employment. In order to obtain immediate employment and

to retain it through his employable years, the mentally deficient must be better fitted for his work, in terms of particularized training, than his competitors who have average or better than average intelligence.

The basic characteristic of mental deficiency is limitation—in adaptive power, in associative power, in learning speed—and this limitation is so great that it extends to the learning and practicing of the simple operations which the average child picks up casually. Yet, upon leaving school, mentally deficient children must meet the competition of the more capable groups. Society does not give them any special consideration with respect to employment; in fact, ordinarily it discriminates against them. Therefore, the only protection of the mentally deficient against such a laissez-faire condition is special education.

A Valid Philosophy of Special Education.—Different philosophies have been utilized as a guide in the education of the retarded. Historically speaking, each may have been necessary at some stage in the development of a valid program, but some school systems still cling to a philosophy long discarded by more progressive systems.

An early philosophy, starting about 1900, could be termed the "relief" philosophy. Under this system, special education was established to relieve normal children in the regular grades, the emphasis being placed solely on their good. As a result of this negative attitude toward the mentally retarded, anything was possible or accepted in the special class. The children and some unfortunate teacher were thrown together in an out-of-the-way classroom, and the child's time was spent in meaningless nothingness.

A more enlightened but not more productive philosophy was that of "happiness," which also flourished in the early 1900's. Under this philosophy, special education was used to remove children from extremely unhappy classroom situations and to place them with their mental equals so that they would not suffer from the unfair competition of normal children. It was believed that, by giving the mentally deficient child command of the simplest academic tools, the most rudimentary manual skills, and the most generalized attitudes, he could be made into a reasonably self-sufficient, self-supporting citizen. This type of program failed because of the urbanization of society, the rise of cultural standards and educational levels, and the mechanization of industry. Experience showed that the mastery of simple academic skills, of generalized skills, and of generalized attitudes did not produce employable or contented individuals.

In the 1920's, with newer forms of education, many educators wishfully thought that the slow child was receiving an adequate education by performing certain manual parts of an activity, such as making dioramas or doing finger painting, while the more able child prepared reports and developed dramatic presentations. Time showed that such an emasculated program for the mentally deficient left them without any real facility in meeting adult responsibilities, slowed down the rate of progress for the more able, and degenerated eventually into that true form of segregation: remaining in the same room without worthwhile participation or emotional rapport.

In the 1930's, it was discovered that the retarded had some capabilities; and so the pendulum swung from "nothing" to "everything," and the emphasis was placed on a "return-to-the-grades" or "salvage" philosophy. Academic training was stressed out of all proportion to the children's needs or abilities. The kindest thing that can be said about the program which resulted was that it did not fool its victims.

Another philosophy, not more valid, was the "handwork" philosophy. In this the child was given something "real to do." He was urged to saw and hammer, plane and chisel; and somehow, some day, it was expected that he would take his place in the ranks of honest, skilled labor.

It is now recognized that no philosophy is valid for the education of the retarded that does not guide us toward providing an education beneficial to the retarded themselves. Such a philosophy must be based on a realistic view of the strengths and weaknesses of these children as well as on the place they eventually will occupy in society. It is believed that the retarded have a potential contribution to make to the world in which they live and that it is a primary function of special education to help the retarded to realize such potentialities.

As early as 1931 the Committee on Special Classes of the White House Conference on Child Health and Problems, in *Special Education: The Handicapped and the Gifted* (see *Bibliography*), stated:

"Serious consideration must be given to the curriculum best suited to the needs of subnormal [retarded] children. The aim is to develop the child's mental capacities and the control of his emotions to the point of adequate social adjustment and the curriculum must necessarily be determined in part by adult requisities. The first point to consider is what work these subnormal [retarded] will eventually be able to do."

In *A Guide to Curriculum Adjustment for Mentally Retarded Children* (see *Bibliography*), Dr. Elise H. Martens, senior specialist in the education of exceptional children in the United States Office of Education, said:

"Education for the mentally retarded is not different in its aim from education for any group of children. This aim is to teach the individual how to live better; to teach him to use all of his capacities; to teach him to become a useful member of the social group."

Dr. Charles Scott Berry wrote in *Education of Handicapped School Children in Michigan* (see *Bibliography*):

"There has been much time, money, and effort wasted in the education of subnormal [retarded] children through the failure to recognize clearly the proper aim of education in the case of this type of child. Since about 20% of the adult population are engaged in unskilled labor the folly of attempting to prepare children of the most inferior intelligence for skilled labor or for electrical work is self-evident. The aim of the teacher, after a thorough trial in the special class has demonstrated the impossibility of the pupils ever successfully doing regular grade work, should be to prepare him to become a law-abiding, self-supporting citizen in the simplest occupations."

Thus, conscientious educators have come to see that the retarded, if they are to realize their potentialities, must be given a different developmental program rather than a remedial or impractical adaptation of a normal program. Such education must give to each child a competency in (1) the technique of self-measurement; (2)

a knowledge of suitable job families and social requirements; (3) the technique of meshing abilities with vocational and social requirements; and (4) the desire for social contribution. The whole program for the mentally retarded must be built around the achievement of vocational and social competence, for here, if anywhere, the retarded will most nearly approach normalcy. This different developmental program is called occupational education.

Essentials of an Effective Program.—Occupational education seeks to give the retarded sufficient freedom to enable him to develop his capabilities for self-support and yet sufficient protection from the rigors of competition to keep him from being too hopelessly discouraged to utilize these capabilities. It provides a series of occupational-social skills leading toward a social maturity that includes occupational adjustment as a part of total adjustment. To accomplish this aim, the complete program includes the following:

(1) *Occupational information*—giving the pupil information concerning the work available to him (considering both youngster and community): how this work is done (job analyses); and what its importance is to the world.

(2) *Vocational guidance*—guiding the pupil to measure his own abilities against the requirements of the job in which he is interested; showing other jobs in the same work area.

(3) *Vocational training*—giving the pupil training in the manual skills found in the work area (25 per cent); training in the nonmanual skills necessary in the work area (25 per cent); training in the general habits, attitudes, and skills common to all good individuality, workmanship, and citizenship (50 per cent).

(4) *Vocational placement*—providing the individual with actual job placement.

(5) *Social placement*—adjusting the adult on the job and in the freedom of his first independence for as long a period as may be necessary.

In New York City the teacher is responsible for the first three of these phases, which he provides ordinarily in the classroom, using the eight following large cores of instruction:

Core	Chronological age
The home	7–9
The neighborhood	10
The borough	11
The city	12
Study of job areas	13
Ways of choosing, getting, and holding a job	14
Ways of spending one's income wisely	15
The worker as a citizen and social being	16–17

Throughout these cores great emphasis is placed on the nonmanual or social skills. These are the skills, not of a manual or technical nature, that likewise are needed for living and working. Several recent studies show that from 60 to 80 per cent of workers lose their jobs for nonmanual reasons. Such skills include: personal health and appearance, manners, means of getting employment, means of keeping a job, means of adjusting to accidents and unemployment, ways to get along with the employer, ways to get along with fellow workers, budgets and banking, ways to travel in the city, suggestions for living at home or away from home, recreation, personal and group relationships, and citizenship.

The ordinary child learns many of these things in the process of living. For the retarded, however, the mastery of these fields of knowledge and skill cannot be left to chance. This is true both because of the way the retarded learn and because service jobs, for which the majority of the retarded are best fitted, are more dependent for success upon general characteristics than upon the specific skills usually associated with vocational training. This training cannot be put off until the retarded is chronologically and socially mature enough to think of job seeking. Many of these skills must be consciously sought by teachers through careful grading and good teaching until they become in the children automatic responses to specific situations. In this regard the Committee on Special Classes of the White House Conference made two significant statements:

(1) "Subnormal [retarded] children obviously cannot acquire as much in quantity as the typical group and they also require more time for any given quantity than is the case with typical children.

(2) ". . . the lower the degree of potentiality the earlier should attention be centered on vocation. The subnormal [retarded] child can be put at productive work earlier than the child who needs more time for preliminary training but he should be prepared for his work as long as possible."

Few things are more certain than the fact of human variation. In one sense there is no such thing as an absolute standard of normalcy. People vary in stature, in color, in weight, in glandular balance, in visual acuity, in emotional balance, in mental ability. Some of these variations have a genetic basis or at least a prenatal basis; others arise largely from environmental circumstances. Most are conditioned by a complex interrelationship of prenatal and environmental factors. These differences account for much of the richness of life and also for many of its problems. The problem, therefore, for educators as well as for society as a whole, is to find a reasonably workable way to prevent the variation which is destructive in result without weakening the variation which is constructive. Obviously, no one knows with certainty how to do this. It is quite sure, however, that it must be attempted. In fact, it is being attempted, though far too seldom consciously and under an intelligent plan.

Like society in general, school people move with much more directness and with much more assurance where the object is concrete. Thus, the great majority of educators would attempt consciously to provide adequate school lunches to the undernourished or for the malnourished. They would provide showers, well-lighted rooms, recreational facilities, even competent vocational guidance and placement workers. There would be far less unanimity and assurance, however, in making realistic provision for the building of socially acceptable intellectual and emotional patterns. We not only know less of how such patterns are made; we are far less certain of the patterns we desire to make.

Throughout his life the individual is engaged in balancing (a continuing task) what he is (his tools, his spirituality, his thought processes, his emotional desires, his physical needs) against what he must do (his problems, human relationships, and physical surroundings) in order to achieve the greatest possible personal satisfaction at the level of his development (survival,

physical enjoyment, gregariousness, aesthetics, logic, social contribution). More simply, every maturing individual is accommodating his changing body to his expanding responsibilities.

For at least 90 per cent of adolescents, achieving acceptable economic status implies achieving economic self-sufficiency. The young person without further training and experiences is expected to be able and willing (that is, emotionally able) to earn his own living in open competition with all others. It is easy of course to overestimate the importance of this fact, but the practice, among curriculum builders especially, is to underestimate it. Yet this and other adjustments or accommodations listed in this article are the required learnings of young people. Whatever the ostensible goals set up by educators, these are the learnings with which the school is expected to give great help. In other words, schools were established and are maintained to help young people achieve such competencies more easily. In a very real sense the nominal goals are merely the media by whose mastery school people have thought the required learnings could be achieved.

Almost all individuals fail sometimes; a few fail so repeatedly and so grossly that they must be considered as problems. Some of the problem children are not school problems in the ordinary use of the term. But before we can determine whether or not a child with a gross problem unmet is a school problem, we must decide what society reasonably can expect from a school. If a school is responsible only for giving pupils academic proficiency, then a school problem is only a child who is not making "normal" academic progress. If a school is responsible only for helping a child to make immediate adjustments, then even the child who acts "acceptably" only when nothing is demanded of him is not a school problem. If, however, a school is responsible for helping an individual to make a total adjustment, both while in school and throughout his life, then the school problem is the child who is not making reasonable progress along all the lines—spiritual, social, physical, emotional, vocational, and academic—which he presumably will need throughout his life.

Educators have recognized the desirability of modifying school programs to meet the needs of individual pupils. Too often, however, such modifications have been mere progressive "waterings down" of subject matter rather than an introduction of new content not technically academic in nature. The general order in which the school has placed its emphasis has been as follows: (1) academic proficiency; (2) occupational competency (largely the concern of vocational schools and commercial departments); (3) competency in social adjustment.

It is clear that for a great many pupils this order of emphasis cannot be justified, and that for at least 20 per cent of the pupils it must be reversed if education is to help such individuals appreciably. The three competencies naturally must be integrated, but the first objective must be to develop citizens capable of making total adjustments as readily and as satisfactorily as possible. This is necessary to ensure comparative maturity, both social and occupational, since almost every study which has been made of job holding and success reveals the need for personal qualities that will enable a person to make adjustments socially acceptable.

As a second objective, the schools must seek to develop economic and occupational competency of a type which will permit the young person to find a place where he can succeed in the world of work. This concern with the vocational objective does not mean that "occupational adjustment is the sole goal of the school program. Rather, what is meant is this: occupational adjustment is one of the inter-related, individual goals of the accepted program. . . . Education which does not seek occupational adjustment is incomplete." [1]

Academic competencies as such must take third place in school objectives for most pupils, especially when school goals are considered in terms of present day courses of study and curriculums. It is estimated that one child out of five of school age is not capable of benefiting at 16 years of age from a school program requiring mastery of academic skills beyond the sixth-grade level. With maturational promotion in effect in the elementary and junior high schools, it must be expected that senior high schools will have approximately this percentage of slow learners in their student bodies.

The retardation encountered will be the result of many factors, heredity being only one. Whatever the cause of the retardation, however, no practical change of teaching method will enable this group of pupils to master academic skills beyond the sixth-grade level. The adaptation of schooling to their needs and abilities involves far more than a meshing of educational guidance goals with existing grade levels and a slowing down of the rate of presentation. Instead, there is necessary a reconsideration of skills from many levels. A lower-level job from an economic standpoint may require the inclusion of certain skills from the standard eighth-grade level and the omission of others on the third-grade level. For example, certain jobs have certain vocabularies. A boy may be reading at the fourth-grade level; he may need to know 20 words at the eighth-grade level. He must be given these words irrespective of his reading level. In point are the words on social security and job applications. It should be stressed, however, that pupils are limited not only with respect to the degree of difficulty which they can master, but also with respect to the amount they can master even at the levels they can achieve. Thus, in order to get the time to teach—not merely to present—the words on a social security blank, it may be necessary to omit fractions with denominators above four, even though such fractions may be standard fifth-grade content and within the grasp of students capable of doing fifth-grade work. There must be long-term planning to ensure the teaching of first things first, both in the sense of order of presentation and in the sense of individual life needs. If it is a question of teaching a pupil to master fractions or to get along with his employer, the latter must be taught. If a pupil cannot be taught to get along with both the boys in his block and the boys halfway around the world, then the pupil must be taught to get along with the boys in his block.

The schools must be equally certain that the content is meaningful and challenging to the pupils. It would be absurd to use books of

[1] R. H. Hungerford and C. J. De Prospo, "Occupational Education and the Curriculum," *Occupational Education*, February 1946.

ninth-grade or even sixth-grade difficulty with a boy capable at the time of using only a fourth-grade book. It is equally absurd to use books with content, particularly social content, much below the pupil's needs and abilities. Thus, for a fourth-grade pupil of 15 years of age, a fourth-grade reader built around the interests of 11-year-old pupils may be almost as bad as a sixth-grade reader. The latter, the pupil is incapable of using mentally (for the time being); the former, the pupil is incapable of using for psychological backgrounds. Help can come from learning about the Eskimos only if such studies deal with the problems of the Eskimo father in bringing in enough blubber, making the man next door keep the dogs chained, and helping a son to realize that life is more than blubber or dogs. A real understanding of actual Eskimo life might be helpful, though probably not as helpful as content nearer home would be; generalizations about trivialities of Eskimo life cannot be justified.

It is the business of the school to give the individual, insofar as possible, all the experiences necessary for building the attitudes, skills, and habits he must use, at least in his beginning independence. Anything which does that is learning. Individualization of instruction is concerned quite as much with content as with technique. There is necessary a thorough reconsideration of the meaning of school goals. Even for the most retarded of the school group it is not necessary to omit or change any of the cardinal aims of education. It is necessary to reinterpret the meaning of applying goals to individual abilities and needs.

Occupational education is an inclusive program. It begins when the retardate enters the special class and does not cease until the need has ceased, however long that may be. It is an inclusive program also because it consciously attempts to prepare the child for many possible life situations. All encounter depressions, booms, war, and peace, and a complete education cannot leave an individual unprepared for any. This is true for all individuals; it is especially true for those who by very definition are unable to make quick and efficient adaptations to new situations.

Occupational education is not a technique of teaching. It is comparable to the social studies in that it provides a series of occupational-social skills leading toward social maturity. Because of its nature, however, it tends to become the interest core for all teaching in a special class. Occupational education is the content of instruction. As such it may be taught by any method, although it is believed that the activity or unit approach will produce the best results.

A continuing tendency in special education has been to try to lift the child above his capabilities. After viewing the total pattern of the individual in relation to this total life, occupational education teaches the possible skills basic to total adjustment. With this point of view, academic skills are relegated to their proper place, becoming only one part of the cores used for instruction.

All teaching presupposes the existence of goals based, at least suppositionally, upon an awareness of pupil needs (including real interests) and abilities. Occupational education consciously accepts responsibility for meeting pupil needs in the order of urgency. It does not limit pupil needs, but neither does it suppose that education occurs through osmosis. A boy does not become a worthwhile member of society by living in a town containing worthwhile members of society. A school has the responsibility of providing each pupil with the curriculum which will enable that pupil to function in school days and in adulthood in the most effective and happy way possible.

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MENTAL SPINE, in anatomy, the single or double tubercle on each side of the body of the mandible, for the attachment of the genioglossus and geniohyoid muscles.

MENTAL TESTS. Historical Background.—Modern psychology has been aptly

characterized as an experimental science, and its preoccupation has been with the typical human being. There were trends, however, as early as the 1880's, that bore in the direction of emphasizing individual differences. One was the clinical study of abnormal personalities, and eventually some of the hospital psychiatrists turned to the psychologists and their laboratory instrumentation for many of their methods of examination.

Meanwhile, out of the laboratory experiment the mental test developed; for once experimentation had furnished a set of findings drawn up as laws about people in general, then the individual man could be examined and compared with man-in-general. When an experimental technique was used to determine a given person's particular ability or trait, it became not a psychological experiment, but a mental test. At first, the traits tested were mainly: reaction time; sensory keenness and sensory discrimination; memory abilities; motor accuracy, steadiness, and speed; imagination; word-association; and attention.

At the beginning of the 20th century attempts had been made at combining tests such as these and others to see which combinations might be fruitfully used. At Columbia University, J. McKeen Cattell was applying a battery consisting of a wide variety of laboratory-derived tests to the entering freshman and again to the graduating seniors, to see what changes due to age or to college environment might be brought to light.

Tests of General Intelligence.—Progress in the measuring of special aspects of psychological equipment became overshadowed by one achievement in particular. This was the successful combining and scaling of different tests to form a measuring rod for general intelligence. In 1905, 1908, and 1911, Alfred Binet (1857–1911) and Théodore Simon (1873–) devised a method, which would be more valid and more time-saving than were the teachers' judgments, for identifying those children in the schools of Paris that should have special attention. Their scale consisted essentially of series of problems and questions, to answer which demanded the exercise of "general intelligence." They were designed not as a test of the child's knowledge derived from school or home training, but as a test of his native capacity to acquire such knowledge. The child might be asked to follow out simple commands, to draw copies of complicated designs, to combine disarranged words into a sentence, to name some objects shown to him, or to tell what he would do in certain everyday situations described by the examiner. The tests were so graded that the easiest lay well within the range of the ability of the average 3-year-old, while the hardest taxed the ability of average adults. The scaling of these tests was done empirically, i.e., was based upon found results with Parisian children of all ages. For example, if, when tried, a given test was successfully passed by two-thirds to three-fourths of the 9-year-olds, but by a much smaller ratio of the 8-year-olds and a still smaller ratio of the 7-year-olds, it was then set up as a suitable test for "9-year-old intelligence." The tests accepted as best differentiating ability of the average 8-year-old were placed together, those for the average 9-year-old were placed together, and so on until for most age-years, a set of five tests was available; the whole series were finally combined into one scale, from age 3 to age 15 and to adult. By such a measuring rod it became possible to find out whether a given child tested was "at age," i.e., normal, or was retarded or superior.

The practical value of the Binet tests was not long in becoming recognized outside France. In America clinical psychologists were prompt in setting about the task of revising Binet's particular tests to the language and experience-background of the average American child, and of improving the scale and the procedures of administering and scoring. The scale most employed today is that constructed by Lewis M. Terman and Maud A. Merrill, which is the 1937 revision of the "Stanford-Binet" examination. They adopted from Wilhelm Stern the method of indicating the *relative* brightness of a child by his "intelligence quotient" or "IQ," found by dividing his "mental age" by his "chronological age." If a subject's IQ is around 100 per cent, then he has tested as somewhere near the average of children of his chronological age—he is of normal intelligence. If his IQ is 75, he has been found able to pass tests only of much younger ages than his and he is classed as mentally subnormal, or perhaps feebleminded.

Interest in intelligence testing has inspired a truly enormous amount of work. Most of this work has been based upon the use of tests as well accepted measures to determine what relationships may be found between intelligence and some other variable such as age, nationality, blood kinship, home status, occupation, and innumerable others. A few of the researches have been in the direction of critical inquiries into the nature of intelligence itself. Binet, and most others who have adopted his scale, have assumed that what the tests purport to measure is largely a native trait, intrinsic to the individual person. The point is reflected in the notion that the IQ of the same individual remains very closely the same throughout childhood. Thus, a boy at 5 years who tests 6 years in mental age, and so has an IQ of 6/5 or 120, will, when 15 years old, continue to have an IQ of 120, and will be mentally as bright as 18-year-olds. Obviously, this predictive function of the IQ has tremendous importance. There is a controversy, however, between those investigators who claim to have demonstrated that a child's IQ can be raised many points by furnishing him a stimulating environment and careful teaching in early years, and those who insist that such claims greatly exaggerate the possibilities.

Certain limitations in the Binet method of examining for intelligence have been recognized, and have led to the development of supplementary tests. (1) It cannot be as successfully employed with adults as with children. This arises from the fact that Binet originally standardized his tests only up to and through the age of 15 years; and the Stanford-Binet of 1937, though adding three more levels of brightness, still assumes 15 years as the "average adult" level. Then, too, the very content of many of the test items is unlikely to elicit the desired interest on the part of adults. Also many of the tests put a premium on the speed factor, whereas the slowing down in mental operations in later maturity has been found to be at no cost in accuracy. For the examining of adults on the other hand there are the *Wechsler-Bellevue Intelligence Scales* or the *Army Individual Test*. With these scales the final score of brightness is not cal-

culated from mental age values of tests passed, but from the total number of points made on all tests, this total being then restated as a distance (in "standard deviations") above or below the average score made by adults of all ages. These have two advantages. The component tests fall into two general sorts: the verbal test and the performance test, which makes it possible to compare an examinee's facility in using words and symbols with his ability to manipulate objects and to perceive designs. Furthermore, the patterns of high and low scores on the respective component tests of the Bellevue scale vary characteristically with certain psychiatric groups (as the schizophrenic, the neurotic, the defective), so that not only brightness-level but clinical type of deviate can be recognized.

(2) The Binet type of test depends in part upon the examinee's ability to use language, oral and written; yet there are classes of people, whom it may be desirable to examine, who are illiterate or deaf, or who are unfamiliar with the English language. The oldest and best-known of the *performance* tests is the *form board* type, consisting of a baseboard bearing holes of varying shapes into which the examinee is instructed —by wordless hand motions if need be—to fit the appropriate blocks from among those supplied him. The *picture assembling* test is much like the popular jigsaw puzzle, with pictured objects or events which require some understanding and interpreting of them in order to completely assemble them. There is the *block design* test in which the examinee is shown a colored pattern and is instructed to copy this by putting together cubes with different colored faces and half-faces. Quite different is the *cube imitation* test: four cubes are set in a row before the subject, then the examiner taps them with a fifth cube in some standardized irregular order, and the subject is bidden to do likewise.

(3) The Binet method of intelligence measurement cannot be employed to test more than one individual at a time. This has led to the develop of *group* intelligence tests.

Group Tests.—The initial spurt of interest in group tests was occasioned by the recognition of their practical value, when the United States entered the First World War, in sorting out army recruits of varying levels of intelligence for promotion, discharge, special training, and other differential assignments. These men were drafted in such numbers that testing them individually proved unfeasible. In a group test the examinees are provided with printed booklets containing a variety of tests, each usually printed on a separate page and so arranged that it can not be seen in advance of or after the time during which work is to be done on it. The examiner uses a series of signals by which all examinees' starting and stopping of tests is controlled in concert. Each test is a series of questions or other items calling for penciled answers.

Just as in individual examining so in group examining there was seen to be a need for tests of nonlanguage or performance types. To meet this need there were developed printed problems that utilized designs rather than words. Since the First World War there has been a heavy output of group intelligence tests of both language and performance nature, including the *Army General Classification Test* employed in the Second World War.

Results of Intelligence Testing.—Just as the origin of intelligence tests lay in practical school demands, so their widest usefulness has been in connection with educational problems. For one thing, they have been quite widely employed to differentiate the children in school classes into the superior, average, and inferior sections; and over a wide area the differential treatment of the sectionized grades has obtained gratifying results. It should be pointed out that in dealing with the individual child, administrators recognize many factors other than native intelligence as contributing to his school success, such as health, home environment, and industry. Intelligence tests do not measure ability in all school subjects equally well; their results have been found to correlate better with grades made in composition, reading, and arithmetic, e.g., rather than with grades made in handwriting, handwork, drawing—or even spelling.

Group tests of the intelligence test type—though not so labeled—have been in well-nigh universal use in the induction of college freshmen, furnishing data for later reference in cases of disciplinary action or of counseling.

The greatest use of tests of intelligence, after educational and after military needs, is in vocational guidance. It is assumed that insofar as the different occupations and trades demand of people successfully pursuing them, different ranges of level of intelligence, then to learn the level of a given young man or woman is very material to guiding him successfully. This has been borne out in a very general way. However, success in a given occupation obviously depends upon so many other factors—interests, special aptitudes, personality makeup, and others —that the tests of general intelligence may be said to have more of an eliminative than a positive selective value.

Achievement Tests.—The impression made on psychologists and educators by the successes of the intelligence test movement led rapidly to the adoption of similar objective methods for measuring other abilities and traits. The impact upon school subject examinations was shown by the adoption of various test forms that freed their scoring from the influence of subjective impressions on the examiner's part. They included the answer of "true" or "false"; underscoring the correct answer out of alternatives; filling in a blank space with the correct word, or matching the relevant items in two arrays. These achievement tests are used to measure what level of facility or range of information the examinee has achieved in some particular area, as algebra, Italian, economics, or a nonacademic subject.

Aptitude Tests.—Another direction taken in the widening application of objective testing methods has been in the measuring of characteristics of a person that predict his ability to acquire, with training, some particular skill or knowledge. A celebrated battery of aptitude tests is that for *musical* talents devised by Carl E. Seashore. He has shown that "ability in music" really involves many components in a complex hierarchy, and for most of these he provided specific testing procedures. Phonograph disks are used to produce the sounds used in testing ability to discriminate differences in pitch, intensity, time interval, timbre, melody, and rhythm. The scores derived from these and other tests are then represented graphically as distances from a zero line, the resulting "profile" presenting a

kind of picture of the examinee's various musical talents. Musical tests have been widely employed to direct attention to pupils who have unsuspected abilities calling for musical training, and they have also shown that in others musical training is an unwise investment. Other tests of music furnish vocabulary and question tests to measure musical knowledge.

Aptitude for *art* training has been tested in a variety of ways. One is by showing pairs of uncolored pictures or sets of four designs, the examinee to indicate his preference in each case, and then comparing these judgments with those previously obtained from art authorities. Many other art aptitudes, such as color preference, have been subjected to measurement.

Aptitude testing has shown much advancement in examining capacity for *mechanical* training. Some tests put a premium on the subject's ability to "get the hang" of a mechanical device, by asking him to assemble correctly into a working unit the separated parts of a bicycle bell, of a monkey wrench, of an electric light socket, or some such device. Other tests are directed at manual dexterities, as those involved in handling a complicated form board or stacking together some "wiggly" blocks. Then there are paper-and-pencil tasks, such as the kind that asks which pictured tool (screw driver, wrench) is used with each pictured object (a nut, a bit); or the kind that demands the quick putting of dots into small circles, or that involves counting how many blocks touch other blocks in a pictured pile of them.

Tests of other vocational aptitudes have been, and are being, developed. Tests of *clerical* aptitudes usually consist of operations not essentially different from those called for on the paper-and-pencil group intelligence tests; but they are directed to details that are especially relevant to the work of a business office, such as checking numbers or matching names.

The interest in vocational counseling, as well as the need which has been felt for sifting applicants for admission to the professional schools, have supported attempts to apply principles of aptitude measuring to the *learned professions*. The validation of these principles has been measured by comparing the scores of such applicants with the grades later made by the examinees in the professional school studies rather than with the degrees of success achieved still later in professional practice; and the value of these tests has been limited on the whole to selecting the persons who will do well in the professional fields in question.

In *medical aptitude* tests, the traits covered vary considerably; but taken together, they include tests of such things as knowledge of scientific facts, visual imagery, logical reasoning. Medical schools are using these tests to some extent for active selecting of candidates, but they are also maintaining a research attitude toward the question of their ultimate validity. There has not been as widespread acceptance of aptitude tests for admission to law schools as for admission to medical schools. For the study of engineering, aptitude tests have been devised ever since the end of the First World War; but there has not been persistent interest in comparing, validating, and standardizing the manifold available tests on a nationwide scale. Mathematical ability seems to be the most adequate single measure upon which ability to do the work of the engineering schools can be predicted, with facility in spatial thinking running second.

Interest Tests.—Success in an occupation certainly depends upon more than one's native ability developed by training; it depends upon his interests in many different directions. Consequently, aptitude tests frequently are supplemented by interest inventories. The examinee may be furnished elaborate lists of items concerning amusements, school subjects, people's peculiarities, personal possessions, and the like, and he is to indicate for each item whether he likes, dislikes, or is indifferent to it. The results are then studied to see whether or not the pattern of the examinee's likes-dislikes resembles that previously obtained from successful engineers, or life insurance salesmen, or other vocational groups. Where there is high correspondence, it is to be concluded that—capacity and training granted—there is evidence that the examinee would be happy in that occupation.

Personality Tests.—The great contemporary interest in problems of the total personality has led naturally to the development of approaches to the measuring of *personality*. But that word has many meanings; the approaches therefore are diverse.

The *questionnaire-inventory* method, developed during the First World War by Robert Sessions Woodworth (q.v.), has been adopted in myriad forms. Essentially this is not a test in which the subject actually faces a problem or situation, but a test which consists of a list of questions which the subject answers in the first person; e.g., "Are you easily moved to tears?" "Are you touchy on various subjects?" "Are you slow in making decisions?" In a form much in use, R. G. Bernreuter has picked 125 questions from many of the more successful inventories and recombined them. By applying different scoring keys which assign different weights to the various answers, the subject can be scored on six personality traits: neurotic tendency, self-sufficiency, introversion-extroversion, dominance-submission, self-confidence, and sociability. It can be seen readily that in the adoption of such self-questioning methods, whatever their internal consistency, their validation (the faithfulness with which they do measure what they purport to measure) must be a persistent problem.

Other scales in much use, especially by industrial concerns, assume certain "components" of the personality for which the tests may be scored: hysteroid, cycloid, schizoid, epileptoid, hypochondriacal, masculine-feminine, and others. Such terms come from the psychiatric hospital, and this use here recognizes that the deviations and eccentricities of mental illnesses are after all only exaggerations of variations to be found among the normal.

In clear contrast with the personality tests which limit the subject's responses to previously drawn-up alternatives and which consist of many discrete items, is the *projection* type of personality test. Therein the subject is free to react as he pleases—and this yields insight into his desires, phantasies, emotionality, dominant interests. The Swiss psychologist, Hermann Rorschach, seized upon the familiar ink-blot exercise as a way of revealing the profounder characteristics of a patient in his way of *seeing* or apprehending the blots. Standardized printed blots are presented one at a time to the individual for his

oral responses. (In a form adapted to groups, the blots are thrown upon a screen and the examinees write out their responses.) Does the examinee see things as a whole, or does he emphasize the details? Is he influenced more by form, by movement-sensations, or by coloring? Does he tend to see human beings, animals, plants, or landscapes? Are his responses individual with him, or much like those of other people? This may look like a piecemeal, item-by-item, analytic sort of approach. It is far from that. All the tabulated details are arranged so that the skillful clinician can inspect them, not by adding and subtracting, but by apprehending them as a whole. It is not unlike the way one looks at a picture; and it should lead the clinician to a true picture of his examinee as a total personality—his expressiveness, interests, talents, temperament, and even his philosophy of life. The idea is not unfamiliar in daily life; one often speaks of knowing his friend—not as a series of itemized details but as an indivisible unique personality. The claims of those who use and adapt the Rorschach method are broad and ambitious; nevertheless it is growing in favor and in use.

A newer projective technique, the "thematic apperception" test, employs a series of pictures, each depicting an ambiguous dramatic human event. The examinee is instructed to build up some fictional story illustrated by the picture, with preceding and subsequent events. In doing so he may be expected to read into the material some of his own personal problems and underlying strivings, the stories when taken together revealing a unifying thema. As is obvious, insight and judgment is demanded of any examiner employing this technique.

Among the most important things in the organization of a man's personality are his *value* attitudes. The esthete, the man-about-town, the sanctimonious, the money-mad, furnish cases of special channeling of interests into specific areas. A method for determining the relative strengths of these different value-species within an individual consists of questions on specific problems or situations, the answers to which will reveal the examinee's appreciations to be more weighted by theoretic, economic, social, political, religious, or esthetic considerations.

In General.—The foregoing account is of necessity selective. Of the hundreds of mental tests in actual use, only some examples of the more distinct kinds could be mentioned.

Nor has space permitted adequate mention of the manifold applications of mental tests to education, to vocations, to military service, to hospitals, and to social-welfare work in general.

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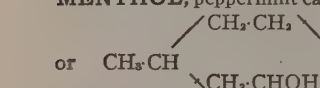
MENTCHIKOF, or MENSHIKOV, Alexander Danilovich, Russian soldier and statesman: b. Moscow, Nov. 6, 1672; d. Berezov, Siberia, between November 1729 and February 1730. He was of obscure parentage, but succeeded in entering the service of Prince Lefort, the favorite of Peter the Great, later discovering and thwarting a conspiracy against his patron's life. After serving in the campaign of Azov, he accompanied the Czar on his trip through Holland and England, and on the death of Lefort became his chief adviser. He was created field marshal and prince by Peter, and prince of the German Empire by Leopold I, and during the absences of the Czar acted as regent. During the campaign of 1706 he defeated the Swedes at Kalish, and in 1709 was largely instrumental in securing the victory over Charles XII at Pultowa. In 1710, as commander of the Russian forces in the north, he took Riga, occupied Pomerania and Holstein, and conquered Stettin. His arbitrary acts, however, finally resulted in his court-martial by Peter, though the death sentence was commuted to fine. He was one of the principal factors in the accession of Catharine I to the throne (1725–27), and till her death was all-powerful, and even after Peter II succeeded to the throne he had absolute control of the government. He was about to marry his daughter to the young Czar when he was suddenly overthrown by Vasili Lukich Dolgoruki (1670–1739) and exiled to Siberia by Peter II in September 1927. His great-grandson, PRINCE ALEXANDER SERGEEVICH MENSHIKOV, b. Sept. 11, 1787; d. May 2, 1869, took a prominent part in the campaigns against Napoleon (1812–15) and the Turks (1828–1829). He was governor general of Finland in 1831 and in 1854–55 he commanded the Russian naval and military forces in the Crimea. He is noted for his conduct of operations in defense of Sevastopol.

MENTHACEAE, sometimes known as *Labiatae*, a family of dicotyledonous herbs or shrubs distributed mainly in temperate climates. The species, of which there are more than 3,000 grouped in about 150 genera, are characterized by four-cornered stems; opposite, exstipulate leaves; mostly two-lipped flowers generally in whorls, cymes or heads; and one to four achenes in a persistent calyx. They are noted for their volatile oils, which in many instances are of economic importance either as perfumes or as flavorings. Some species are cultivated for ornament, but probably the best known are those which have been used for centuries for flavoring food, such as sage, thyme, savory, marjoram, mint, balm and basil (qq.v.). The kinds used most frequently in perfumery are probably lavender, rosemary and patchouli. One species, variously known as Chinese or Japanese artichoke, chorogi and knotroot, *Stachys sieboldi*, yields edible tubers which are eaten raw or cooked in Asia, France, and to a small extent in the United States. Many labiates have at some time been reputed medicinal but are now rarely used except to disguise

the taste of disagreeably flavored drugs. The best-known genera represented in the United States are *Nepeta* (catnip), *Mentha* (mint), *Origanum* (marjoram), *Salvia* (sage), *Thymus* (thyme), *Marrubium* (horehound), *Satureia* (savory), *Lavandula* (lavender), *Monarda* (horsemint), *Ocimum* (basil), *Melissa* (balm), *Scutellaria* (skullcap), *Lamium* (dead nettle), *Calamintha* (calaminth), *Teucrium* (germander), and *Trichostema* (blue curls).

MENTHENE. See METHANE.

MENTHOL, peppermint camphor, $C_{10}H_{19}OH$,



or $CH_3 \cdot CH(CH_2 \cdot CH_2 \cdot CH \cdot CH(CH_3)_2) \cdot CH_2 \cdot CHOH$

is the chief solid constituent of the Japanese and Chinese peppermint oil (from *Mentha piperita* Linne, or *Mentha Arvensis*). American and English oils contain menthol in much smaller quantities, and the menthol obtained from these sources is said to differ from Chinese or Japanese menthol in its crystalline structure.

The commercial product is chiefly obtained from the Japanese oil of peppermint, which sometimes contains from 70 to 90 per cent of menthol. For the extraction of menthol the oil is cooled to a very low temperature, when prismatic crystals separate out. The yield is considerably increased by subjecting the peppermint oil to fractional distillation and then cooling the residue. A number of substances are sometimes used to adulterate the commercial product; among these may be mentioned hydrated magnesium sulphate, paraffin, wax, thymol and various inorganic compounds. The pure substance should possess a sharp melting point and should completely volatilize when heated on a water-bath in an open vessel. Menthol separates in long prismatic crystals. It melts at 43° C., and boils at 212° C. The crystals possess a strong peppermint odor and a cooling taste. It dissolves readily in alcohol, ether, chloroform, carbon bisulphide, strong acetic acid and in a number of oils. Its solubility in water is very slight but the water solution possesses the odor and taste of the substance.

The molecule of menthol contains three asymmetric carbon atoms, and a number of stereo-isomerides are possible; the commercial product consists mainly of the laevo modification. Menthol exhibits the properties of a saturated secondary alcohol. Careful oxidation with chromium trioxide converts it into the corresponding ketone, menthone. With acids it yields esters. With phosphorus pentachloride it forms menthyl chloride. Heated with phosphoric anhydride or zinc chloride it forms menthene, $C_{10}H_{18}$. With copper sulphate it yields cymene, and with hydriodic acid, in the presence of phosphorus, it forms hexahydrocymene.

Menthol acts as a mild local anæsthetic. In the form of cones or in solution in various solvents it has been used as a remedy for neuralgic headache, toothache, catarrh of the nose, asthma, diphtheria, diarrhœa, sciatica and tuberculosis of the bone. Sometimes it is also employed as the chief ingredient in atomizers, inhalers, toothpastes, ointments, liniments, and in a number of preparations for internal use.

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MENTONE, mĕn-tō'nĕ (Fr. MENTON, mŏñ-tôñ), France, a seaport town and health resort on the Mediterranean, in the department of Alpes-Maritimes, near the Italian frontier, and 15 miles northeast of Nice. It is charmingly situated on a promontory about the middle of a bay five miles in circuit, encircled by abruptly rising hills. The ancient walls of the feudal town are still standing, and there the streets are dark and crooked. The new part of the town, with numerous fine villas, stretches along the base of the hill on which the old part is situated, parallel to the sea. The climate of Mentone is mild and equable; it is rare that the thermometer descends as low as the freezing point, or rises higher than 86° F., hence making Mentone a favorite resort for persons in delicate health. There is a considerable trade in fruit, in flowers and leaves used in the manufacture of perfumes, and in olive-oil. The town of Mentone belonged to the principality of Monaco from 1346 to 1860, but in the latter year was ceded to France. In the vicinity, but on Italian territory, are the grottoes of Baoussé Rousse, popularly known as the Caves of Mentone, famous for the valuable evidences of prehistoric man that they have yielded. Pop. (of commune) 18,000.

MENTOR, according to Greek legend, the faithful friend of Ulysses, who entrusted to him the care of his domestic affairs during his absence in the war against Troy. The education of the young Telemachus fell to his charge, and when the latter set out on his voyage in search of his father Minerva accompanied him under the form of Mentor (Odyssey, ii, 390; iii, 12, etc.), acting the part of a prudent and experienced counsellor to the young hero. This character of a sage adviser is more fully developed in the Télémaque of Fénelon, in which Mentor plays a conspicuous part.

MENZALEH, mĕn-zā'lĕ, or **MENZALA,** Egypt, a large lake or lagoon (one of several at the Nile delta), extending from Damietta to the Suez Canal, and running parallel with the Mediterranean, from which it is divided by a narrow slip of land, from 2 to 12 miles in breadth. Length of the lake from northwest to southeast, about 50 miles; average breadth, about 20 miles. It receives the Pelusiac and Tanitic branches of the Nile, and communicates with the sea by three openings called Dibeh, Gemileh and Om Farejeh. The lake is of comparatively recent origin, and covers what was a fruitful district of the delta, having formed through neglect of the dams. There is a small town of the same name on the south side of the lake. The Suez Canal cuts into its eastern edge from north to south.

MENZEL, Adolf Friedrich Erdmann von, German artist: b. Breslau, 8 Dec. 1815; d. Berlin, 9 Feb. 1905. In 1830 his parents settled in Berlin, where his father had a lithographic studio, and where the son studied a little in the academy and more by himself. At 18 he published a cycle of lithographs called 'An Artist's Wanderings,' which immediately attracted attention; four years later he had begun to draw historical scenes from the past of Brandenburg and had commenced painting in oils with 'Checker-Players' (1836) and 'Judgment' (1837). About the same time his work as an illustrator opened up with the 400 pictures

for Kugler's 'Frederick the Great' (1840), in which Menzel showed himself original, dramatic and historically correct. This vein he followed out in his 200 illustrations for the 'Works' of Frederick the Great, and in 600 more accompanying a work on the army of Frederick the Great (1856); as well in his oil paintings, a dozen or more, of various scenes in Frederick's life. A trip to Paris in 1867, so the French critics claim, worked a change in Menzel's methods, so that he applied himself more to problems of light and shade. After 1890 he used color less and less and in his pencil drawing broke away from mere line to the use of a cloudy treatment. He was one of the greatest of German artists of his day; and in 1899 he received the Order of the Black Eagle, conferring hereditary nobility. Apart from his historical pictures, mention should be made of the 'Modern Cyclops' (1875), the interior of a Silesian rolling mill, with excellent lights, and of social satires like 'Carnival Morning' (1885). Consult Jordan, 'Das Werk Adolf Menzels' (1895); and lives by Sondermann (1895), and Knackfuss (1897); Singer, 'Drawings of Adolf von Menzel' (London 1908).

MENZEL, Wolfgang, German author: b. Waldenburg, Silesia, 21 June 1798; d. Stuttgart, 23 April 1873. He studied at Jena and Bonn, became a follower of F. L. Jahn and the Turnerei, and was for four years schoolmaster at Aarau in Switzerland. In 1825 he returned to Germany, having already made himself known to the literary world by his 'Elastic Verses' (1823). He edited and contributed to magazines, and wrote a very great number of works, poems, romances, histories, criticisms, political polemics and Christian theology. From 1826 to 1848, and again later, he was editor of the *Litteraturblatt* in Stuttgart. His chief writings include histories of Germany (1825), German literature (1827), German poetry (1858) Europe (1853–57), and the world ('Universal History' 1862–72). He also produced a work of mythological research (1842), a book on the pre-Christian doctrine of immortality (1869), and autobiographical memoirs (1876). He was often involved in controversy, assailing with equal zeal theological rationalists and political radicals. His attacks upon Goethe and other authors were fully equaled for virulence by the criticisms upon Menzel himself, made by Heine and some of the younger German writers.

MEQUINEZ, or **MEKINEZ,** Africa, a town of Morocco, 40 miles southwest of Fez. It is one of the capitals and the sultan maintains there a palace. There is a historic mosque and many other fine buildings, especially those of the 18th century, when the town was the preferred residence of Sultan Muley Ismail. There is an ancient city wall with nine gates. There are tanneries and potteries. Pop. 30,000.

MEPHISTOPHELES, mĕf-ĭs-tŏf'ē-lēz, a name for the devil, which has been made popular by Goethe's 'Faust.' He was also a chief character in Marlowe's 'Dr. Faustus.' Goethe derived it from an old popular legend, in which it is spelled *Mephistophiles* or *Mephistophilis.* The etymologies of the word are as various as the spelling. Some suppose it to be an irregularly formed Greek compound from the negative *mē; phōs,* light; and *philos,* loving, thus signifying "not loving the light." Others surmise that it may be derived from the Latin *mephitis* and the Greek *philos,* in which case it will signify literally "loving the mephitic vapors of hell." The Mephistopheles of Goethe has little in common with the devil of the popular imagination. He appears, especially in the original form of the drama of Faust, as a real man of flesh and blood, who only preserves those traits of the popular devil of the Middle Ages which are compatible with a true human individuality — as the companion of Faust, as a selfish and malevolent votary of pleasure, always looking to the real, and bringing back Faust by cold and heartless irony, from barren speculation to the enjoyment of the present life.

MER DE GLACE, mār dè glās, France, an Alpine glacier on the northern slope of Mont Blanc, with an area of 16 square miles and an extreme length of about nine miles. It is formed by the confluence of three branches called the Glacier du Géant, the Glacier du Lechaud and the Glacier du Talèfre and is noted for its beautiful scenery. It ends as the Glacier des Bois whence flows the Arveyron River, in the valley of Chamouni. From the village of Chamouni the Mer de Glace is easiest visited and Mont Blanc ascended. The glacier has an average flow of two feet a day during summer and autumn.

MERAMEC SPRING, an unusually large spring in Phelps County, Mo., about seven miles south of Saint James. The water flows as an underground stream in limestone and emerges as a great spring with a flow averaging 125 cubic feet per second.

MERAN, mā-rän', Italy, a celebrated health resort in Tyrol, charmingly situated on the river Passer, near its entrance into the Adige, at the foot of a hill called the Küchelberg. It is the chief town of a small district of the same name. It consists of an old and a new town, the latter with handsome villas and hotels, and numerous fine residences and old castles in the neighborhood. The old town is mainly on the Laubengasse, which is a long, narrow, winding street. The Polish church and other buildings date from the 14th and 15th centuries. It is believed to have been settled originally in the 9th century. Lying in a sheltered situation on the southern slope of the Alps, it possesses a mild and equable climate, and is much frequented in winter by invalids with pulmonary affections. Permanent population 18,000.

MERCADANTE, Saverio, sä-vā'rē-ō mĕr-kä-dän'tā, Italian composer: b. Albamura, 26 June 1797; d. Naples, 17 Dec. 1870. He studied music at the college of S. Sebastiano in Naples under Zingarelli. From flute and violin he turned to vocal music; won great success with a cantata 'L'Unione delle Belle Arti' in 1818, and with an opera 'L'Apoteosi d'Ercole' in 1819; was made chapel-master of the Novara Cathedral (1833) and director of the Naples Conservatory (1840); and in 1862 became totally blind. He wrote many masses and other ecclesiastical music, such as 'The Seven Last Words'; but is best known for his operas, of which the following, out of a total of 50, should be mentioned: 'Elisa e Claudio,' 'Il Bravo,' 'Il Giuramento,' 'I Briganti,' and 'Le due illustri Rivali.'

MERCANTILE AGENCY, a business enterprise, usually an incorporated company, which agrees to furnish subscribers who pay a yearly fee, with information as to the business responsibility, financial standing and credit rating of business houses, whether conducted by private individuals, firms or corporations. They also sometimes have a department for the collection of debts, and sometimes they sell two or three different services, at different prices. The business originated in the United States in 1837, following a financial panic, it being recognized that it was necessary for business houses to obtain better information in the giving of credits. Lewis Tappan was the founder of the first mercantile agency in New York City. The most important agency is Dun & Bradstreet, Inc., a consolidation of the two agencies which had previously led in the business. Merchants prize good ratings in the agency's large books which they issue usually once a year, and loan them to subscribers for their own use; in these books appear lists of addresses and the kind of business, followed by letters or signs indicating their financial responsibility, their promptness in paying bills, etc. Subscribers are also entitled to send in for special reports, giving more detailed or later information. The agency obtains its information — (1) direct from the parties in question, sending a representative to interview them, and asking for a statement, but in no case indicating who wants to know their standing; (2) by inquiry of the concerns from whom the party buys goods; (3) by exchange of information between other agencies or people likely to know their reputation. Concerns that are noted in the agency books as prompt pay, or as being worth $5,000 or more, are usually spoken of as "rated" houses. The highest rating is usually worth $1,000,000 or more, and prompt pay.

In addition to agencies doing a general confidential reporting business on all classes of business houses all over the country, there are others that confine themselves to a particular industry, as Typo, which reports on the houses engaged in printing, publishing and allied industries. The laws recognize that such exchange of information is legitimate, and essential to the conduct of business on a credit basis, and an action for libel in sending out a bad report will not hold against an agency that conducts its business in a fair manner. However, the reports have to be made confidential; if promiscuously circulated, they might become libelous. For it unquestionably happens that at times the agencies report concerns as having less money and less standing than they are entitled to, and they can make mistakes. But as long as they try to be fair, and send out their reports under the seal of confidence, the law protects them. Abuse of the system, to revenge, spite or for blackmail, is practically unknown. The agencies are more apt to err in the matter of continuing to rate concerns too high when their financial standing is impaired. When large concerns have failed it has frequently happened that the mercantile agencies had continued to report them in good standing up to the last. Therefore the credit men of the large houses do not pin their faith entirely to commercial ratings, but use other means wherewith to know the truth. In the very large cities there are credit men's associations, where they confer as to ways and means of keeping credits safe. While there is opportunity for better and more accurate reporting as to credits, it is true that the mercantile agencies of America handle their business extremely well, and constitute one of the most important links in the artificial chain between the industries of the nation. Consult Errant, 'The Law Relating to Mercantile Agencies' (1889); Reinhard, 'A Treatise on the Law of Agency' (1902).

MERCANTILE LAW. See COMMERCIAL LAW.

MERCANTILISM. See ECONOMICS.

MERCANTINI, Luigi, Italian poet: b. Ripatransone, in the Marches, 20 Sept. 1821; d. Palermo, 18 Nov. 1872. Against his inclinations he was intended by his father for the priesthood, but he deserted that vocation before taking orders and turned to school teaching. For a time he was professor of Italian and Latin literatures in Sinigaglia. He wrote a number of patriotic songs, including "I tre Colori," but gained his greatest popularity by the song which is now the Italian national anthem or "Inno di Garibaldi." See GARIBALDI HYMN.

MERCAPTANS (Latin, "taking up mercury") or **THIO-ALCOHOLS,** *in chemistry,* a large class of substances having the same constitution as the alcohols, but differing from them by having the oxygen atom in the hydroxyl replaced by sulphur. They are oily liquids or crystalline solids having an offensive, garlic-like odor, and are all insoluble in water. They possess acid tendencies that are more marked than those of the alcohols, and combine with metallic oxides to form salts which are known as "mercaptides." They combine with especial facility with mercuric oxide, and take their name from this circumstance. Ethyl mercaptan is the best-known members of the series, and it is this substance that is understood when "mercaptan" is spoken of, without further qualification. Ethyl mercaptan, $C_2H_5.SH$, is prepared by acting upon ethyl chloride, C_2H_5CL, with potassium hydrosulphide, HKS; the potassium atom and the ethyl radical changing places as indicated by the equation $C_2H_5Cl + HKS = C_2H_5SH + KCl$. Ethyl mercaptan is a colorless, mobile liquid, boiling at 99° F. It is very inflammable, burning with a blue flame, and it mixes readily with alcohol and ether, though only to a very slight extent with water. Like the other mercaptans, it forms salts with the oxides of the metals, the hydrogen atom that is associated with the sulphur being the one that is replaced by the metal. The mercury salt, $Hg(S.C_2H_5)_2$, may be prepared very readily by agitating the mercaptan (or its alcoholic solution) with red oxide of mercury, HgO. Its formation is attended by the liberation of considerable quantities of heat, and the mercaptide itself is obtained in the form of soapy white scales. All of the metallic mercaptides are decomposed by hydrochloric acid. The mercaptans of fatty radicals all give a fine green color when treated with a solution of isatin in strong sulphuric acid and this reaction (as well as their insufferable smell) is used as a test for their presence.

MERCATOR, mĕr-kā'tĕr, **Gerardus** (Latinized form of GERHARD KREMER, krā'mĕr), Flemish geographer: b. Rupelmonde, Flanders, March 5, 1512; d. Duisburg, Dec. 2, 1594. He studied at Louvain, and became a lecturer on geography and astronomy, making his instruments with his own hands. In 1544 he was arrested for heresy, being liberal in his views. He escaped, but 42 of those arrested with him were burnt alive. Recommended to Charles V, Mercator entered into the emperor's service, and executed for him a celestial globe of crystal, and a terrestrial globe of wood. In 1559 he retired to Duisburg and received the title of cosmographer to the Duke of Juliers. His last years were devoted to theological studies.

Mercator is known as the inventor of a method of projection called by his name, in which meridians and parallels of latitude cut each other at right angles, and are both represented by straight lines, which has the effect of enlarging the degrees of latitude as they recede from the equator. (See CHART—*Scales and Projections.*) The method is convenient in mapping small areas. His first maps on this projection were published in 1569; the principles were first explained by Edward Wright, in 1599, in his *Corrections of Errors in Navigation,* whence the discovery has sometimes been attributed to him. Mercator's *Tabulae Geographicae* (1578) is the best edition of the maps of Ptolemy. See MAP.

MERCATOR, Nicolaus. See KAUFMANN, NICOLAUS.

MERCED, city, California, seat of Merced County, 55 miles northwest of Fresno on U.S. Highway 99 and the Atchison, Topeka, and Santa Fe and the Southern Pacific railroads. Altitude 167 feet. Lying in the San Joaquin Valley, Merced is a trade and shipping center for an extensive agricultural region specializing in farming, dairying, fruitgrowing, and stock raising. Industries of the city include the manufacture of cement, fruit processing and packing, dairy products, and pottery.

The city has a library, sanitarium, county hospital, courthouse, national guard armory, three public parks and swimming pools. Nearby is the recreational center of Lake Yosemite, and Yosemite National Park lies 45 miles to the northeast.

Founded in 1870, Merced received its first charter in 1889. It has a council-manager form of government. Pop. (1950) 15,278.

MERCEDES, mĕr-sā'dĕs, city, Texas, in Hidalgo County, 30 miles west-northwest of Brownsville on U.S. Highway 83 and the Missouri Pacific Railroad. Altitude 61 feet. Located in an agricultural region producing citrus fruits and vegetables, Mercedes is a center for packing, canning, processing, and shipping. The city's industrial production includes packed meat, cheese, clay products, oil and natural gas, and sheeet metal and machine shop products.

In 1949 a 1,840 mile pipe line to the New York region was begun. Founded in 1907, Mercedes was incorporated two years later. Its government is administered by a commission. Pop. (1950) 10,081.

MERCENARIES, mûr'sĕ-nĕr-ēz (also formerly called STIPENDIARIES, stī-pĕn'dĭ-ĕr-ēz), foreigners or others who received pay for their services as soldiers, especially as distinguished from government soldiers or those owing military service to the crown or nation.

Hired professional soldiers appear very early in the history of military organization. Foreign mercenaries were used in the armies of Alexander the Great and the Romans, and in England King Harold (1066) had a body of Danes in his army when he defeated the Norwegian king. These were the famous "housecarls" (from the Anglo-Saxon *hūscarl*) who were hired soldiers originally established in the kingdom by King Canute (1018–1035). William III had for some time a body of Dutch troops in his pay after he became king of England and throughout the 18th century Hessian and Hanoverian regiments were constantly in the pay of the British government for temporary purposes. Hessians fought for Great Britain in the Revolutionary War, and the landgrave of Hesse, who sold his troops at so much a head, received upward of $2,500,000 for Hessian soldiers lost in that struggle.

The most famous of all mercenaries were the Swiss soldiers, who were hired, sometimes by the cantons themselves, over all Europe, and formed many famous body guards. They were long employed by the French monarchs, and the Vatican at Rome still has its Swiss guards.

Other designations for mercenaries are *condottieri* (q.v.), who were Italian troops banded together and hired out to the city states in the Renaissance, and "soldiers of fortune," who pursue a military career for adventure and pleasure as well as for gain.

MERCER, mûr'sĕr, **Henry Chapman,** American archaeologist, antiquarian, and inventor: b. Doylestown, Pa., June 24, 1856; d. there, March 9, 1930. Graduating from Harvard in 1879, he was curator of American and prehistoric archaeology at the University of Pennsylvania from 1894 to 1897, and served as editor for anthropology in *American Naturalist* from 1893 to 1897. He made extensive investigations and studies in anthropology in America, discovering several unknown extinct species, and 1897 to 1917, made and presented to the Historical Society of Bucks County, Pa., an extensive collection of objects illustrating the Colonial and early history of the United States by means of the implements and handiwork of the pioneer settlers. In 1916 he built and presented to the society a fireproof museum for preserving the above collection.

Mercer established a pottery at Doylestown, Pa., in 1898, experimented upon and developed the processes of the Pennsylvania Germans for making and decorating pottery, inventing in 1899 a new method of manufacturing tiles for mural decoration and in 1902 a new process for making mosaics. His writings include *Lenape Stone* (1885); *Hill Caves of Yucatan* (1896); *Researches upon the Antiquity of Man in the Delaware Valley and Eastern United States* (1897); *Tools of the Nation Maker* (1897); *The Bible in Iron or the Pictured Stoves and Stoveplates of the Colonial United States* (1915); *Ancient Carpenter's Tools* (1925).

MERCER, Hugh, American general: b. Aberdeen, Scotland, about 1725; d. near Princeton, N. J., Jan. 12, 1777. Educated as a physician, he served as surgeon's assistant in the army of the Young Pretender at the battle of Culloden. Emigrating in 1747 to America, he settled in Pennsylvania, and resided there, in the

practice of his profession, until 1755, when he volunteered in the expedition led by Braddock to Fort Duquesne. Later he moved to Virginia and at the outbreak of the Revolution joined the Continental army, and attained the rank of brigadier general. He subsequently accompanied Washington on his retreat through New Jersey, and rendered valuable assistance at the battle of Trenton. In the succeeding action at Princeton he was mortally wounded and died a week later. Mercer County, N. J., was named in his honor.

Consult Goolrick, J. T., *The Life of General Hugh Mercer* (New York 1906); *Dictionary of American Biography,* vol. 12 (New York 1933).

MERCER, John, English calico printer and chemist: b. Dean, near Blackburn, England, Feb. 21, 1791; d. Nov. 30, 1866. The son of a handloom weaver, he worked in weaving and cloth-printing shops from the age of nine, making his first experiments in dyeing cloth in 1807 and a few years later inventing several weaving designs. He was mainly self-educated and through his study of James Parkinson's *Chemical Pocket-Book* in 1814, he arrived at his first major discovery: a method of dyeing calico by the use of orange sulphide of antimony. As a chemist in the color shop of the Fort Bros. print works, he introduced into England a method of applying lead chromate as a cloth dye. He contributed a number of other improvements and inventions, and served as a partner in the firm from 1825 until its dissolution in 1848.

Mercer devoted the remainder of his life to his own chemical researches. In the field of theoretical chemistry, he suggested the first rational theory of catalytic action and his most far-reaching discovery was the process, called mercerizing (q.v.), of treating cotton cloth to improve its strength and adaptability for dyeing.

MERCER UNIVERSITY, Macon, Georgia, a coeducational Baptist institution opened at Penfield, Ga., as Mercer Institute on Jan. 14, 1833. Chief among the founders were the Rev. Jesse Mercer, early conceiver and patron for whom the school was named; Adiel Sherwood, D.D., who after coming to Georgia in 1818 established a theological school at his home near Eatonton; and Josiah Penfield, of Savannah, who at his death in 1827 bequeathed a fund for educating young ministers. Additional funds were provided by the Georgia Baptist Convention.

Conceived as a theological and classical school for ministerial students only, Mercer from its opening served a wider clientele; and in 1837 it obtained a charter giving it collegiate rank and changing the name to Mercer University. Thereafter it grew steadily.

During the administration of President Weaver (1918–1927), Mercer expanded rapidly. The campus was extended, new buildings were erected, the curriculum was revised, and nearly three-quarters of a million dollars were given to the institution by Georgia Baptists. Another period of physical growth and curriculum adjustment followed the inauguration of President Dowell. Mercer is now organized as a liberal arts college and school of law, with comprehensive curricula in the humanities, the social sciences, and the natural sciences.

In 1951 the working plant, covering about 65 acres, was valued at $3,191,613 and the endowment was $3,072,604. The plant, which includes three libraries, adequately meets the educational requirements of a student body numbering about 1,000 and dormitory and dining facilities are provided for both men and women students.

The teaching staff numbered 81 in 1951. Degrees conferred are B.A., B.S., LL.B., and M.A. Mercer is fully accredited by the various standardizing agencies, and the work done is accepted by the graduate schools of leading institutions in America and Europe.

MERCERIZING, mûr'sẽr-īz-ĭng, a process invented by John Mercer, of Lancaster, England, for treating cotton fiber or fabrics, first patented in 1851. The process consists of steeping the cloth in a solution of caustic alkali. The cloth shrinks about one-fourth and takes more brilliant colors in dyeing than unmercerized cotton goods. Cotton may be mercerized either in the yarn or in the cloth, and a variety of machines are made for this purpose. Some of these machines operating on the cloth employ a tension to obviate some after-shrinkage. This gives a greater yardage, but it reduces the gloss.

The name has sometimes been incorrectly extended to sizing of cloth to give it a better sheen. True mercerizing gives a luster to the cotton cloth, because the fibers are drawn closer and flattened, presenting a smooth surface that reflects the light. A variation in the caustic soda process is employed to give the modern crimped-of-crepe effects.

Consult Marsh, J. T., *Mercerizing* (New York 1941).

MERCERSBURG, mûr'sẽrz-bûrg, borough, Pennsylvania, in Franklin County, near the western rim of the Cumberland Valley at an altitude of 590 feet. It lies 17 miles west-southwest of Chambersburg and is served by the Pennsylvania Railroad. Situated in a productive agricultural region, it has considerable trade in dairy products and its local industries include a tannery, shirt factory, and lumber yard.

Mercersburg Academy, a well-known preparatory school for boys, had its origin here in 1836 with the founding of Marshall College. When Marshall College was moved to Lancaster, Pa., and combined with Franklin College in 1853, the Theological Seminary and preparatory department remained in Mercersburg. From this Mercersburg College developed and was superseded in 1893 by the Academy. Three miles from Mercersburg is Stony Batter, birthplace of James Buchanan, 15th president of the United States. Buchanan made his home in Mercersburg from 1796 to 1809.

The borough was first settled in 1730 by Scotch-Irish Presbyterians. In 1780 the town was laid out and named after Hugh Mercer, the Revolutionary War general. It was incorporated in 1831. Pop. (1940) 1,763; (1950) 1,613.

MERCERSBURG THEOLOGY, a school of religious philosophy founded by Frederick Augustus Rauch (1806–1841) of the German Reformed Church in 1836, his work being taken up by John W. Nevin (q.v.) and Philip Schaff (q.v.). The name comes from the Mercersburg Theological Seminary of the German Reformed Church, whence the teaching of this system spread. The Mercersburg theology urged that the Church was not a voluntary society of believers but a historic and spiritual growth—an attitude showing markedly less hostility to the Roman Catholic

Church; that old confessions cannot express the modern faith in the Church; that the sacraments are more than symbols; that church worship should be orderly—hence the Liturgy (1858) and Order of Worship (1866); and that religious education is of prime importance.

MERCHANT ADVENTURERS, The Company of, an association of English foreign traders with trading stations in Netherlands cities, also extending to Hamburg and other German ports, which enjoyed special privileges and exemptions similar to those of the Hanseatic League in London. Its earliest charter dates from 1407. It was a private company holding a monopoly of exporting certain manufactured articles, especially cloths, and its members were all subjects of the English crown, unlike the Staplers who included aliens as well as Englishmen and were limited to trading in unmanufactured products, particularly wool. Probably the nucleus of the Merchant Adventurers was formed of members of the Mercers' Company of London. New companies of Merchant Adventurers arose in the 16th and 17th centuries, especially during the reigns of Elizabeth and her immediate successors. These included the Muscovy, Levant, Guinea, Morocco, Eastland, Spanish, and East India companies. The Company of Merchant Adventurers trading to the Low Countries in the 18th century was called the Hamburg Company. From its inception in the early 15th century the company was in continuous rivalry with the Hansa, the German group that for centuries had monopolized the North Sea trade. This was intensified in 1545 when the Emperor Charles V cut off the Adventurers' trade with the Low countries and the Hansa was thus able to obtain a monopoly of the English cloth export to Antwerp. In retaliation, the Hansa's London privileges were revoked in 1552; briefly restored, they were suspended in 1555. Queen Elizabeth in 1560 made peace with the Hansa; the terms excluded the Hansa from the Antwerp cloth trade and abolished their customs exemptions in London. Thus the Merchant Adventurers finally won their long trade war.

MERCHANT MARINE OF THE UNITED STATES. The United States merchant marine comprises all vessels of the nation engaged in water-borne commerce. However, in general usage, it is considered to include only that portion of our shipping which sails the seas, thus excluding vessels on the Great Lakes and on inland waters. It is distinguished, in addition, from the ships of the navy, which are sometimes known as the naval marine.

The American merchant marine has had, since the earliest days of the country, two primary purposes: (1) to further and increase national foreign trade; (2) to assist in the national defense. Throughout American history it has been an instrument of national policy. While it is pleasant to think of a ship as an instrument of peaceful trade between nation and nation, yet it is a fact that merchant ships have been used repeatedly for military purposes.

Under the Merchant Marine Act of 1936, the United States for the first time instituted a realistic policy concerning the operation and financing of the nation's merchant marine. The United States Maritime Commission was established, and upon it devolved the duties of interpreting the major purposes of the act. (See UNITED STATES—*New Federal Agencies.*)

In 1938 a program of shipbuilding, envisaging the construction of at least 50 ships a year for 10 years, was launched by the commission. These vessels were to replace the slow and obsolete ships which, as of the inception of the commission's program, comprised over 90 per cent of the nation's ocean-going fleet.

The European war which broke out in September 1939 sharply increased the demand for merchant shipping. Under the Neutrality Act United States ships were forbidden to carry trade on two fifths of their accustomed routes. The withdrawal of thousands of vessels of belligerents from international trade, however, together with increases in freight rates in all parts of the world, gave American shipping an opportunity to expand services on neutral trade routes. When the United States entered the war, the armed forces drew on the merchant marine for many of their auxiliary vessels, and throughout the war merchant ships carried the great bulk of men and materials to places where they were needed, thus vindicating the national defense aspect of the American merchant marine policy much sooner than any of the promulgators of the 1936 act had expected.

A huge emergency shipbuilding program was superimposed on the original long-range program, and by the war's end the United States merchant marine contained over 6,000 ships, most of them new. Since the war these ships have had to be put into private operation, and readjustments made to meet changed peacetime requirements for merchant shipping.

The early years of American shipping were ones of peaceful development and aggressive mercantile adventuring.

Colonial Period.—The white man first approached the shores of the newly discovered continent of America in a ship; and for nearly two centuries thereafter the sea and the inland waters were his chief avenues of communication. The whole early history of the development of the United States is closely interwoven with the history of the expansion of its merchant marine.

Long before actual colonization had begun, the daring fishermen of the British Isles, the Dutch lowlands, and the rough coasts of Brittany had crossed the sea in their cockleshell fishing boats to reap the harvest of the Grand Banks—cod and other fish—and had used the forbidding shores of what are now Canada and the New England states as curing stations where they salted down their catch.

The British, restlessly seeking expansion from within their small island territory, were the most daring of these fisherfolk, and it was they who first colonized America's eastern coasts. When King James made a grant to the Plymouth Company in 1606, it was primarily for the purpose of establishing a fishing colony where much of the work of curing the cod-catch could be done by the permanent settlers, rather than by men specially brought over with each vessel to do the task.

The first settlement on the northeastern American coast was known as the Popham colony, on the Kennebec River in Maine. It was here that the nation's merchant marine had its inception, in the fall of 1607, when the colonists laid the keel of the *Virginia.* This was a seagoing pinnace of 30 tons, undecked and propelled with two sails.

and oars if the wind should fail. In this frail craft the colonists fished the Banks, and even made a voyage from the Kennebec River clear across the Atlantic.

Though the Popham colony failed, the tradition for industry, daring and ingeniousness established with the little *Virginia* carried the American colonists ahead until, about 200 years later, they were masters of sail and able to compete with the fleets of the world in foreign trade.

That ships were absolutely necessary to the early colonists is evidenced by the fact that each one of the early settlements produced one or more sailing vessels within a short time after their founding. In 1611 the Jamestown colonists built a 13-ton shallop; in 1614 Adrien Block, of New Amsterdam, built a "yacht"—the first decked vessel constructed in the colonies; and in 1624, only four years after it was first founded, the Plymouth Colony of Pilgrims launched two small shallops to export cod to England. A shallop was a small, open-decked, two-masted vessel usually used for fishing purposes. Other shallops laden with fish sailed down the coast to trade with the Southern colonies and the West Indies. To avoid a profitless empty hold on the return trip, these vessels purchased cargoes that could be disposed of at home—sugar, rum, tobacco, and the like—and before long many of the ships were engaged entirely in carrying miscellaneous cargoes wherever profitable. In other words, they became our first merchant marine.

So urgent became the need for ships that in 1629 the first formal shipyard in America was established on the Mystic River in Massachusetts. The Puritans, settled at Salem, chose that location for the venture because it was well sheltered from the sea storms. On July 1, 1631, the 30-ton bark, *Blessing of the Bay,* was launched from the Mystic shipyards. Another yard, established the same year on Richmond Island off Cape Elizabeth, Me., built America's first ship for "export"—a sailing vessel for English purchase.

By 1635, less than 30 years since the launching of the first ship in colonial America, the British Admiralty announced that there were six American-built and owned ships in regular commerce between the colonies and the mother country. Thus aggressively was the maritime history of the Western Hemisphere originated.

Shipbuilding, in fact, was one of the major industrial pursuits of the colonies until the revolution. The early American colonists faced a vast, wild, and forbidding hinterland. They scratched out small patches of ground on which to raise sufficient food to support themselves, and turned to the luxuriant forests which blanketed the continent for materials with which to build ships for trade. Not for decades did the exploring instinct take the colonists more than a hundred miles or so overland into America's interior; but from the start they treated the Atlantic as their highway, and plunged fearlessly into the forests to provide themselves with the stout timber needed for their ships. Even at that time, English forests were already impoverished, and American ships and shipbuilding materials became one of the country's major exports to England.

While American shipping and shipbuilding were in the period of early growth, the mother country assisted it by laws, passed in 1646 and 1650, limiting trade with the colonies to vessels sailing under the British flag. This meant that American-built ships were for awhile given a practical monopoly (along with British vessels) in colonial trade.

However, as American adventurousness in maritime trade and American industry in shipbuilding continued to increase, Great Britain changed her policy. In 1660 and 1663 navigation laws were passed requiring all major American exports to be transshipped through English ports. The colonists, however, were not men to submit to such tyranny; during the next century they turned to smuggling on a huge scale. They evaded the transshipment laws simply by not paying any attention to them, and by openly importing and exporting goods directly to America. Commerce seemed to feed on the British restrictions; it was as if the Americans were goaded to greater efforts by the highhandedness of the British kings and their representatives.

The story of the American merchant marine for the whole period from 1660 to 1770 is one of increasingly successful colonial shipping, working against an increasingly repressive policy on the part of the mother country. The colonists successfully boycotted British manufactures, and smuggling became not only respectable but patriotic.

As an indication of the health of American commerce, the figures on shipbuilding are illuminating. In one year alone, 1769, the American colonies built and launched 389 sailing vessels. And in 1776, just at the beginning of the Revolution, it was estimated that over one-third of the British ocean-going merchant marine was composed of American-built ships.

Among the major maritime occupations, other than smuggling, which flourished before and after the revolution were deep-sea fishing, whaling, and slave trading. Whaling, about which some of the most thrilling pages of American maritime history were written, started in 1712, and by 1770 Nantucket alone owned 125 whalers, which that year brought in a cargo valued at $358,000. Slaving, too, was enormously profitable; it laid the foundations of some of America's greatest fortunes.

The Revolutionary Period.—Not all was serene and prosperous, however. While a few American merchantmen made over 700 per cent profits on single voyages, the great majority of them were not so fortunate. The British, in the middle of the 18th century, began wreaking havoc on colonial shipping. Up to the American Revolution they had captured over 300 American trading vessels, and had caused such a rise in shipping rates that many foreign commodities were completely beyond the reach of the average American colonist. British raiding of America's "illicit" commerce may be said to have been the basic cause of the Revolution.

The Revolution nearly ruined both British and American shipping. British war vessels and privateers annihilated the American fishing fleets, and either sank or captured more than 1,000 American merchantmen. They succeeded in bringing normal trade between America and Europe to a complete halt for several years. At the same time, American privateers, numbering over 1,600 vessels, together with the 30 ships of the American Navy, captured or sank as many as 3,000 British vessels. Of the 30 naval ships only nine remained at the end of the war, however; and according to most authorities it must be admitted that the British Fleet defeated America at sea in the revolution.

Moreover, though the privateers brought considerable assistance to the beleaguered American forces, the privateer tradition resulted in the growth of piracy after the war. The usual concept of our country's early merchant marine as a fleet of vessels valiantly fighting for freedom is not one entirely upheld by the facts. Smuggling, slaving, and piracy were the major sources of the private incomes of American shippers in those days. There were excellent reasons for this—the British restrictive legislation both before and after the Revolution. But those reasons do not erase the picture of the American merchant marine of the 18th century as a fleet of adventurers.

The first accurate figures on the deep sea tonnage of this nation were obtained in 1789, when 123,893 tons of American shipping were registered. The smallness of this figure resulted from the chaotic conditions at sea immediately following the Revolution. It was not until Congress first met as a body legally authorized to pass laws for the nation as a whole, in the year 1789, that the merchant marine had a chance to grow under normal conditions of national protection. In that year the first Congress required that only United States-built and owned vessels could be registered under the American flag. Another more important law established a discriminating duty of 10 per cent against all goods imported in foreign ships; and further, a discriminating tonnage tax providing a differential nearly 10 times as high on foreign vessels as on American. The result of these discrimination laws was immediately evidenced. From the low tonnage figure of 1789, the merchant fleet of the United States jumped to 411,438 tons in 1792, three years later. In 1789, 76 per cent of the total exports and imports were carried in *foreign* ships; by 1794 the ratio had been startlingly reversed, and American ships were carrying over 88 per cent of American combined imports and exports.

A number of causes, in addition to the country's policy of favoring United States shipping by means of discriminating duties and tonnage taxes, can be found for the relative prosperity of the American merchant marine during the 20 years from 1792 to 1812. Europe was in the throes of the Napoleonic wars much of the time, and both British and French fleets were busily engaged in fighting each other. Despite the ruinous embargoes placed on neutral shipping by both British and French during the 1800's, the United States merchant marine captured a large amount of the commerce of the world at that time.

Moreover, new avenues of trade had been opened. In 1784 *The Empress of China* had made the first trip of any United States vessel to China; and the Chinese market for furs, ginseng, and other commodities brought great profits to American traders. In 1789, 15 American vessels were counted in the Canton roads at one time. To make trade easier with the East, and to tap the enormous wealth in furs of the Far West, John Kendrick and Robert Gray established the first fur post on the west coast, in 1788. Captain Gray made the first round-the-world voyage under the United States flag in the sloop *Columbia,* 1789–90.

Finally, America's own coastal trade brought some prosperity to the nation's shippers. The law of 1789, which established discriminating tonnage taxes, was written in order to give once and for all a practical monopoly in coasting to American ships. This law stated that American vessels in the coasting trade should pay the tonnage tax—$6—only once a year. Foreign vessels had to pay a $50 tonnage tax *every time they entered an American port.* Naturally, few, if any, foreign ships attempted to trade on that basis. In 1808 Congress explicitly forbade foreign vessels in the coasting trade, and it has continued to be a national monopoly.

An indication of the growth of the American merchant marine during this period is found in the increase in the United States tonnage registered for foreign trade: from 411,438 in 1792, to 984,269 in 1810—well over 100 per cent. Similar increases were made in the tonnage of vessels occupied in coastal and inland waters.

From 1812 to the Civil War.—The War of 1812, resulting from the British policy of ruthless sea raiding, impressment of American sailors, and interference with United States trade, caused only a temporary interruption to American shipping, though it was catastrophic while it lasted. More than 500 of the best American merchantmen were withdrawn from normal commerce to become privateers, supplementing the 23 vessels which then comprised the United States Navy. And while these privateers captured or sank well over 1,300 British merchant ships, the British Navy disposed of nearly an equal number of American vessels, causing a shrinkage in American tonnage in foreign trade from the nearly one million tons of 1810 to a little less than 675,000 tons in 1814. American commerce declined from $150,000,000 in 1810 to $20,000,000 in 1814.

But foreign commerce revived soon after the war, and the merchant fleet of the nation grew to considerably larger volume than ever before. The China trade continued to expand; whaling, sealing, and other special fisheries trades brought millions of dollars into American tills; and the development of swift, regularly scheduled packet lines, prophetic of the coming of the clipper, brought more and more international trade into American ships.

One reason for this expansion was the fact that in 1815 Congress passed a law prohibiting foreign vessels from importing any goods to the United States except from the country under whose flag they sailed. The law was used as a weapon with which the United States forced many nations to sign reciprocal trade treaties. Another reason was the general improvement in American ships. Builders had begun to study ship models and rigs, and were able to experiment with reference to the trade needs of the times. Ships became larger, more maneuverable, faster. According to many authorities, the period 1816–1828 was perhaps the most flourishing in all American maritime history. United States ships were everywhere, in every port, competing on equal footing with the vessels of European fleets, and often walking away with much inter-European trade, as well as the bulk of the Far Eastern shipping and nearly 90 per cent of America's own imports and exports.

In 1828, Congress abandoned the preferential duty system, in accordance with the then popular free trade idea. This revocation worked a temporary hardship on American shipping, causing numerous transfers to foreign flags and other defections from the merchant marine. In 1828 American registered tonnage numbered 812,619 tons; by 1830, it had fallen to about 575,000 tons. However, it had returned to the 1828 level by 1834, and from then until the Civil War period

(1861) the American merchant marine under sail grew by leaps and bounds. In that year it was registered at 2,540,000 tons—nearly a fivefold increase in sailing ships alone. The enormous annual growth in immigration from 1825 onward meant profitable passenger lists, and resulted in new, swift, and luxurious types of cargo-passenger combination sailing vessels. Growing industries in the United States also produced more goods for export, and American tastes began to lean toward products of European refinement. All these things helped fill American ships.

It was the great era of the packet line and the clipper. A packet line consisted of a regular service for freight and passengers. Its vessels were common carriers, as opposed to the earlier type of sailing vessel which carried goods only for the owner, or for the owner and a few others who shared in the proceeds of the voyage.

The first American packet line was established between New York and Liverpool in 1816—the Black Ball Line. By 1836 there were 50 sailing vessels in the American packet fleet, running on regular schedules to many European ports, and also to Central American countries. These packets of the sail were relatively small, averaging less than 500 tons, although the *Roscius,* put into service in 1838, was a monster of 1,100 tons. Many of these packets made the Atlantic passage from New York to Liverpool in less than two weeks—magnificent time for ships of the sail.

John W. Griffiths, according to some authorities, was the man who invented the clipper type of merchant vessel. His first ship, the *Rainbow,* went into service in 1841. One of his vessels, the famous *Sea Witch,* ran from Canton to New York via Cape Horn in 77 days—record time for a sailing ship.

The full development of the clipper coincided remarkably with the opening up of the west coast of the United States in the days of the Gold Rush. American shipping during the 1850's might have suffered considerable losses owing to the introduction of steam vessels and of heavily subsidized British lines into the Atlantic trades, had it not been for the enormous trade with California which grew with the exploitation of the west coast gold fields. Right up to the beginning of the Civil War, this trade brought unprecedented prosperity to east coast shippers, and was instrumental in the development by Donald McKay of the most famous clippers—the *Flying Cloud,* for instance, which cut sailing time from New York to San Francisco from 127 days to 89 days.

Other famous American clipper builders were Brown and Bell, Howland and Aspinwall, and William H. Webb, whose *Helena* competed with Griffiths' *Rainbow* for the honor of being the first true clipper. Some of these clippers were capable of 330 miles a day. An average of 15 miles an hour under favorable winds was ordinary. *The Sovereign of the Seas* once sailed 437 miles in 24 hours—a record which many steam or motor vessels of today would find difficult to equal.

The repeal by Great Britain of its navigation laws restricting international trade in 1849 also opened up the Atlantic trades to United States vessels, and the clipper and early United States steamers for several years dominated the Liverpool run. With the end of the Crimean War in 1856, however, the seeds of decay were sown in the American merchant marine. Thousands of tons of British vessels were released to compete in international trade, and as a result, United States shipbuilding, the first of any maritime industry to feel the effects of a foreign trade depression, shrank from nearly 600,000 tons under construction in 1855 to only a little over 200,000 tons in 1860. The Civil War resulted in a complete stoppage of United States shipbuilding, and practically strangled the American merchant marine.

There are several important reasons for this decline, in addition to such incidental setbacks as those in the wake of the Crimean War, the collapse of the gold boom in California, and the Civil War. For one thing, the immense wealth of the American continent was being opened up by the great westward expansion of the mid-19th century. Railroads were absorbing nearly all American capital; discovery and exploitation of American natural resources were luring American men from the sea of their heritage, inland to a new kind of life. The immensities of the American continent offered full scope for the expanding energies of the American people, and interest in the merchant marine in international trade sank very gravely as a result.

The development of steam navigation, and the adoption by European nations of consistent policies of subsidization of their merchant marines, were other important reasons for the shrinkage of American shipping in foreign trade.

The Advent of Steam.—In 1781 the Marquis de Jouffroy ran the world's first workable steamboat down the River Saône, in France. In the 1780's John Fitch of Philadelphia experimented with steam, and one of his vessels was in use as a packet between Trenton and Philadelphia in 1790. William Symington, a Scotsman, further developed and improved the steam vessel; his tug, the *Charlotte Dundas,* was in successful operation in English waters by 1802. Robert Fulton's *Clermont,* first launched in 1807, was an adaptation of Symington's design for use on United States inland waters. All of these early steamboats were operated by paddle wheels, though John Fitch did experiment with screw propulsion as early as 1787.

Though the first steam-and-sail voyage across the Atlantic was made by the American *Savannah* in 1819, using wood for fuel, American steamship development was limited predominantly to the design of vessels useful for service on inland waters. It was not until the 1840's that the United States began to think in terms of regular transatlantic voyages for steam vessels, and then the subject arose only because of a new kind of competition which the British were bringing into effect.

The famous *Great Western* was the first British steamer to enter the regular transatlantic service; her first trip was made in 1837. However, serious competition with American sail packets began in 1840, when the first Cunard liner crossed the Atlantic, subsidized with a British mail contract of £80,000 a year. The United Kingdom also subsidized a steamship line to the West Indies in that same year. Though American sailing vessels for a while kept their advantage in freighting and in the Orient runs, the new, fast, regular British steamers began to eat into the American trade for passengers and fast freight.

As a result, Congress passed its first maritime subsidy legislation in 1845, appropriating $400,000 annually for the Ocean Steam Navigation

Company, New York to Southampton and Bremen, and further amounts to assist in the construction of steamers for the Liverpool run. The latter vessels were to be owned and operated by E. K. Collins, one of the first of the great steamship moguls of America. His four wooden sidewheel steamships competed effectively with Cunard for several years during the 1850's, until Congress in 1858 withdrew the subsidies it had granted. Two other lines, the Sloo and the Pacific Mail, for South America and Pacific runs, both received subsidies. Because of the enormous profits made from the gold rush, they were able to make money. Collins, however, was constantly in financial difficulties, not only because of mismanagement, but also because of insufficient competitive subsidies.

When American policy turned against subsidies in 1858, the steamship lines were all, with one or two exceptions, forced to suspend operation. The percentage of the value of United States foreign trade carried in American ships dropped from 73.7 per cent in 1858 to 25 per cent in 1866. Until World War II our ships never regained as much as 40 per cent of the total import and export carriage of the United States trade.

The Civil War to World War I.—The Civil War did not, of course, destroy the United States merchant marine, but it did nothing to retard the self-destructive tendencies which were already evident within it. Anglo-Confederate cruisers harried northern merchantmen, causing insurance rates to skyrocket, and resulting in the transfer of over one third of the total registered tonnage of the Union to foreign flags. Shipyards were abandoned; many vessels were sunk or captured; and many more merchantmen were taken from their accustomed trade routes and put into blockade duty around the ports of the Southern states. All this meant severe dislocation to the nation's shipping and its foreign trade as well.

After the end of the Civil War, American shipping in foreign trade continued to decrease steadily. There are many reasons for this, among the most important of which are the following. In the first place, United States shipbuilders and shipowners proved unusually reluctant to adopt the most modern and advanced type of ship. The iron ship had its first success in Great Britain, whereas Americans continued to build wooden vessels. This was owing to the fact that Britain's iron technology developed at a swifter rate than America's, since a chronic lumber shortage in England made the use of iron a necessity. The United States, on the other hand, had enormous reserves of standing timber, and American shipbuilders preferred to use that material rather than rely on the lagging and inefficient American iron founders for shipbuilding materials.

Moreover, although an American, John Ericsson, is said to have been the first to perfect a practical screw method of vessel propulsion, here also the United States lagged far behind the British in adopting that method of propelling its steam vessels. Ancient American sidewheelers were ploughing across the Atlantic long years after the British, with the aid of liberal subsidies, had replaced their older wooden vessels with relatively swift and safe iron ships propelled by the screw.

In the second place, the pressure of the Western agricultural states against ship subsidies resulted in a complete absence of coherent subsidy legislation during the whole period. American ships found it impossible to compete with the large and regular mail subsidies paid to Cunard by the British government. For a brief period, 1865–1875, Congress subsidized a few lines to Latin America and the Orient; but as a result of scandals connected with payments to the Pacific Mail Line, all these subsidies were withdrawn. No payments were paid to steamship companies in competition with Great Britain on the important Atlantic run from New York to England.

A third reason, previously mentioned, continued in effect with unabated force during the whole of the 19th century: and that is, the internal expansion of the nation, the development of American industry, the leap into boisterous manhood of an inventive people in a nearly self-sufficient land. American economy did not need a national merchant marine in those days.

Finally, a fourth reason for the continued slump in the registered fleet in foreign trade of the United States was, of course, the coincidental profitable growth in the coastwise and intercoastal monopoly of American shipping. While United States vessels in foreign trade decreased in tonnage from over one and a half million tons in 1870 to under 800,000 tons in 1910, the tonnage engaged in the coastal, inland, and Great Lakes trades rose from 2,729,700 tons in 1870 to 6,716,200 tons in 1910, over two and one-half times.

Nevertheless, many forces were at work to bring the nation back into the international shipping picture. Shipbuilders and ship operators both desired a larger portion of the American carrying trade. The danger of monopolies abroad constantly suggested the possibility of prohibitive freight rates imposed by closely held European shipping combines. The need for a merchant marine in the organization of national defense was also often stressed by thoughtful people.

As a result, in 1891, a conservative mail subsidy law was entered on the nation's books. A total of $29,630,000 was spent during the life of the act, more than half of this sum going to ship lines operating in the transatlantic trades. Nevertheless, total expenditures were less than one half those of Canada, and one sixth those of England during this period.

It was hoped by the promoters of the law that the subsidies would encourage the building of new ships for the mail lines. However, the advent of the Spanish American War indicated that those hopes had not been translated into fact, largely because of insufficient operating bounties and the entire absence of financial aid for ship construction. During the war period, 1898–1899, Congress had to permit the temporary registry of 42,700 tons of foreign vessels, in order to cope with the problem of transporting United States troops and supplies to Cuba, the Philippines, and elsewhere. The army and navy bought another 94,000 tons of foreign shipping to care for their requirements. The actual tonnage registered for foreign trade *decreased* from 844,954 in 1896 (both sail and steam) to 826,694 in 1900.

More generous operating subsidies and the institution of a policy of ship construction subsidies were constantly urged in Congress, but with no success up to the year 1916. The agrar-

ian states, continuing to fear a rise in shipping rates, succeeded in defeating all attempts at establishing national protection for American registered shipping.

The only additional assistance to United States shipping which the government was able to bring forward between the years 1898–1916, was the extension of the coastal monopoly to include Hawaii and Puerto Rico, and trade via the Panama Canal from one coast to another.

In the spring of 1915 the Nelson Act, often miscalled the LaFollette Act, was signed by President Wilson. This law provided a "new deal" for American seamen. It entirely abolished imprisonment for desertion. It set up requirements for better working conditions, manning scales, and food. Tests by the Department of Commerce were required before a man could receive his able seaman's certificate; and 75 per cent of the crew had to be able to understand the language of their superior officers, thus virtually eliminating low-paid Chinese crews on American vessels.

Also, in 1914, there was a congressional investigation of liner shipping, and of the combinations in support of fixed rates into which various lines entered. These combinations are called *conferences*. The investigation discovered no discrimination against American ships, but did reveal certain unfair practices by the conferences, which were finally outlawed in 1916. These practices included deferred rebates, preference contracts with large shippers, and "fighting ships." The fighting ship was a vessel assigned by the conference to undercut the rates of nonconference lines which were, in turn, undercutting the conference rates. With the elimination of the discriminations above outlined, the conference system of interline self-regulation has proved a sound way of avoiding cutthroat competition and a constantly bankrupt merchant marine.

World War I and Shipping.—The outbreak of World War I in August 1914, provided a major turning point in the history of the American merchant marine. In 1912 about one million tons of ocean shipping, owned and controlled by American capital, were operated under foreign flags. When the war began, a large number of these vessels returned to American documentation, in order to escape capture by the warships of belligerent nations. As freight rates began to increase and more and more ships belonging to belligerents were immobilized by the war, hundreds of thousands of tons of American coastwise shipping transferred from domestic to overseas routes to take advantage of the wartime prosperity in foreign trade.

The proportion of United States imports and exports carried in American vessels jumped from 9.7 per cent in 1914 to 16.3 per cent in 1916. High freight rates caused such a demand for shipping that buyers gladly paid up to $300 a ton for ships which, before the war, could have been bought for $60 a ton.

American shipbuilding did not noticeably increase. While there was a growth of approximately 100,000 tons in 1916, 120 *fewer* vessels were built than in 1915.

The enormous increase in freight rates brought about a congressional investigation in 1914, which discovered rate increases in cotton shipments from New Orleans to Liverpool, to take an example, of from $2.50 per bale before the war to $50.00 per bale in 1914. In 1916 a bill was passed to regulate rates.

The Shipping Board Act, as it was called, authorized the establishment of a United States Shipping Board, whose function was to supervise ocean freight rates. Deferred rebates, preference contracts, and fighting ships were all forbidden. The board was given power to disapprove, cancel, or modify any conference agreement it found to be discriminatory or unfair.

By that time the nation was on the verge of a declaration of war with Germany. The provision for government construction of ships became the most important section of the act, and one of the first major steps of the newly created board was to set up (April 16, 1917) the Emergency Fleet Corporation, to carry out the herculean task of building a "bridge to France." The funds earmarked for ship construction were increased in June 1917 from the $50,000,000 provided in the act, to $750,000,000, and before the end of the war, to a total of $2,884,000,000. This sum was used for ship and shipyard construction alone. Other funds for the purchase and operation of ships already afloat brought the total spent on an emergency fleet to over $3,000,000,000 by the time the program was completed.

Less than one sixth of the Fleet Corporation's ship construction program was completed by the end of the war; and meanwhile the transport problems of the army and navy had to be solved. The government borrowed 1,200,000 tons of cargo shipping from Great Britain in September 1918. More than one half of the United States troops sent abroad during the war period were carried in English, French, and other allied vessels.

Early in 1917 the nation had 61 shipyards with a total of 225 ways. On Nov. 11, 1918, there were 341 shipyards with 1,284 launching ways in the United States. The number of workmen in the shipyards had increased from 45,000 to 380,000. During its whole period of existence, the corporation built 2,318 ships, totaling over 14,000,000 dead-weight tons. Some 5,000,000 tons of ships, over one third of the total, were actually started after the armistice, the last vessel built not being delivered until May 1922. Many of the ships were of poor quality, low speed, and short operating life. The corporation paid from $150 to $200 a dead-weight ton, whereas, before the war, good steel cargo steamers were built in the United States for about $65 a ton.

Perhaps the most famous of the wartime vessel types was the Hog Island freighter, with a cargo capacity of 4,963 gross tons and speed of about 11 knots. Built on a mass-production basis at the shipyard at Hog Island near Philadelphia, it became a distinctive part of the American merchant marine during the next 20 years.

During the war, the shipping industry operated completely as an arm of the United States government. At the end of hostilities, the board found itself responsible for a huge, government-owned fleet which, under the law, it was obligated to transfer to private owners or operators within five years after the end of the war. The Merchant Marine Act of 1920 was passed by Congress to enable a new Shipping Board to dispose of the vessels, and to assist private operators, under charter or as managing agents, in running them.

The act also set up a construction loan fund of up to $25,000,000 for loans to private companies to build new ships. The postmaster gen-

eral was given the authority to make contracts for the carriage of mail on Shipping Board trade routes without asking for competitive bids. During the period from 1924, when the first subsidy was paid under the act, to 1929, when the Merchant Marine Act of 1928 went into effect, only $4,801,953 was paid out in mail subsidies, and only six lines benefited.

By June 30, 1928, 1,164 cargo and other types of vessels had been sold at an average price of about $18 a ton to operators who would agree to make a stated number of sailings in a stated trade with the ships they purchased. The Shipping Board itself operated vessels on several lines, usually at a loss. Finally, many of the remaining vessels were temporarily retired from service.

The postwar world depression affected American as well as foreign shipping. At the same time that there were surpluses in ocean-going tonnage in every one of the major maritime nations, foreign trade dropped, and never, during the prosperous 1920's, rose to a point where the world's shipping was able to run at a profit on cargoes alone. Although the percentage of American foreign trade carried in American vessels rose from an average of 10.6 per cent in 1911–1915, to an average of 35 per cent in 1921–1930, the newer European postwar merchant fleets, subsidized both as to construction and as to operation by their increasingly nationalistic countries, undercut the relatively unsubsidized American fleet until it became obvious that most American shippers would be unable to continue in business without further assistance.

In 1928, an effort was made to put America back into competition with the merchant fleets of other nations through a new Merchant Marine Act which authorized much heavier mail subsidies. Construction of new vessels in American shipyards was required of recipients of the subsidies, and as a result, there began the first new ship construction since World War I. Forty-two vessels were built under the act, between 1928 and 1936, totaling less than half a million tons. Forty-three mail subsidy contracts were let, involving an average annual expenditure of a little less than $20,000,000.

Even these sums of money proved insufficient to put the American merchant marine on its feet. Many of the recipients were not operating efficiently enough, or under the right type of regulations, to forward economical and successful shipping. Moreover, the continuing growth of foreign trade fleets resulted in a world fleet much superior in size, speed, and efficiency to the American vessels.

The higher costs of American operation of shipping were due to three factors: (1) much higher overhead and carrying charges on an average American vessel, unsubsidized as to construction and unassisted either directly or indirectly in operation; (2) increased costs in upkeep due to higher standards of subsistence and safety; (3) higher costs of labor on American vessels.

The first attempts to improve the situation took the form of laws designated to improve safety and working conditions, the first such laws passed since 1915. The Bureau of Marine Inspection and Navigation was reorganized and its authority increased. Marine casualty boards were established to deal with questions of negligence leading to marine disasters on the part of marine personnel.

Finally, the Roosevelt administration asked Congress in 1935 to give the United States a realistic policy for its ocean-going merchant marine, and the right to support that merchant marine with direct and easily controllable subsidies.

The Merchant Marine Act of 1936 finally was passed and signed. One of the first actions of Mr. Roosevelt as president had been to put the old Shipping Board into the Department of Commerce as the United States Shipping Board Bureau. The new act abolished the bureau entirely, as well as the Merchant Fleet Corporation which had succeeded the old Emergency Fleet Corporation. It also established the United States Maritime Commission to administer the act, and authorized it to cancel the ocean mail contracts executed under the 1928 act. These contracts were cancelled by June 30, 1947, and claims totaling over $73,000,000 were settled at a net cost to the government of approximately $750,000.

The chief feature of the legislation, however, was the frank power of subsidy which it granted the commission. The new subsidies were intended to give private industry the difference in cost between both construction and operation in the United States and in a foreign nation. The act authorized the commission to establish rules and regulations which would assure efficient use of its funds; to provide for the determination of essential trade routes; to create minimum wage and manning scales and working conditions; to create a training program for American seamen; and to set up a construction program for the replacement of the country's obsolescent shipping.

The new commission made an extensive survey of the merchant marine as it then existed. It discovered in this survey that over 90 per cent of the existing American merchant fleet in foreign trade would be over age by 1942.

The commission immediately embarked on a large-scale construction program, which envisaged the building of 50 ships a year for 10 years. By Nov. 1, 1940, contracts had been let for 179 cargo, cargo-and-passenger combination, and tanker vessels. The vessels were the most modern, most efficient, and most economical afloat. Included in the program was the largest passenger liner ever built in an American yard, the *America,* which was put into service in the summer of 1940.

Subsidies on ship construction under the commission's program amounted to between 30 per cent and 45 per cent of the actual cost of construction in American yards. Operating subsidy outlays in 1937, 1938, and 1939 averaged approximately $13,000,000 per year.

New safety and maritime labor legislation adopted in 1935 and 1936 plus unusually high constructive standards have made the commission's ships the safest in the world.

The American Merchant Marine in World War II.—The emergency shipbuilding program instituted at the outbreak of World War II produced 185 new ships within two years, but when the United States was forced into the war, it was evident that this program must be expanded many times. All resources were mobilized for another great shipbuilding effort. The basis of the new program was the 10,000-ton 11-knot Liberty ship, a standard cargo vessel modeled on an old British type, that could be built quickly and did not require the complicated propulsion machinery that was in great demand for naval vessels. The race between the German submarines and the Amer-

ican shipyards was won by the yards within a year and a half after our entry into the war. The 40 shipyards available at the start of the war increased to nearly 80, employing 700,000 workers, who turned out over 5,500 ocean-going vessels, an average of one vessel every 6 hours night and day, for 4 years.

A new government agency, the War Shipping Administration (WSA), was formed in February 1942 to take over the task of manning and directing the operation of these vessels, while the Maritime Commission continued to administer the shipbuilding program. The WSA operated in close cooperation with the Maritime Commission, many of whose officials also served in the new agency, and with the armed services and government departments of both the United States and other Allied nations. The War Shipping Administration recruited 100,000 former seamen and trained over 200,000 men to man the ships, and directed the transportation overseas of millions of soldiers, their weapons and supplies, and four fifths of the cargo required for the entire United Nations war effort. In addition, ships under WSA control carried essential supplies for the United States civilian economy and the imports needed to sustain war production. Many vessels were turned over to the army and navy to serve as hospital ships, repair vessels, oil and cargo carriers, and for other special uses.

Many merchant vessels also took an active part in the fighting. In addition to landing troops and cargo under fire, a number of merchant ships sank enemy submarines and shot down enemy planes. Some old damaged vessels were sunk off Normandy Beach to serve as breakwaters and to support the piers used in landing supplies for the European invasion. About 700 ships were sunk and 5,600 seamen lost, but merchant ships kept on carrying men and goods to and from battlefronts all over the world until the war was finally won.

Postwar Reconversion.—While war plants closed down and the armed forces were demobilizing, the merchant marine was busier than ever. Seven million men had to be brought back from overseas, together with many war brides and children. To the devastated nations of Europe and Asia, cargo vessels carried millions of tons of grain, coal, flour, and other relief supplies.

In addition to the government-built and government-owned ships which had been operated by the government through private agents, about 900 privately owned merchant vessels had been requisitioned by the government for war service. These vessels had to be returned to their owners and compensation paid for their use. Where vessels had been lost, insurance had to be paid or another vessel made available as a replacement.

Since private ownership of merchant vessels insofar as practicable is the general policy of the United States, when the war emergency was over, the Maritime Commission was directed by Congress in the Merchant Ship Sales Act of 1946 to sell as many of its war-built vessels as possible to private operators. Up to September 30, 1949, 1,831 vessels had been sold, of which 1,113 had gone to foreign nations to replenish war-depleted merchant fleets, and 718 of the best types had been sold to United States operators. After March 1, 1948, government-owned vessels could no longer be sold to foreign buyers. There were 2,095 vessels laid up in reserve fleets at seven permanent and two temporary sites. Some of these laid-up vessels, carefully preserved, will be kept as a reserve for emergencies. Until June 30, 1950, when the Commission's sales authority was due to expire, others might be sold to American operators, or, if they were too badly damaged for further use, they might be scrapped.

On September 1, 1946, the War Shipping Administration was dissolved and its remaining functions turned over to the United States Maritime Commission.

There was not enough privately owned tonnage available to meet the heavy postwar demands for relief and rehabilitation cargoes. Pending completion of the ship sales program and restoration of normal shipping conditions, Congress sought to provide sufficient tonnage under the United States flag to meet these needs by authorizing the Maritime Commission to charter war-built government-owned ships to private American operators. This authority was also due to expire on June 30, 1950. As of September 30, 1949, there were 182 government-owned ships in operation. During and immediately following the war, the Commission and the War Shipping Administration had operated vessels through general agents. Such active general agency operation had ceased by the fall of 1949. Privately owned active United States ships of 1,000 gross tons or over (exclusive of those on the Great Lakes and inland waterways) totaled 1,032 of 12,452,000 dead-weight tons, making an active fleet of about 1,214 vessels in the United States merchant marine at that time.

The vessels built during the war were for the most part emergency types like the 2,710 Libertys and the 531 slightly larger and faster Victorys. These ships were not designed for competitive peacetime operation. The original 500-ship long-range program had been finished years ahead of time, and most of these C-type ships and large tankers were quickly sold to American operators after the war. A few vessels designed as troop carriers could be reconverted for use as passenger vessels. There were 127 passenger or passenger-cargo vessels with a total passenger capacity of 38,357 in active operation before the war. All were taken over by the army or navy for war service, and 52 were lost. Others were too badly damaged or too old to be worth reconverting. The number which, like the S.S. *America,* were reconverted and returned to service, make up a passenger fleet only about one third the size of that operating before the war. High postwar shipbulding costs, and uncertain prospects for United States passenger ships in competition with airplanes and with foreign liners, together with steel shortages and the difficulty of determining fair subsidy rates, delayed the start on a liner replacement program.

Increased costs for new ship construction, plus the large number of war-built ships available for sale at comparatively low prices brought about a sharp slump in the American shipbuilding industry. War-built emergency yards were closed down. Even long-established yards closed or turned to other types of work, while many skilled workmen left the industry. In 1947 only 26 cargo ships, 2 combination passenger-cargo liners, and 2 tankers were built. The president and other high officials pointed out the serious implications of this curtailment of shipbuilding capacity to the maintenance of an up-to-date merchant marine and to the national defense.

The United States Maritime Commission shortly after the war had worked out a long-range program indicating the need for a minimum of 1,044 vessels of 11,400,000 dead-weight tons to serve 31 trade routes determined to be essential to the United States economy and defense. The plan proposed the building of about 144 new vessels in the next 10 years, of which 58 would be combination passenger-cargo vessels and 86 freighters of specialized types not available from the war-built fleet. In addition a number of high-speed tankers would have to be built to meet constantly increasing requirements for oil transport. A replacement program to keep the fleet up-to-date and prevent its becoming obsolescent all at the same time was also proposed.

In 1947 President Truman appointed 4 leading industrialists and a high ranking naval officer to serve as an Advisory Committee on the merchant marine. After an extensive study of the needs of the merchant fleet, this committee issued a report in November 1947 proposing a shipbuilding program of 46 passenger vessels in the next four years, together with a number of high-speed dry cargo ships and tankers. Early in 1948 a committee of Cabinet members recommended through the secretary of the navy that Congress increase the merchant shipbuilding appropriations for the fiscal year 1949 to $100,000,000, of which $90,000,000 would be for new construction. It was pointed out that 50 additional passenger vessels would be needed to furnish troop carrying capacity estimated as minimum in case of war, plus 170 tankers within the next four years.

In response to these requests, Congress made available about $178,000,000 in contract authority for ship construction during the 1949 fiscal year, and the Maritime Commission requested ship operators to determine their shipbuilding needs and to place contracts as soon as possible. Up to November 1, 1949, contracts had been placed by the Maritime Commission for three round-the-world combination passenger-cargo vessels of 13,000 gross tons each, two passenger vessels of 21,000 gross tons each for Mediterranean service, and one 48,000 gross-ton transatlantic "superliner," with construction subsidies to be paid by the government in additon to payments for special national defense features. Bids were also received on a vessel for South American service and two passenger-trailer ships for domestic Pacific Coast service, the latter to be built without subsidy but with mortgage aid. Several other operators had expressed an interest in ordering new passenger vessels, and for the first time since the war's end there was a brighter prospect for the rehabilitation of the depleted United States passenger fleet.

The Commission had also contracted on its own account for a prototype cargo vessel, designed to serve as a replacement for vessels of the peacetime fleet which had become obsolete and also as a model for mass building in case of emergency.

At the war's end the United States merchant marine was the only important fleet which was much larger than before the war. These ships were called on to carry the major part of the relief cargoes going abroad. The profitable operating conditions during the period just before and after the war helped to reduce the cost to the government of ship operating subsidies. The Merchant Marine Act of 1936 provides for the return of one-half the profits earned by a subsidized operator in excess of 10 per cent of the capital necessarily employed in his business, up to the full extent of the subsidy received. Under this provision, the 10 shipping companies whose first 10-year subsidy contract periods ended on or before September 30, 1948, will return about two-thirds of the subsidy paid them.

Gradually, however, as other countries built up their fleets by new construction or by buying surplus United States ships, foreign competition for available cargoes increased and demand for United States shipping fell off. The need of other nations for United States dollars made them eager to use their own ships, both to earn and to save dollar payments. The share of United States trade carried by American ships dropped from nearly 70 per cent shortly after the war to less than 50 per cent, fiscal year 1949.

In setting up the Economic Cooperation Administration, however, Congress stipulated that half of the relief and reconstruction cargo originating in the United States must be carried in United States ships. This made it possible for American flag ships to continue to share in the available trade. Nevertheless, decreases in bulk shipments of coal and continued lack of imports from other countries meant a gradual decline in United States shipping and a return to the government of many of the ships chartered by private operators. Increases in wages of American seamen and in other operating costs such as food, insurance, repairs, etc., have made it more difficult for United States operators to meet lower cost foreign competition. Since subsidy payments are based on the differences between United States and foreign costs, the devaluation of their currencies by many leading maritime nations late in 1949 increased this differential, in some cases beyond the limitation of 50 per cent of the United States cost set by the Merchant Marine Act of 1936 for construction-differential subsidies. For this reason President Truman in the fall of 1949 directed the Maritime Commission to study the situation and present its views to Congress in 1950 for possible modification of existing legislation.

Domestic shipping, which furnished a large number of ships for war service, has not been able to regain its prewar position. Before the war coastwise and intercoastal dry cargo carriers numbered 400 of 2,700,000 dead-weight tons. On September 30, 1949, there were about 131 of 1,189,000 dead-weight tons, much of it in bulk or coal trades. Although protected from the foreign competition which oceangoing ships must meet, domestic lines are handicapped by the depressed rates of competing land carriers and their own sharply increased postwar costs. Until June 30, 1947, the United States Maritime Commission had operated some essential domestic services through general agents, but on that date it withdrew from all remaining services of this type. However, the government charters vessels to private operators in domestic trades at lower minimum rates than those obtained from operators in foreign trades. Although an overall review of rail-water rates by the Interstate Commerce Commission has not been made, several increases in rail rates have given some relief to water carriers who could raise their rates correspondingly.

Future prospects for shipping prosperity depend on a fair adjustment of rates between domestic land and water carriers, the revival of

healthy international trade, and on continued support by the American people of an active and efficient American merchant marine for purposes of national economy and defense.

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MERCHANT OF VENICE, The. 'The Merchant of Venice,' entered in the stationer's register in 1598, and published in quarto form in 1600, was written about 1594 or 1595. Several stories that had long had currency in the world—notably the story of the caskets as a device for the choice of suitors by a wealthy heiress, and the bond story of the rich Jew and his debtor — are happily blended in this play, and thereto are added the story of the rings, the romantic minor plot of Lorenzo and Jessica, and the comic character of Launcelot Gobbo. Shakespeare never constructed a better plot, or one better calculated to win popular approval. It meets every demand of stage-management. Although the two main incidents—the choice of the caskets and the pound of flesh—are almost childishly absurd, they are made to seem probable and even natural by the romantic atmosphere in which the characters move. Whether walking the streets of Venice or watching the moonlight sleep sweetly upon the banks of fair Belmont we breathe the air of the Renaissance in Italy. All the characters fit in perfectly with this background except Shylock. Unquestionably to an Elizabethan audience the impression made by him was partly humorous and not at all typical. With his huge nose and the red wig of the traditional Judas he was fair game, not only for the characters in the play, but for those in the pit. His practice of usury and his Jewish qualities rendered him the legitimate object of hatred and ridicule—his passionate words of rage only increased the laughter of an Elizabethan audience. While Shakespeare gave sufficient ground for this interpretation of the character, he has so humanized him as to produce a different effect on a modern audience. His famous words, «Hath not a Jew eyes, etc.,» are an instinctive protest against race hatred and in favor of social sympathy. Whatever may be doubtful in the interpretation of Shylock, there is none in the interpretation of Portia. There is no better illustration of the power with which Shakespeare transformed his material than in the change of Portia from «a piratical and widowed siren, who persuades merchants to stake their all against her hand that they will possess her person, and who then drugs them at supper» into one of the most charming characters of all times. Her beauty of person, brilliancy of intellect, nobility of soul, and gift of poetical expression, all combine to produce an effect not surpassed by any other creation of the dramatist. She is the bond of union between the casket story and the pound of flesh story, and all the other characters group themselves naturally about her. The concluding scene of the play at Belmont, after the excitement of the trial scene and the disappearance of the sinister character Shylock, is one of the supreme passages of poetry in the language—almost magical in its beauty of background and expression.

EDWIN MIMS.

MERCHANT VESSELS, Neutral. At the Washington Disarmament Conference of 1921–22, Elihu Root remarked, as to the term *merchant vessel*, that it «could not be made clearer by the use of definitions which would only serve to weaken and confuse it.» In general, the term refers to any vessel not owned or operated by the government of any state, though even this distinction is clouded by the recent practice in which governments have engaged, that of owning or operating vessels for commercial purposes. In time of peace, such a vessel encounters conflicts of jurisdiction as it moves from one country to another. Upon the high seas, it is subject to no interference or control by any state other than its own; within the territorial waters of a foreign state, it is, for the most part, subject to the jurisdiction of that state. In time of war, the merchant vessel encounters much more difficult and dangerous problems. If it belongs to the enemy, it is subject to capture, or even to destruction. If it belongs to a neutral, it is subject to the international law of neutrality.

Nationality.—A neutral merchant vessel, according to the code prepared by the Research in International Law (see bibliography below) «is a merchant vessel entitled to fly the flag of a neutral state.» The flag is presumptive evidence of its neutral character; this presumption is open to challenge, because it has long been an accepted *ruse de guerre* for a belligerent vessel to carry a neutral flag. The ship must be legally registered with some state, and one state only, to be entitled to carry its flag. The purpose of such registration, said the United States Supreme Court in the case of the *Mohawk* (3 Wall. 571, 1865), «is to declare the nationality of a vessel engaged in trade with foreign nations and to enable her to assert that nationality wherever found.»

Transfer.—On account of the liability of enemy merchant vessels to capture, their owners have frequently sought to transfer them to neutral registry at the outbreak of a war, or when war was imminent. Whether such transfers are legal and entitle the transferred vessel to the immunities of a neutral, are questions which have been much debated. British and American practice during the 19th century admitted the validity of transfers made during, or in contemplation of, war, provided they were bona fide, that is, if the transfer was a fully perfected transaction, in which the purchase price had passed from the purchaser to the former owner, the ship being actually delivered and duly registered in accordance with the registry laws of the state whose flag it was to fly, the former owner reserving no interests or title in the vessel so transferred. Consult the cases of the *Benito Estenger*, 176 U. S. 568 (1899); the *Ariel*, Moore's *Privy Council Cases* IX, 128 (1857); the *Roelfina, American Journal of International Law*, Vol. 16, p. 136 (1922). During the American Civil War, large numbers of vessels under American registry were transferred to neutral flags in order to avoid capture by Confederate cruisers. The French and Russian rules, however, denied the legality of all such transfer made after the outbreak of war. An

attempt was made at the London Naval Conference in 1908 to harmonize the conflicting views, and a draft treaty was actually adopted. This Declaration of London, however, was never ratified, and its rules cannot be regarded as binding upon belligerents. During the World War (1914–18), the question was raised in the case of the *Dacia,* a Hamburg-American liner which, while lying in an American port, was purchased by an American citizen and given American registry. On a subsequent trip it was captured by a French warship and condemned by a French court. A British court, following British precedents, would probably have released the vessel; it was doubtless arranged, for this reason, that the capture should be made by a French cruiser. In view of the treatment which neutral merchant vessels received during the European war which began in 1939, the transfer of vessels to neutral registry offers little advantage.

Neutral Character.—A neutral merchant vessel, once its neutral nationality is clear, may lose some of its neutral rights through its behavior. Many cases and statutes offer justification for capture of a neutral merchant vessel which is carrying enemy military persons, conveying dispatches or transmitting military intelligence, accepting charter from a belligerent, piloting a warship, or providing other such services. Thus, in the case of the *Orozembo* (6 C. Rob. 430, 1807), an American vessel was condemned by a British prize court for carrying three enemy military persons and two civil officials to an enemy colony. In various cases it has been held that the master's ignorance of the fact that dispatches were being carried in his vessel, or even that he acted under compulsion by the enemy, afforded him no excuse. It now seems to be the majority opinion that a neutral vessel sailing under enemy convoy is subject to condemnation; indeed, during the World War and the European war which began in 1939, German warships sank such vessels without warning and without safety for the crews. In the case of neutral vessels participating in hostilities, as by fighting, bringing supplies to warships, transporting troops, transmitting intelligence by radio, etc., the penalty is more severe than condemnation; such vessels may be treated as enemy warships and sunk at once. Unrestricted submarine and air attacks on neutral vessels raise the question whether they should be permitted to arm themselves; if they do so, they would probably be treated as enemy warships. Congress was unwilling to accept President Wilson's recommendation that United States neutral vessels should be armed; the current Neutrality Act forbids arming them for more than internal discipline. As war is now waged, such questions are of no more than academic interest; any neutral vessel is in danger.

Neutral Risks.—According to the law of neutrality, neutral merchant vessels are entitled to navigate the high seas in time of war as in time of peace, subject to certain restrictions and risks imposed for the benefit of the belligerent. If the vessel is carrying contraband of war to an enemy, or running a blockade, it is subject to capture, and it or its cargo or both may be confiscated, if lawfully condemned by a prize court. (See CONTRABAND; BLOCKADE; PRIZE COURTS AND PRIZE JURISDICTION.) For the purpose of ascertaining whether a vessel is carrying contraband or running a blockade, a belligerent warship may order a neutral vessel to stop anywhere upon the high seas, and may there visit and search it in order to ascertain its true character. If such inspection reveals enough evidence, the ship may be ordered into a port of the belligerent, and there held until its fate is decided by a prize court, in accordance with the rules of international law. (See RIGHT OF SEARCH.) In recent wars, however, neutral vessels have been ordered into port, even by radio, for visit and search at the convenience of the belligerent, and at great delay and cost to the vessels themselves. This practice was protested by the United States during the World War of 1914–18, but without success; it is now a regular practice. Indeed, during the World War, a system of «navicerts» was introduced by England, which in the European war that began in 1939, came into regular use. Under this system a neutral vessel is inspected at its port of departure by a British official, and, if no objection can be found, it is given a certificate which, in general, though not absolutely, relieves it of visit and search en route.

Further invasion of the right of neutral vessels to use the high seas is found in the announcement by belligerents of war zones. It was formerly held that a belligerent could not declare a zone of the seas from which neutrals could be excluded; modern warfare disregards this principle. A belligerent now sows mines within a declared area, or sinks neutral shipping in this area (or anywhere else) by submarines or bombs from above. The fact that the neutral vessel has a legal right to proceed in these waters is of little value to it when it may be sunk without warning. Neutral states are entitled to protest against such injury; such protests are ineffective unless backed by force. The United States, which had defended its neutral rights for a century and a half, announced that it would not defend those rights, in its neutrality legislation, first passed in 1935. Under this statute, the neutral United States itself declares «combat zones» into which American vessels may not proceed. It should be noted that this is domestic law, and does not change international law.

Destruction of Vessels.—The above statements lead into the broader question of the right of a belligerent to sink a vessel without warning or adjudication, and without assuring the safety of persons on board. International law has always maintained that the lives of those on board merchant vessels must be protected, and therefore that the ship must not be destroyed, but must be taken into port. In the Russo-Japanese War, a Russian cruiser sunk the *Knight Commander,* a British merchant vessel, on the ground that lack of fuel and of men for a prize crew made it impossible to take the captured vessel into a Russian port. England indignantly protested this as a «very serious breach of international law»; but seven other neutral merchantmen were destroyed by the Russians during this war. The problem was much discussed at the Second Hague Conference, but no agreement was reached. At the London Naval Conference of 1908–09, the general principle was affirmed that a neutral vessel cannot be destroyed but must be taken into a prize court for adjudication, but exceptions were

made for cases in which such conveyance of the prize to port would mean danger for the captor or for the military operations in which he was engaged. This declaration was never ratified. During the World War of 1914–18, the Germans were unable to take captured vessels into their own ports because of the British blockade, and therefore sank them. Further, the use of the submarine, which obviously could not take prizes into port or even save the lives of those on the vessel destroyed, extended the danger to neutral vessels. More than 800 neutral ships were sunk during the World War. In the European war which started in 1939, the greater use of the airplane made possible greater destruction of vessels—again with the impossibility of saving lives therein. Millions of tons of shipping, a large part of it neutral ships, were sunk without warning. Thus, because of new methods and machines of warfare, and because of the totalitarian character of modern war, the belligerent may be expected to destroy recklessly whatever neutral vessel comes within range of his suspicions or declared zones; it is inevitable that he should do so, and international law cannot prevent it unless neutral states combine to protect their rights by physical force, or unless the community of nations prevents war. In this interdependent world, shipping is as important a part of warmaking as are guns.

Neutral vessels in belligerent jurisdiction may be requisitioned for use by the belligerent, subject to adequate compensation. The uncertain term «angary» has been applied to this procedure. It is a sort of «eminent domain.» In modern war, the belligerents control the movements of neutral vessels to a very large degree without taking them over. Thus, the Allied Supreme War Council, during the World War, was able to tell neutral vessels when and where they should sail, what cargoes they could carry, and what could be unloaded at each port.

War and law are antithetical. As the range of modern war has increased, the protection which international law can give has diminished; this situation will continue until war is brought under control. Until that time, the neutral merchant vessel must face far greater risks than ever before in its search for profit during wartime. See also INTERNATIONAL LAW; INTERNATIONAL LAW, CHANGES IN; NEUTRALITY.

Bibliography.—Full references to literature and cases, as well as complete information to its date, may be found in the draft-treaty prepared by the Research in International Law, entitled *Rights and Duties of Neutral States in Naval and Aerial War,* published separately by the Carnegie Endowment for International Peace, and also as a supplement to *The American Journal of International Law,* Vol. 33, July 1939.

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MERCIA, mĕr'shĭ-ą, England, the largest kingdom of the Saxon heptarchy, now comprised in the Midland counties on both sides of the Trent from the North Sea to Wales. Mercia was founded by Crida in 585. Like the other Anglo-Saxon kingdoms it had a stormy history, being almost continually at war with some of its neighbors. In 827 it was conquered by Egbert, who united the different kingdoms of England into one. As its frontiers extended to those of the other kingdoms, as well as to Wales, it derived its name from that circumstance (Anglo-Saxon *mearc,* march or boundary). See ENGLAND, *Geographical History.*

MERCIE, Antonin, ăñ-tō-năñ mĕr-sē-ā, French sculptor and painter: b. Toulouse, 30 Oct. 1845. He studied under Jouffroy and Falguière; won the first Prix de Rome in 1868; and in 1872 obtained a medal of the first class for his bronze statue of the young David, now in the Luxembourg. His masterpiece was 'Gloria victis' (1874), followed by a nude throned Juno (1877); a marble statue of 'Painting' (1890); 'William Tell,' now in Lausanne; monuments to Thiers, Meissonnier (in front of the Louvre), and Jules Ferry, and 'Napoleon' on the Vendôme Column. He painted a Venus, now in the Luxembourg. In 1891 he was elected an Academician. Died, 14 Oct. 1916.

MERCIER, Charles Alfred, American Creole author: b. McDonogh, near New Orleans, 3 June 1816; d. New Orleans, La., 12 May 1894. His father was a native of Louisiana and his mother, Eloise Le Duc, was a Canadian. At the age of fourteen he went to France and studied classical and modern literature at the College Louis-le-Grand. At first destined for the law he turned to literature; returned to Louisiana in 1838 and spent some time in Boston during which he perfected his knowledge of English. Returning to Paris, he published an Oriental story in verse, 'La Rose de Smyrne' in 1840; 'L'Ermite du Niagara,' a mystery play. In the next few years, Mercier traveled extensively on the continent and composed the drama 'Henoch Edesias,' which was lost during the revolution of 1848. After the revolution he studied medicine and returned to practise it in New Orleans, but soon returned to Paris. He disapproved of slavery but considered the Civil War as a triumph for Anglo-Saxon civilization and scored it in 'Du Pan-Latinisme ou la Necessite d'une Alliance entre La France et la Confederation du Sud.' After the close of the Civil War he returned to New Orleans and engaged in the practice of medicine. He continued his writing, however, and 'Le Fou de Palerme' appeared in 1873. In 1876 Mercier founded the Athenee louisianais, an organization having for its object the preservation of the French language in Louisiana. Thereafter much of his literary effort appeared in the *Comptes Rendus* of the Athenee. Of his later works, 'Emile des Ormiers,' the story of a Paris painter, and the drama 'Fortunia' have had the most enduring fame.

MERCIER, Desiré Joseph, Belgian cardinal, archbishop of Malines and primate of Belgium: b. 21 Nov. 1851 at Braine-l'Alleud; d. Brussels, 23 Jan. 1926. Educated at Louvain, Paris and Leipzig, he was ordained priest in 1874 and became professor of philosophy at the University of Louvain. Here he organized the Institut Supérieur de Philosophie, based on the teaching of Saint Thomas Aquinas and founded under the auspices of Pope Leo XIII. As a distinguished lecturer Professor Mercier —as he then was—earned a high reputation for literary and scientific abilities united with

zeal, leadership and exalted purpose. He wrote several volumes of note, e.g., *Les Origines de la Psychologie Contemporaine* (1897), *Métaphysique Générale* and *Critériologie,* which passed through numerous editions, as well as others of a less didactic character. He was also the founder of the *Revue Neo-Scholastique* when officiating as head of the school of neo-scholastic philosophy. On Feb. 8, 1906 it was announced that "Dr. Mercier, president of the Institute of Advanced Philosophy at Louvain," had been appointed archbishop of Malines. Though at first a general surprise, the appropriateness of selecting him to the episcopal bench soon became apparent. With energy and amiability he devoted himself to the administration of his diocese, and on April 15, 1907 was created and proclaimed cardinal and primate of Belgium. The German conquest of Belgium in the early stages of the European War brought him into world-wide prominence by the fearless and determined attitude he adopted toward the ravagers of his country. In the papal conclave of September 1914, after the death of Pope Pius X, a number of the assembled cardinals decided to give Mercier their vote in the election for a new pope as a demonstration of sympathy with Catholic Belgium. He was supported by the French and English cardinals, while the Germans and Austrians protested against what they called undue interference of politics in the highest spiritual functions of the church, and Cardinal Della Chiesa was ultimately elected. Cardinal Mercier arrived in London Sept. 12, 1914, and on the following day (Sunday), accompanied by the late duke of Norfolk, was received in audience by the king and queen. In the afternoon he witnessed a remarkable and enthusiastic demonstration in Westminster, organized by Irish members of Parliament and attended by many thousands of people. He returned to Belgium the same night and exerted himself during the long period of the German occupation to ameliorate the sufferings of his compatriots. He came into frequent collision with the German authorities, notably Baron Moritz Ferdinand von Bissing (q.v.). The cardinal's pastoral letters, collected and published by Burns and Oates (London 1918), form a series of earnest exhortations to the practice of Christian fortitude and hope amid the horrors and afflictions of war.

MERCIER, Honoré, Canadian lawyer, journalist and politician: b. Iberville, Quebec, Oct. 15, 1840; d. Montreal, Oct. 30, 1894. He was educated at Saint Mary's (Jesuit) College in Montreal and afterward studied law at Saint Hyacinthe, being admitted to the bar in 1865. During his legal studies (1862–1864) he was editor of the *Courier de Saint Hyacinthe,* the Conservative organ of the district; but as a journalist he was among those who opposed Canadian Confederation. This led him to abandon his editorship and to sever his connection with the Conservative Party. During the years immediately following the confederation of 1867 Mercier devoted himself to his profession, but in 1871 he reappeared in politics as the leader of the National Party (also called the Parti noir), whose leading aim was to curtail the power of the Dominion government in favor of provincial rights. On this platform he was elected to the federal Parliament for Rouville in 1872, but did not stand for re-election to the Parliament of 1873. After some four years devoted to the successful practice of law at Saint Hyacinthe, Mercier was elected (1879) to the legislative assembly of Quebec, being appointed solicitor general of the province in the ministry of M. Joly. On the defeat of the Joly administration in the same year, Mercier passed into the opposition, of which he presently became leader. In 1881 he left Saint Hyacinthe to practise law in Montreal. In 1885 the French Canadian population was thrown into a ferment by the trial and execution of Louis Riel, the leader of the North West Rebellion (q.v.). Mercier, heading the agitation thus occasioned, declared Riel to have been a "victim of the fanaticism of Sir John A. Macdonald." On the strength of the feeling thus aroused, the Conservative Party was defeated in the provincial elections of 1886 and Mercier found himself at the head of the administration. In this capacity he carried through the legislature the famous Jesuit Estates Act, a measure intended to compensate the Jesuits for the property confiscated by the crown at the time of the papal dissolution of the order. In spite of the agitation throughout Canada against the act the Mercier government was upheld in the election of 1890. In the same year grave charges of peculation were brought against the premier and his colleagues on the ground that a subsidy of $100,000, intended for the Baie des Chaleurs Railway, had been diverted to political uses. Investigation resulted in the dismissal of the ministry (Dec. 15, 1891), action which was ratified by the overwhelming defeat of the Mercier party in the election which ensued. The criminal charges brought against Mercier, as a result of this and a second official investigation, ended in a verdict of not guilty. Mercier remained a member of the assembly but with diminished influence and shattered health.

MERCUR, mėr'kėr, **James,** American soldier: b. Towanda, Pa., Nov. 25, 1842; d. West Point, N. Y., April 22, 1896. He was graduated from West Point in 1866 and commissioned in the engineering corps. He was engaged in surveys made under the government and in 1867–72 was assistant professor of natural and experimental philosophy at West Point, after which he was in command of an engineering corps and in 1876–1881 assisted in clearing the New York harbor of the obstructions at Hell Gate. He was professor of civil and military engineering at West Point from 1884 until his death. He published a revised edition of Mahan's *Permanent Fortification* (1887) and the original works, *Elements of the Art of War* (1888); and *Military Mines, Blasting and Demolitions* (1892).

MERCURIC CHLORIDE. See Corrosive Sublimate.

MERCURIC CYANIDE. See Hydrocyanic Acid.

MERCURY, mėr'kū-rĭ, the Roman god Mercurius who presided over commerce and gain. See also Hermes.

MERCURY, the nearest planet to the Sun, has been known from prehistoric times, though

most persons have never seen it. There is a tradition indeed that even Copernicus never did. This is due to the fact that, since its orbit is far inside that of the Earth, its angular distance from the Sun never exceeds 28°. This last occurs when the planet comes to aphelion at greatest elongation, when near perihelion it would be only 18°. Again, as Mercury is always near the ecliptic, it will best be seen when the latter is most nearly perpendicular to the horizon. This occurs for middle northern latitudes after sunset near the spring equinox and before sunrise near the fall equinox. Even then, by the time darkness has fallen, the planet is quite near the horizon or has set. So no one can ever observe Mercury under favorable night conditions, in fact the best observations are made in full daylight when the planet is higher in the sky. Being an inferior planet it has phases, being crescent when nearest us and quarter when near elongation.

The planet is yellowish in color and when brightest is about —1 magnitude. Older books make its brightness much less. Its apparent diameter can vary from 4."7 to 12."9. Its mean distance from the Sun is 36 million miles or 0.3871 astronomical units, and the eccentricity of its orbit is 0.206. This means that under extreme circumstances the planet may be as near as 48 million or as far as 138 million miles from us, at inferior and superior conjunction respectively. Its sidereal period is 88 and its synodic period 116 days. Its mean orbital velocity is 29 miles per second, and its orbit is inclined to the ecliptic 7°. Due to the orbit's great eccentricity the solar heat received at perihelion to that received at aphelion has the ratio 9:4. Its diameter is 3,100 miles which gives a volume of 0.06 that of the Earth. Its mass is very difficult to compute as the planet has no satellite. The best value is about 0.045 that of the Earth which then gives a density of 4 in terms of water. About the year 1800, observations by Schroeter a celebrated planetary observer, were supposed to indicate an axial rotation of nearly a day, but Schiaparelli, working in Italy in 1889, pretty clearly proved that the planet keeps the same face towards the Sun. Observations, even with the most powerful telescopes, are very difficult and markings on the planet very indistinct, but all recent evidence now tends to confirm Schiaparelli's conclusion. As with Venus observers are handicapped by the fact that when nearest us Mercury shows only a narrow crescent and in addition is angularly near the Sun. By the time half of its illuminated surface is turned towards us, it is already nearly an astronomical unit distant. Indeed Mercury is so near the Sun that body tides caused by the latter would slow up the axial rotation and eventually bring about the coincidence of its day and period. Nevertheless the orbit is so eccentric that there are enormous librations and due to them at most only 30 per cent of the surface is in perpetual night. Obviously an equal per cent has continuous sunshine while, for the rest, the Sun must rise a certain distance in the sky and then set in the same direction it rose once per revolution. The planet has no atmosphere detectable by either visual or spectroscopic observation. Nor, remembering its small mass, its nearness to the Sun, and the kinetic theory of gases could any atmosphere be expected. Its low albedo of 0.07 and the changing per cent of light with different phases indicate that the surface must be very rough, probably quite like the Moon, and for the same reasons. On the side in continual sunlight radiometric measurements give a temperature of 410°C. or enough to melt lead or tin. No measurable radiation could be detected from the dark side, which must be frightfully cold. Obviously life as we know it could not exist on Mercury: it is an even worse place than our Moon, due to more violent temperature changes. Otherwise they seem quite alike.

A planet's orbit is not a fixed thing but changes its shape and position slowly due to the mutual gravitational interactions of the other planets. The changes can, however, be calculated. Due to these the perihelion point of Mercury's orbit moves eastward nearly 10′ per century. But observations indicated an excess of about 40″ over theory. An explanation was sought in many ways. First a small planet was thought of whose orbit would be nearer the Sun. But such a planet cannot be found and now it is certain that it does not exist. Next the zodiacal light was used, which is caused by innumerable small particles in the plane of the ecliptic, and filling some of the space within our orbit. However, modern observations show that the mass necessary is out of all reason compared to what is found. Finally in 1915 the general theory of relativity by Albert Einstein predicted that Mercury's perihelion point would advance 43″ per century faster than the Newtonian theory demanded. As, within the probable errors, this is sensibly the value computed from observations, it is considered the first practical proof of Einstein's theory. Mercury is far the best object on which to make this test because of its high orbital velocity and, since the eccentricity of the orbit is great, it becomes relatively easy to determine the perihelion point with exactness. This cannot be done for Venus, since its orbit is so nearly a circle, and the other planets have too slow an orbital velocity.

At intervals the motion of Mercury causes it to pass directly across the face of the Sun. This phenomenon is called a transit. On such occasions observations with powerful telescopes should show traces of an atmosphere were any appreciable amount present, but the planet's outline is quite sharp. Transits also serve to give excellent positions of the planet. Beyond these uses they are merely interesting events. There are now about 13 per century. They take place in May or November. The next three will occur on Nov. 14, 1953, May 6, 1957 and Nov. 7, 1960.

CHARLES P. OLIVER.

MERCURY, or **MARKERY,** a perennial herb (*Chenopodium bonus-henricus*) of the natural order Chenopodiaceae. Like other members of its genus, it has mealy foliage and inconspicuous greenish flowers.

MERCURY, Medical Uses of. Mercury uncombined is used only for its bulk. As it is without medicinal effect, at one time as much as two pounds of uncombined mercury would be given for the purpose of mechanically dislodging some obstruction in the intestines. Triturated with some other substance it is valuable medicinally and produces specific mercurial effects, local and constitutional. Such compounds are "blue mass" (blue pill), mercury with chalk (gray powder), mercurial ointment and mercurial plaster. All mercurial compounds entering the circulation have a rather peculiar influence

over nutrition. This is especially true of salts of mercury, such as mercurous chloride or calomel, mercuric chloride or corrosive sublimate and mercurous iodide or the green iodide of mercury. In small doses, especially in syphilis, mercury has a definite toxic action on the spirochete which is the known parasite which causes syphilis. In large doses mercury acts as a corrosive poison and tends to inflame the mucous membrane of the mouth, stomach and intestines. Calomel and blue pill are largely used for their laxative effects. Mercury in the various forms of powder, ointment, lotion and plaster is used to remove body-vermin, relieve itching and as a remedy in certain skin affections. Mercuric chloride, known as corrosive sublimate, is a powerful antiseptic and is taken internally in very minute doses. See Toxicology.

MERCURY, or QUICKSILVER, a metallic element which has been known for many centuries and which is distinguished from the other metallic elements by the fact that it is liquid at ordinary temperatures. Mercury occurs native in the metallic form, but by far the larger part of it is obtained by distilling the native sulphide, cinnabar (Hgs), in a current of air which is regulated so as to burn the sulphur of the sulphide, while leaving the mercury in the metallic state. Cinnabar occurs abundantly at Idria, Austria, at Almaden, Spain, and at New Almaden, near San Francisco Bay, and it is from these sources that the mercury of commerce is chiefly obtained. It occurs as veins and disseminated deposits, the ores of which are believed to have been introduced by hot waters of magmatic (q.v.) origin. Spain is the largest producer and the chief output in the United States comes from California, though deposits are known in Texas and Oregon. Mercury freezes at 37.9° F. below zero and boils, at the ordinary atmospheric pressure (760 mm.), at 675° F. Its specific gravity at 32° F., when compared with water at 39° F., is 13.596. Its specific heat at ordinary temperatures is about 0.0331, and its average coefficient of expansion between 32° F. and 212° F. is 0.00010085 (Fahrenheit scale). The ratio of the specific heat of the vapor at constant pressure to its specific heat at constant volume has been found, experimentally, to be 1.666, which indicates that the molecules of the vapor are monatomic and that they behave, so far as their collisions among themselves are concerned, as though they were elastic spheres. (See Gases, Kinetic Theory of). Mercury may be freed from dust and dirt by filtering it through leather. To remove tin, lead and other dissolved metals, the mercury may be left for some weeks in contact with concentrated sulphuric acid and subsequently digested with dilute nitric acid; or it may be several times distilled. Various other modes of purification are also known.

The metal is chiefly used, in the arts, for the extraction of gold from crushed ore or fine gravel, the ore being washed by a gentle stream of water over a copper plate which is amalgamated with mercury. The gold particles, being heavy, sink through the water so as to come into contact with the copper plate, where they are held by the mercury in the form of a gold amalgam. (See Gold and Amalgam). In physics, mercury is also greatly used for filling thermometers and barometers, and for many other purposes. It is likewise used in medicine, both in the metallic form and in its compounds with other elements. Metallic mercury, when rubbed up in a mortar with confection of roses until its globules are so fine as to be indistinguishable to the eye, is known as "blue mass" and is administered in the form of pills, as a cholagogue.

Mercury has the chemical symbol Hg (from "hydrargyrum," its Latin name), and an atomic weight of 200.3 if O = 16, or 198.8 if H = 1. It forms two oxides, each of which give rise to a series of stable salts. The metal does not oxidize upon exposure to air at ordinary temperatures, but when heated nearly to its boiling point in air or in oxygen it slowly oxidizes, with the formation of mercury monoxide (or mercuric oxide), HgO. When prepared in this manner the monoxide is crystalline and red, and for this reason it is familiarly known as the "red oxide." The same substance may be prepared in an allotropic form by precipitating a solution of mercuric nitrate by the addition of caustic potash, the monoxide then coming down as an amorphous yellow powder. The red oxide turns black when strongly heated, but recovers its color upon cooling. When heated to redness the monoxide decomposes into metallic mercury and free oxygen. It can, therefore, be used as a source of oxygen; and it was in fact by heating this substance that oxygen was first discovered by Priestley. By acting upon the red oxide or upon metallic mercury by excess of nitric acid, mercuric nitrate, $Hg(NO_3)_2$, is formed; while if nitric acid is allowed to act upon excess of mercury, mercurous nitrate, $HgNO_3$, is obtained. The corresponding sulphates of the metal are obtained by acting upon metallic mercury with sulphuric acid, mercuric sulphate ($HgSO_4$) or mercurous sulphate (Hg_2SO_4) being obtained, according to the conditions of the experiment. Mercuric sulphide, HgS, which occurs native as the mineral cinnabar, and which is also known as vermilion, is bright red in color and may be prepared artificially by heating mercury with sulphur, or by passing sulphuretted hydrogen gas through a solution of mercuric salt. When obtained in the latter way it comes down as a black amorphous powder, which may be brought into the normal red crystalline form by sublimation. Mercury forms two chlorides which are extensively used, especially in medicine. Mercuric chloride (also known as "bichloride of mercury" or "corrosive sublimate"), $HgCl_2$, is prepared by heating a mixture of equal parts of mercuric sulphate, $HgSO_4$, and common salt, NaCl; the reaction being $HgSO_4 + 2NaCl = HgCl_2 + Na_2SO_4$. The bichloride is fairly soluble in water and dissolves readily in a solution of sal ammoniac. It is also quite soluble in alcohol. It crystallizes in the trimetric system, melts at 509° F. and boils at 563° F. It is intensely poisonous and is one of the most powerful germicides known. It is used in surgery and medicine as an antiseptic and disinfectant, and is occasionally administered internally in very small doses. Mercurous chloride, HgCl (more familiarly known as "calomel," or as the "mild chloride"), is a white powder, insoluble in water and is greatly used in medicine, both as a cholagogue and otherwise. It may be prepared in various ways, but the usual method is

by heating four parts of corrosive sublimate with three parts of metallic mercury; the mercury combining with half of the chlorine of the corrosive sublimate, as indicated by the equation $HgCl_2 + Hg = 2HgCl$. The calomel sublimes and must then be ground to a fine powder and thoroughly washed, in order to remove any free soluble corrosive sublimate that may not have been decomposed. The so-called "white precipitate," which is obtained when ammonia is added to a solution of corrosive sublimate, has the composition NH_2HgCl. Mercurous oxide, or "black oxide of mercury," Hg_2O, may be obtained as a black powder by digesting calomel with excess of caustic potash. It decomposes into the red oxide and metallic mercury upon exposure to light, or upon being heated to the boiling point of water. Many other compounds of mercury are known. See STRATEGIC AND CRITICAL MINERAL SUPPLIES.

MERCURY VAPOR LAMP. See VAPOR LAMPS.

MERCY, Fathers of, Roman Catholic religious congregation founded on the restoration of Louis XVIII, 1814, and approved of by the Pope (1834) under the title 'Society of the Priests of Mercy.' The object of the society is the conversion of sinners by mission preaching and the practice of the corporal works of mercy. In 1839 the order founded houses in New York and Saint Augustine, Fla., and the fathers have churches for the French population in Brooklyn and Manhattan. The mother house was originally at Paris, but was removed to Rome in 1903 as a result of the Association Law. Consult Delaporte, 'Vie de Jean-Baptiste Rauzan' (1857).

MERCY, Sisters of, a name given to members of several religious communities founded for the purpose of nursing the sick at their own homes, visiting prisoners, attending lying-in-hospitals, superintending the education of females and the performance of similar works of charity and mercy. Communities of Sisters of Mercy are now widely distributed over Europe and America. There are also religious orders under the same name connected with the Anglican Church. The term is applied more specifically to the Order of Our Lady of Mercy, a Roman Catholic order founded for the objects above enumerated in Dublin 1827. The first house in America was established in Pittsburgh, Pa., 1843, and from it have sprung 65 convents. Consult 'Leaves from the Annals of the Sisters of Mercy' (1881). See MCAULEY, CATHERINE.

MERCY-SEAT (Heb. *Kappo'reth,* covering or lid, that is, of the sacred ark in the ancient Jewish tabernacle), an unfortunate and inappropriate term as applied to the cover of the chest or ark containing the two tables of the law and overspread by the wings of the Cherubim. Between these wings appeared the Shekinah or fiery symbol of the divine presence hovering over the mercy-seat, which consisted most probably of a sheet of the finest gold (Ex. xxv, 17, etc.; xxx, 6; xxxi, 7, etc.). The New Testament writers seem to hold that the term contains by implication the idea of the propitiation (q.v.) (Heb. ix, 5; Rom. iii, 24). The high priest sprinkled on it the blood of the yearly atonement, and some writers think that the term covering as applied to it refers more to the covering of or atonement for sins than to its use in covering the treasures of the ark. In any case the idea of a seat, as if the expression in Psalms xcix, 1, "he sitteth between the cherubims" referred to the earthly tabernacle, is inappropriate. Consult Pratenias, 'De Judæa Arca' (1727); Werner, 'De Propitiatoria' (1695). See SHEKINAH.

MEREDITH, George, English poet and novelist: b. Hampshire, 12 Feb. 1828; d. London, 18 May 1909. Details of Meredith's life are meagre; little is known of his parentage or of his education except that he was sent to school in Germany and later studied law, which he gave up for literature. For a time he was a pupil of T. L. Peacock (q.v.), whose daughter became his first wife. His residence was for some years at Box Hill in Surrey.

His first work in literature was a volume of poems published in 1851. This was followed, in 1856, by 'The Shaving of Shagpat,' a brilliant, fantastic Oriental tale in which some interpreters have professed to see a political satire. In 'The Ordeal of Richard Feverel' (1859), however, he began the course of studies in human temperament which have made his name famous. The novel, unquestionably one of the most powerful in the language, deals with the ordeal of adjustment to the world of a high-spirited youth; it is the conflict between temperament and desire, represented in the hero, and a variety of conventions, most rigidly typified in the "system" of his father, Sir Austin Feverel. The effect of the book is chiefly tragic. 'Evan Harrington' (1861), the next novel, is wholly comic in idea; the characters are embodiments of various "humors," most strikingly represented in the intriguing Countess; the plot, as in all of Meredith's novels, is quite secondary in interest and springs from the characters. 'Modern Love,' a sequence of brilliantly phrased, intricate, 16-lined sonnets, was published in 1861. 'Emilia in England,' now called 'Sandra Belloni,' appeared in 1864, and its sequel 'Vittoria' three years later. The story is that of a young Italian girl of unaffected manners and character and her life among people of very diverse temperaments and social ideas; the theme of the novel may be regarded as the conflict, among very real people, of the genuine with the sentimental character. Between the two novels appeared, in 1865, 'Rhoda Fleming,' perhaps the simplest of all Meredith's novels in style and a powerful study in character. It deals, on the whole, with a conventionally more humble order of society than is usually found in Meredith's novels, and is rather more direct, but few things in fiction are more impressive than the almost instinctive steadfastness of the heroine or more gloomy than the spiritual confusion that she tries to set in order. In 'The Adventures of Harry Richmond' the note is again chiefly comic. Much of Meredith's best work lies in the freshness of the varied scenes of this book, and in the hero's father is perhaps as typical a character of the novelist as can be found, a man whose adventurous fancy and devotion to his son "informs" numberless odd and extravagant acts. Another excellent study of a different sort is 'Beauchamp's Career' (1876). It is the analytical, yet lively, story of a young man whose earnestness of character and whose activity caused him, from a conventional point of

view, to fail in life. Like other of Meredith's novels it is a great contribution to our understanding of the varieties of human temperament and to our sympathy with them.

In 'Beauchamp's Career' perhaps more than in any of his preceding novels Meredith directly explained his aim in drawing character; it was to present a type of motive and to show how it dominates and gives unity to a series of acts. The motive which causes action is, so to speak, temperamental rather than deliberate; in typical examples like the Countess in 'Evan Harrington,' or Beauchamp, for instance, Meredith is interested in the expression of temperament rather than a story. The Countess, on the face of the matter, wished for the social advancement of her family; what she really wanted was scheming for the sake of scheming and her social ambitions were but the medium of expression. This manner of approaching character, indeed, dominated all the character drawing in Meredith's novels, but it was not expressed as a deliberate theory until the publication, in 1877, of 'On the Idea of Comedy and the Uses of the Comic Spirit.' The essence of this essay is that comedy is one of the most wholesome and effectual ways of probing and purifying the ills of the world, that good comedy, as in the plays of Molière, really enables the reader to recognize what is genuine and discard what is sentimental; unfortunately, instead of good comedy we often are treated, in most literature, to painful moralizings. Meredith's fullest and finest expression of this idea is in his 'The Egoist' (1879), unquestionably his masterpiece and one of the chief glories of English fiction. Egoism, that love of self which prevents men from seeing things in their true relations, is one of the fundamental failings of mankind and Meredith has drawn it, in the inimitable Sir Willoughby Patterne, as a figure of colossal proportions. The novelist's skill and dispassionateness as an artist was never better shown than in the fact that he refuses to give conventional rewards and punishments; for the hero's unfailing egoism permits him in the end to turn to the flattering of his vanity what would ordinarily be regarded as humiliation.

Pursuing his end, an analysis and a synthesis of the springs which govern action, Meredith in his next novel, 'The Tragic Comedians' (1880) took a story from contemporary European court life and explained it as a piece of dramatic psychology. The comparative shortness of the novel makes it a good study of the author's method. This novel, too, indicated a tendency on his part to depict the motives and the psychology of people actually in existence rather than, as in 'The Egoist' and its predecessors, to draw the embodiment of a type of "humor." This tendency was certainly evident in his next novel, 'Diana of the Crossways' (1885), his greatest popular success, and is shown in the fact that certain of the incidents and characters excited curiosity as, to their originals. It is manifest also in his last three books, 'One of Our Conquerors' (1890), 'Lord Ormont and His Aminta' (1894) and 'The Amazing Marriage' (1895), which are perhaps less broadly representative and more particular than his earlier novels. Meredith's writings also include four short stories, 'The Tale of Chloe,' 'The House on the Beach,' 'Farina' and 'The Case of General Ople and Lady Camper.'

Meredith, who was one of the last great novelists to hold over, as it were, from the age of Victorian literature, belongs to the so-called psychological school, of which the great popular representative is George Eliot, with whom he is practically contemporary. He differs from her in several important respects: The comedy of character (as the term is understood with Cervantes and Molière) as well as the tragic side of life, is reflected in his pages. His attitude is detached and impersonal and he never allows his sympathies to intrude upon his study of the type he is treating, a characteristic which accounts for the criticism sometimes made that he lacks temperament and which is doubtless one of the reasons for his comparative unpopularity. He is more interested in his characters as types of temperament than as individuals, and in this field he has perhaps represented the greatest range and variety of human motive that is to be found in English fiction. Taking strata of society, on the whole, conventionally above those treated by George Eliot, he has made them representative of a great variety of "comic" motives. As a moralist, his attack has been upon those types which are broadly termed sentimental, and in this respect his pictures of such men as Wilfred Pole and Willoughby Patterne are inimitable. The person that he most approves is the simple, considerate, intelligent being, well represented in such minor heroes as Merthyr Powys, Vernon Whitford, Dartrey Fennellan and Tom Redworth, and pictured to the height of brilliancy in his real heroines. In no other novelist, in no English writer except Shakespeare, can be found so splendid a galaxy of women: Rose Jocelyn, Janet Ilchester, Renée, Cecilia Hilkett, Jenny Denham, Clara Middleton, Emilia, Carinthia Jane and many others, as well as such older ladies as Lady Jocelyn and Lady Charlotte Eglett, are the best tribute to womankind that English literature possesses, and the creation of them is an achievement of the very first rank. His style is frequently criticized as involved and epigrammatic, but no novel contains passages of greater poetical charm. See DIANA OF THE CROSSWAYS; EGOIST, THE; ORDEAL OF RICHARD FEVEREL, THE.

Bibliography.—The best complete American edition of the poems and novels is by Messrs. Scribner, in 16 volumes. Commentary is scattering and appears chiefly in the form of contemporary reviews. Consult Brownell, 'Victorian Prose Masters' (1901); Lynch, Hannah, 'George Meredith' (1891); and, for a varied symposium, LeGallienne, 'George Meredith, Some Characteristics; with a Bibliography by John Lane'; and for his place in the history of the novel, Cross, 'The Development of the English Novel' (1899). Consult also Ellis, S. M., 'George Meredith: His Life and Friends' (London 1919).

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MEREDITH, Louisa Anne Twamly, Australian author and artist: b. Birmingham, England, 20 July 1812; d. Hobart Town, Tasmania, 21 Oct. 1895. She had already published a volume of verse (1835); and 'The Romance of Nature,' illustrated by herself (1836), before

she married her cousin Charles Meredith (1839) and removed to Australia, whence they went to Tasmania five years later. She continued her literary activity till the end of her long life and for many years before her death had been the most prominent Tasmanian author. Among her books, many illustrated by herself, are 'My Home in Tasmania' (1852); 'Over the Straits' (1860); 'Tasmania: Friends and Foes, Feathered and Furred' (1880). Her prose works were popular in Australia and had also a circulation in England and this country; and her verse, of which she published several collections, was at once pleasing and unpretentious.

MEREDITH, Owen, the pseudonym of Bulwer-Lytton. See LYTTON, EDWARD ROBERT BULWER.

MEREDITH, Samuel, American patriot and first Treasurer of the United States: b. Philadelphia, Pa., 1740; d. 10 March 1817. His father was a Welshman and a friend of George Washington. Meredith became a member of the Pennsylvania colonial legislature, and when the American Revolution broke out he entered the Colonial army as major, took part in several battles and was made brigadier-general for gallant services. He gave £10,000 in silver for carrying on the war, and was exiled from Philadelphia when the British occupied it. Meredith served in Congress in 1787–88 and in 1789 became the first Treasurer of the United States, advancing to the government, on taking the office, $20,000 and later $120,000, for which he was never reimbursed. He remained in the office of Treasurer until 1801.

MEREDITH, SIR William Ralph, Canadian jurist: b. Westminster, Ontario, 31 March 1840; d. 22 Aug. 1923. He was educated in the University of Toronto and was admitted to the bar in 1861, beginning practice in London, Ontario. He became queen's counsel in 1876 and in 1881 removed to Toronto. In 1872 he entered the provincial legislature of Ontario as member for London and for 16 years he was leader of the Conservative opposition during the long reign of Mowat as Premier. In that position he showed a disposition to subordinate provincial rights to those of the Dominion; and he was an advocate of manhood suffrage, secret ballot, the enlargement of powers to municipalities and workmen's compensation. In 1894 he was appointed chief justice of the Court of Common Pleas and in 1912 chief justice of Ontario. In 1896 he was appointed a commissioner for the revision of the provincial statutes, and in 1905 he was one of the commission that investigated the affairs of Toronto. He was knighted in 1896, and became chancellor of the University of Toronto in 1900.

MEREZHKOVSKI, Dmitri Sergeyevich, Russian critic and novelist: b. Saint Petersburg, 1865. He was educated in his native city and published his first volume of verse at the age of 23. In 1893 he published an essay on the decadence of Russian literature which attracted general attention. In 1901–02 appeared his 'Critical Studies of Tolstoy and Dostoyevsky as Men and as Artists' and 'The Religion of Tolstoy and Dostoyevsky,' which proved him a critic of high order. Next there appeared his trilogy of historical novels dealing with the perennial conflict between Christianity and paganism. Collectively known as 'Christ and Antichrist,' this work has appeared in most modern languages. It includes 'Smert Bogov' (Eng. trans., 'The Death of the Gods,' London 1901), in which the chief character is Julian the Apostate; 'Voskresenie Bogi' (Eng. trans., 'The Forerunner,' ib. 1902) with Leonardo da Vinci as chief character; and 'Antikhrist: Pëtr i Aleksyey' (Eng. trans., 'Peter and Alexis,' London 1905). He also wrote the dramas 'Paul I' (1908) and 'Alexander I' (2 vols., 1913). Consult collected edition of his works (15 vols., Saint Petersburg 1911–12) and Phelps, W. L., 'Contemporary Russian Novelists' (Boston 1913).

MERGANSER, or **FISH-DUCK,** a duck of the genus *Mergus,* distinguished by the slender cylindrical bill, the upper mandible terminating in a strong hooked "nail," and the margins presenting the appearance of rows of tooth-like processes. The most widely distributed is the red-breasted (*Mergus serrator*), known as sheldrake in America where it is less numerous than in the Old World. The goosander (*M. merganser*) and the nun or smew (*M. albellus*) are familiar European and Asiatic species, while the hooded merganser (*Lophodytes cucullatus*) or sawbill is familiar in North America. The mergansers feed chiefly upon fishes and swim and dive after their prey with great ease and dexterity. They are essentially northern in their distribution, breed in the far north and migrate southward on the approach of the colder season. The nest is built of grass and roots and is lined with down. It is usually placed in a hollow of the bank near water, but some species prefer the greater security of a hollow tree. The flesh is coarse and rank. Eight or 10 species are known in various parts of the world. The female alone incubates, but the male watches near the nest. From 8 to 14 eggs are laid and the young enter the water as soon as they are hatched.

MERGENTHALER, mĕr'gan-tä-lèr, **Ottmar,** American inventor: b. Württemberg, Germany, 10 May 1854; d. Baltimore, 28 Oct. 1899. He was a watchmaker by trade; came to the United States at 18, entered the employ of the United States government at Washington, where he kept clocks and electrical bells throughout government buildings in order; improved apparatus used in the signal service, and in 1876 removed to Baltimore, where he devoted himself to perfecting a type-setting machine. On this he spent several years, his scheme going through four stages, the last of which was the linotype (q.v.). When he had patented this machine he had much difficulty in introducing it. It was perfected by the addition of the Rogers spacer and numerous minor inventions by Philip T. Dodge and others, brought its inventor large profits and is now in very common use in large printing establishments. Mergenthaler also invented a machine for making fruit gift-baskets of veneered wood.

MERGER, *in law,* the sinking or obliteration in conveyancing of lesser estates or property into greater ones, or the consolidation of two or more estates; a term used in financial or business circles, meaning the consolidation or combination of a particular class of manufactories, railroads or other business interests;

generally in the nature of a trust. Late in the 19th century it became common in the United States for a group of corporations, which it was desired to bring together for monopolizing an industry, to merge by forming a holding company, which took over the majority stock of each subsidiary company in the merger and gave in exchange the stock of the holding company. To test the validity of such mergers a suit was brought against the Northern Securities Company, and after exhaustive arguments and much delay the United States Supreme Court declared that the procedure was "in restraint of trade." Since then corporation mergers have ceased. The principle still holds good, however, in both civil and criminal law, that the lesser may merge into the greater. In contracts the acceptance of a high grade of security is held to extinguish the lower grade. When a bond is given for the performance of a contract the obligation to fulfill the contract is merged in the bond as the higher obligation. See also TRUSTS.

MERGUI ARCHIPELAGO, mûr-gwē′, a chain of about 800 islands in the Andaman Sea, off the coast of Tenasserim in Burma, forming a part of the Lower Burma district of Mergui which has an area of 10,906 square miles. The islands are generally covered with jungle growth, and present many picturesque features, rising at some points to the height of 3,000 feet. The largest island is Tavoy, and others are King, Elphinstone, Ross, and St. Matthew islands. There is some mining of tin and tungsten on these islands and there are rubber plantations on several of the larger ones.

The chief town is Mergui, situated on a small island off the coast of Burma, with a population (1931) of 20,405. The locality is one of the dampest on the globe, the rainfall exceeding 100 inches annually. The inhabitants, mainly Selungs, give little attention to agriculture, obtaining a sustenance mainly by fishing, pearl gathering, and selling edible birds' nests. They are peaceful and industrious, but few in number. Pop. of Mergui District (1941) 180,827.

MERIDA, mā′rē-thä, **Carlos,** Mexican painter: b. Guatemala, Dec. 2, 1893. He studied in Paris (1910–1914) under Kees van Dongen and Anglada Camarasa, and returned to Guatemala where he began to explore the folklore themes of Central America. In 1919 he went to Mexico and held his first exhibition and in 1920 he joined a group of revolutionary Mexican painters under the leadership of David A. Siqueiros. With them he painted frescos in several government buildings, including in 1923 the children's library in the Ministry of Education Building, Mexico City.

A second trip to Paris (1927–1929) turned his interest to surrealism, and on his return to Mexico City, as professor of painting at the Escuela Centrale de Artes Plásticas, he propagated this form of art. He has exhibited in the United States and in Mexico and has written and illustrated *Tres motivos, huecograbado* (copperplate engravings, 1936); *Modern Mexican Artists* (1937); *Ten Interpretive Guides on Mexican Frescos* (1937); *Dances of Mexico* (10 color lithographs, 1938); *Carnival in Mexico* (1939); and *Mexican Costumes* (1941).

Mérida's painting has always been highly personal, emphasizing the abstract and symbolic aspect of the art. Out of his study of the Indian customs, dances, and art, he has evolved an expression that is truly poetic. Although he works in a variety of media, some of his finest painting has been done in watercolor. His handling of this medium is one of the most original and sensitive of the present century.

MERIDA, city, Mexico, capital of the State of Yucatán. It is situated on part of the great, low plain which comprises most of the state and is surrounded by henequen (sisal hemp) plantations. The climate is tropical. Numerous metal windmills in and around the city provide water from wells. The city was founded in 1542 by Francisco de Montejo the younger on the site of a Maya city called T'ho, and the early buildings were largely built of the stones from Maya temples and other native structures. The city has a strong Spanish tradition which is reflected in its architecture. The population, however, is largely Maya. The Montejo house, which dates from 1549, is located on the main plaza, as is the cathedral (1561–1598).

Mérida is the center of the Yucatán henequen industry, manufacturing rope, cordage, and coarse fabrics for sacking, and dyeing and weaving finer fabrics for small bags and hats. Cotton and leather goods are also made and there are numerous bottling works and breweries.

Some 75 miles to the east are the extensive and magnificent ruins of Chichén Itzá (q.v.), the sacred city of the Maya civilization during the New Empire. This place was settled by the Itzá people during the 6th century A.D. and reached its highest point 500 to 700 years later, to be completely abandoned about 1450. Even more elaborate in its architecture, although smaller in extent, is the Maya city of Uxmal (q.v.) whose ruins are about 55 miles south of Mérida. This was founded by the Xiu toward the end of the 10th century and abandoned about the same time as Chichén Itzá.

For many centuries Mérida was the most isolated of the larger Mexican cities since its only connection with the rest of the republic was by sea through Progreso, Yucatán's chief port, 23 miles distant by rail and highway to the north. With the coming of air transportation, this isolation was somewhat alleviated, for the Pan American Airways established a large airfield just outside the city. However, there was no land connection, except for the road and narrow gauge railroad which went only as far south as Campeche, until this latter railroad was linked with the rest of the republic in 1950. Other principal buildings in Mérida are those of the University of Yucatán and the Archaeological Museum. Pop. (1940) 96,852.

MERIDA, commune, Spain (Roman name AUGUSTA EMERITA), in the province of Badajoz, situated on the Guadiana River, 33 miles east-northeast of Badajoz. It is unique in Spain, and is in some points a rival of Rome itself because of the number and magnitude of its remains of Roman antiquity, built when it was the capital of the province of Lusitania. The Guadiana is here crossed by a Roman bridge of 64 arches (originally 81, but 17 were destroyed in 1812), with a length of 2,575 feet and a breadth of 26 feet. There is another Roman bridge over the Albarregas nearby, 450 feet long, 25 feet wide, and still quite perfect, in spite of the traffic of 18 cen-

turies. Among the other noteworthy monuments of antiquity are an old Roman castle, later a Moorish alcazar, constructed out of a temple dedicated to Diana, several aqueducts, a triumphal arch built by Trajan, a colonnaded theater, an ancient amphitheater, and a circus.

Mérida was founded in 23 B.C. by Augustus, and flourished in great splendor under Roman and Moor until 1228, when it was taken from the Moors by Alfonso IX, after which it began to decline. The city fell to the insurgents in the early stages of the Spanish Civil War (1936–1939). Pop. (1940) 22,440.

MERIDA, town, Venezuela, capital of the State of Mérida, 5,384 feet above sea level, 30 miles south of Lake Maracaibo, at the foot of the Sierra Nevada de Mérida, which tower to a height of 15,000 feet. It was founded in 1558 by Juan Rodriguez Saurez, and is situated on the Venezuela-Colombia transandean highway. It was almost totally destroyed by an earthquake in 1812 and again seriously damaged in 1894.

It is the seat of a bishop, contains a fine cathedral, and is the site of Los Andes University, one of the two national universities of Venezuela, and a Jesuit college. It has a hospital and several high schools. Its manufactures are woolen and cotton goods, tobacco products, cordage, furniture, and vegetable oils. Pop. (1950) 24,994.

MERIDEN, mĕr'ĭ-d'n, city, Connecticut, in New Haven County, at an altitude of 190 feet, 17 miles northeast of New Haven, served by the New York, New Haven and Hartford Railroad, modern highways, and a municipal airport. It is the industrial center of a truck farming area, has brass and iron foundries, and manufactures plated and sterling silverware, ball bearings, lighting fixtures, plastics, carburetors, oil filters, household appliances, telephones and signals, hardware, and airplane accessories.

The silver industry, for which the city is noted, developed from its pewter button and tin shops of the late 18th century. The manufacture of Brittania ware was begun in 1808, and in 1852 numerous small plants combined to form the Meriden Brittania Company. In 1857 this company bought the Rogers plant in Hartford where, in 1847, the Rogers brothers had discovered a successful method of plating other metals with silver by electrolysis. They came to Meriden to manage the local company, and in 1898 it combined with several others to form the International Silver Company. A tuberculosis sanatorium and a state reform school for boys are located here.

Settled in 1661 and named for the English home of an early landed proprietor, it was incorporated as a town in 1806, as a city in 1867, and consolidated in 1922. It has a mayor and council, and a municipally owned water supply system. Pop. (1950) 44,088.

MERIDIAN, mĕ-rĭd'ĭ-ăn, city, Mississippi, seat of Lauderdale County, at an altitude of 341 feet, 96 miles east of Jackson, and served by the Southern (Alabama Great Southern; New Orleans and Northeastern), the Gulf, Mobile and Ohio, and the Illinois Central railroads, and an airport with scheduled service. The region about the city comprises areas of forests and of fertile farmlands which produce cotton, corn, sweet potatoes, strawberries, peaches, melons, and pecans. In the city there are extensive railroad shops, stockyards, lumber mills, cotton gins, cottonseed oil and grit mills, and brick, creosoting and cement plants. The Meridian factories produce hosiery, textiles, mattresses, and shirts. In connection with the lumber industry, wallboard is manufactured. The town has a public library and in the school system separate provision is made for white and Negro students. The city is the seat of the East Mississippi Insane Hospital.

Interesting points are the arboretum in Highland Park, the grave of a gypsy queen in Rose Hill Cemetery, and the Scottish Rite Cathedral. The state fair and dairy show is held at Meridian in the fall, and in April, Confederate Memorial Day is publicly observed. There is a federal agricultural experiment station nearby. Meridian has commission form of government, and a city-owned water supply system.

Settled in 1831, it was strongly developed by the advent of the railroad in 1854, becoming a supply depot and troop center during the Civil War. Gen. William T. Sherman entered Meridian on Feb. 16, 1864, with 20,000 troops, after marching virtually unopposed from Vicksburg. Here his troops burned the arsenal, extensive storehouses, and cantonments, while over 10,000 men were employed in a systematic destruction of the railroads to and from the city. Over 125 miles of rail were torn up and 61 bridges and trestles were burned, rendering Meridian useless as a railroad center for the rest of the war. Thereafter, the transporting of supplies eastward from Mississippi was seriously interrupted for a long time and was greatly impeded up to the close of the war. After the Civil War, Meridian was quickly rebuilt, again becoming a rail center, and in the early part of the 20th century, new industries began to be attracted there. Pop. (1950) 41,893.

MERIDIAN, one of the imaginary north and south lines on the surface of the earth that may be conceived of as passing through both poles and serving to indicate the longitude of places, and with a parallel of latitude mark their exact position. If one conceive the earth sliced into on one of these lines, the resulting surface is the plane of the meridian. There are also corresponding lines called astronomical or celestial meridians, which are imaginary circles of the celestial sphere passing through the poles of the heavens and the zenith of any place on the earth's surface. These correspond exactly to the geographical meridians, that is, the celestial is exactly above the geographical meridian of any place. Every place on the globe has its meridian, and when the sun arrives at this line it is noon or midday, whence the name (Latin, *meridianus—medius,* middle, and *dies,* day). (See LONGITUDE.)

The inconvenience arising from having a fixed meridian in different countries is sufficiently obvious, and geographers, navigators and astronomers have all found it frequently a source of confusion. After years of fruitless discussion the question of a reference or first meridian for the world came before an international conference held at Washington, in 1884. There, although the representatives of France and Brazil dissented, it was agreed to recommend the meridian of Greenwich both as the astronomical and as the geographical reference meridian of the world, longitude to be reckoned east and west from this

up to 180°. At the same time it was advised that the astronomical day should begin at midnight, mean Greenwich time, the hours for astronomical purposes being reckoned as before from 0 to 24. This arrangement began on Jan. 1, 1885. The change of time has had some importance for astronomers, but ordinary civil time is still computed much as before. The zone system of reckoning standard time has been adopted throughout the world. In the United States, since 1883, there have been four zones: the Eastern, taking time from the meridian of 75° W. (5 hours slow on Greenwich time); the Central, with standard meridian 90° W. (6 hours slow); the Mountain, 105° W. (7 hours slow); and the Pacific, 120° W. (8 hours slow). The magnetic meridian at any place on the earth's surface is the horizontal line along which a freely suspended compass needle points when influenced only by the earth's magnetism.

MERIMEE, mā-rē-mā', **Prosper,** French man of letters: b. Paris, Sept. 28, 1803; d. Cannes, Sept. 23, 1870. After attending the Collège Henri IV, Mérimée studied law, but never practiced, preferring to enter the civil service. Following the revolution of July 1830 he was made secretary to the ministers of commerce and marine, and in 1831 he was appointed inspector of ancient monuments. In 1844 he was elected a member of the French Academy, and in 1853 he became a senator of France; in 1860 he was made commander of the Legion of Honor. He began his literary career under the pseudonym "Joseph Lestrange" with two clever mystifications, *Le Théâtre de Clara Gazul* (1825), and *La Guzla* (1827), which he published as translations respectively of the plays of a Spanish actress and of Illyrian folk songs. These he followed with a historical novel, *Chronique du Règne de Charles IX* (1829). He also published several important works connected with his duties as inspector of ancient monuments, and he was the author of *Colomba* (1840), a very popular novel of the Corsican vendetta; *Carmen* (1847), a romance upon which the famous opera *Carmen* by Georges Bizet is founded; *Lettres à Une Inconnue* (1873), his most famous work, which throws an interesting light upon his enigmatical character; *Lettres à Une Autre Inconnue* (1875); *Lettres à Panizzi* (1881); and *Une Correspondance Inédite* (1896). The four works last named are Mérimée's most characteristic writings, revealing him as a loyal, devoted friend. They differ widely from his other works which, though often brilliant, are hard and unsympathetic; while these are tender and romantic.

A man of a melancholy, skeptical, and sensitive temper, and endowed with a powerful intellect, he was one of the greatest masters of imaginative prose in France in the 19th century. See also Carmen; Colomba.

MERINO, a woolen or worsted fabric, introduced about 1826, and so named because made from the wool of merino sheep. The word is originally the title of an inspector of sheep pastures in Spain, and became attached to the short-wool Spanish sheep. The breed did not originate here, however, being imported from Africa by the Moors and bred by the Spanish. The wool was so highly regarded that merino sheep have been exported for breeding all over the world, but especially to Australia. See also Wool.

MERIONETHSHIRE, měr-ĭ-ŏn'ĕth-shĭr, county, Wales, bounded on the north by Caernarvon and Denbigh, on the east by Denbigh and Montgomery, on the southeast by Montgomery, on the south by the estuary of the Dyfi (Dovey), and on the west by Cardigan Bay. The area is 660 square miles. The surface is rugged and hilly; the highest peak is Cader Idris (2,927 feet). Rivers include the Dyfi, Dee, and Mawddach. Bala Lake, in the eastern part of the county, is the source of the Dee; it is the largest natural lake in Wales. Limestone and slate are quarried, and there are deposits of manganese ore. There is much pasture land, and the small, hardy Welsh ponies are raised. Dolgelly is the county town; it has replaced Harlech, the ancient capital of Gwynedd (now included in Caernarvonshire, Denbighshire, and Merionethshire), and a center of resistance to the English. Pop. (1951) 41,456.

MERIT, Order of, is a British order designed as a special distinction for eminent men and women without conferring a knighthood upon them. It was created by King Edward VII on June 26, 1902, and is awarded by the sovereign without ministerial advice. Alone among royal honors, the O.M. confers no precedence and no stated position at court functions; and no sum of money, no perquisite, accompanies it. The initials O.M., when written, are placed before any others except those denoting membership in the four great orders of chivalry; and the red and blue enamel cross of the order is not returned at the holder's death. Membership is limited in number to 24 living persons, with the addition of foreign honorary members. The Order of Merit is highly prized in Britain, and it is the only honor which, so far as is known, has never been declined. The first 12 members included, in addition to generals and admirals, Lord Rutherford, winner of the Nobel Prize for chemistry; Sir William Bragg, the physicist; Sir James Jeans, astronomer and physicist; and Sir James Frazer, anthropologist. Musicians, painters, and writers were among later recipients, the last category including T. S. Eliot. Florence Nightingale was the only woman ever to have held the order.

MERIVALE, měr'ĭ-vāl, **Charles,** English historian and ecclesiastic: b. Barton Place, Devonshire, March 8, 1808; d. Ely, Cambridgeshire, Dec. 27, 1893. He was the son of John Herman Merivale (1779–1844), a barrister, translator, and minor poet. After graduating from St. John's College, Cambridge University, in 1826, he studied theology and was ordained in the Church of England in 1833. He was rector of Lawford, Essex, from 1848 to 1869, and during this period was chaplain to the speaker of the House of Commons. In 1869 he declined the professorship of modern history at Cambridge but became dean of Ely, in which capacity he served until his death. His *History of the Romans under the Empire,* 7 vols. (1850–1862), considered his greatest work, unduly glorified imperialism. *The Fall of the Roman Empire* (1853) was a popular epitome of a section of that work; and his *General History of Rome from the Beginning to the Fall of the Western Empire* (1875), was a summary of the entire work. His *Autobiography and Letters,* edited by his daughter, appeared in 1899.

MERIVALE, Herman Charles, English novelist: b. London, 1839; d. there, Jan. 15, 1906. He

was educated at Harrow and Oxford, became a barrister of the Inner Temple in 1864 and edited the 'Annual Register' 1870–80. Among his publications are 'The White Pilgrim and Other Poems' (1875); 'The Cynic' (1882); several plays; 'The Whip Hand' (1884); 'The Dove' (1888). He was a son of J. H. Merivale.

MERIWETHER, Lee, American lawyer, social reformer and author; b. Columbus, Miss., 25 Dec. 1862. Having obtained a secondary education at Memphis, Tenn., he there published the *Free Trader* with a brother, Avery, in 1881–83, and in 1885–86 toured Europe afoot from Gibraltar to the Bosporus for study of the condition of Continental workingmen and of the protective tariff. In 1910, on the 25th anniversary of this "Tramp" trip through Europe, he covered the same route in an automobile; the contrast between walking and motoring abroad, and the changes that had taken place in the manners and customs of the peoples of Europe between 1885 and 1910 were interestingly set forth in a book entitled 'Seeing Europe By Automobile' (New York 1911). He was appointed by the Secretary of the Interior to write for the United States Labor Bureau a report on the 'Condition of European Labor,' published in the annual report of the bureau for 1886. In 1886–89 he was employed as a special agent of the Department of the Interior for which he made investigations of labor in the United States and the Hawaiian Islands, and in 1891 visited the island prisons of the Mediterranean. He was admitted to the bar in 1892, and in 1893 entered practice at Saint Louis. In 1889–90 and 1895–96 he was labor commissioner of Missouri. His reports on municipal government and street-railway franchises led to his nomination in 1897 for the mayoralty of Saint Louis on the Democratic ticket. He was defeated at that time and also in 1901, when he was candidate of the Public Ownership party. Besides his various reports, he has published 'A Tramp Trip: How to See Europe on Fifty Cents a Day' (1887); 'The Tramp at Home' (1890); 'Afloat and Ashore on the Mediterranean' (1892); 'Miss Chunk' (1899); 'A Lord's Courtship' (1900); 'Seeing Europe by Automobile' (1911); 'War Diary of a Diplomat' (1919), etc.

MERLE D'AUBIGNÉ, Jean Henri. See D'Aubigné, Jean Henri Merle.

MERLIN, mêrlĭn, a semi-legendary British prophet and magician, supposed to have flourished toward the end of the 5th century. The accounts of him are hopelessly mixed with fiction. He was said to be the son of a demon and the daughter of a British prince, and was brought up at Caer-Merlin, a city supposed to be the modern Carmarthen. He received from his father the power of working miracles and was the greatest sage of his time, the counsellor and friend of English kings. Vortigen, according to the legend, on the advice of his magicians, had resolved to build an impregnable tower for security against the Saxons but the foundation was scarcely laid when the earth opened by night and swallowed it up. The magicians informed the king that to give firmness to the foundation he must wet it with the blood of a child born without a father. After much search the young Merlin was brought to the king. Merlin disputed with the magicians and showed them that under the foundation of the tower was a great lake, and under the lake two great raging dragons, one red, representing the British, one white, representing the Saxons. The earth was dug open, and the dragons began a furious battle; whereupon Merlin wept, and uttered prophecies respecting the future state of England. Merlin is a character in Tennyson's 'Idylls of the King.' A collection of the prophecies attributed to him appeared in Paris in 1498, at London in 1529 and 1533, at Venice, 1554. They can be traced back to about 1360. His prophecies were published at Edinburgh in 1615 and contain also those ascribed to the Cambrian or Welsh Merlin. Consult Child, 'Her Book of Merlin' (New York 1904); Tennyson, Alfred, 'Idylls of the King.'

MERLIN. This dramatic narrative poem by Edwin Arlington Robinson is among the most distinguished and significant products of recent American literature, and bids fair to take its place beside the best of its very admirable kind. It is entirely modern in its spirit and treatment, with lines like these that mark its date:

> "Time swings
> "A mighty scythe, and some day all your peace
> "Goes down before its edge like so much clover."

In Mr. Robinson's poem King Arthur and his knights are not romantic heroes, as other poets have made them, not "our conception of what knighthood should be"; they are a modern poet's conception of what leaders of men always and universally are,—king, warrior, lover, fool; Arthur, Gawaine, Lancelot, Dagonet. Nor is Mr. Robinson's Merlin like Tennyson's — a magician in his dotage falling a victim to the wiles of a false woman. He is a prophet whose "memories go forward"; he is a man "Who saw himself, A sight no other man has ever seen," and he follows Vivian, "a woman who is worth a grave," because Fate wills it so. It is not the age of chivalry but our own time, our own double world of hope and of reality, with its loves, faith, fears, wars and failures that Mr. Robinson revivifies in 'Merlin.' The philosophy of the poem, that faith and creative love will someday save the world, is a lustrous background for the story: "The torch of woman, who, together with the light That Galahad found, is yet to light the world." As a tale Merlin is vivid and compelling, with scenes, like that of Merlin's first meeting with Vivian and his final parting, which rival the best in drama for beauty and intensity.

Edith J. R. Isaacs.

MERLIN, or **STONE-FALCON,** a small and handsome European falcon (*Æsalon æsalon*) prevailingly blue, known throughout the temperate parts of the old world, and very similar to the American pigeon-hawk (q.v.). It is fierce and courageous, and is trained in falcony for the pursuit of the birds that form its natural prey.

MERMAID, a mythical being living within and under the sea, having the form of a woman above the waist and that of a fish below it. They are usually described as having great personal charms, and as using these for the purpose of luring imaginative and amorous men to

destruction by enticing them into the depths of the sea; and, as a correlative, they are sometimes represented as securing their own destruction by quitting the sea, through marriage with some favored human husband by which they magically obtain temporarily a complete human form and soul, but always end in bringing disaster to one or both of the sacrilegious pair. Mermen are also occasionally heard of, but take an unimportant part in the legendary lore of the sea.

This mediaeval notion is doubtless a survival of the primitive fancies, half fearful, half poetic, which created the classic conceptions of tritons, nereids, and the like. Shakespeare wrote (*Antony and Cleopatra,* II, 2, 211):

"Her gentlewomen, like the Nereides,
So many mermaids, tended her."

All of these ideas probably arose from a mixture of observed human resemblances in certain marine animals with purely mystical fancies which peopled the ocean with similitudes of terrestrial creatures. Primitive men have everywhere derived a large part of their sustenance from the natural products of the waters; and always the vastness and mystery of the sea, full of strange creatures and incomprehensible phenomena, have powerfully affected the imagination of the ignorant and superstitious. So this day the ocean is more familiar and more important in the life of many isolated peoples, who dwell upon its margin and derive their support almost exclusively from it, than is the land; and they invest it and everything it contains with a wondering regard which the inlander can neither share nor understand. To these, even in civilized regions (as on the coast of Ireland or the Hebrides), mermaids remain only one of many present realities, herding sea-cattle and piping in wait for unwary humanity as surely as when seahorses raced over the Aegean waves with the scar of Poseidon or the Sirens tempted the mariners of ancient Greece. In one form or another such stories have been rife in the folklore of all maritime peoples since prehistoric times; and, although not so widespread, the belief in mermaids, and their kith and kin, is still a matter of firm faith with hosts of persons in all parts of the world. Folklore abounds in evidence of this.

The physical basis for these notions rests upon the resemblance which some marine animals bear to human beings when seen at a distance and in certain attitudes. Such, in northern countries, are various seals, which formerly abounded upon the coasts of western Europe, and still are to be seen in the less frequented spots. They have a way of lifting their round heads and shoulders from the water, with a queer human intelligent look upon their faces, and hugging their young to their bosoms with motherly affection. Impressed with this resemblance, easily turned into a story to beguile a long winter evening or to amuse a child, and growing with imaginative repetitions, the northern peoples were quick to believe the similar and more elaborate stories brought to them by early voyagers from the Mediterranean, and so the tales grew and changed into the rich folklore of the coasts of the North Sea.

The southern stories, embellished by classic culture into the sea-myths of Neptune, Proteus and the sea-nymphs of old, and descending into the mermaids and mermen of mediaeval folklore, yet alive around the Mediterranean and Oriental seas, and among sailors generally, probably have their root in the aspect of the East Indian and African dugongs (q.v.). Near at hand these uncouth monsters would never be mistaken for human beings; but seen at a distance, by fearful and wondering voyagers along the coast, such an error might easily happen, for they frequently stand upright among the weedy shallows of the coasts, perhaps draped with loosened vegetation like long hair, and holding to their breasts a young one who nurses from pectoral mammae much as a human baby would do. Such reports, brought back to the inquiring poetic minds of Greece, might easily blossom into the tales of sea-mythology which formed so large and real a part of the popular belief as well as of the legendary lore of the classic age of India, Persia and the Mediterranean peoples. The fish-gods of the Phoenicians and other idolaters are closely related.

From this has come down to us the extensive and varied use of mermaids and mermen in heraldry. "In French heraldry," says Robinson, "the mermaid is called the Siren; in German she has two tails; in the Italian she carries a harp; and in many cases in each country she is crowned. In England it is a very ancient crest, and among others the lords Byron, the earls of Portsmouth . . . and many others display the sea-maiden in their armorial bearing. With her comb and Looking-glass she smiles at us from the shields of the Holmes, Ellises, Lapps; and as a supporter holds up the arms of the Viscounts Boyne and Hood, the earls of Howth and Caledon, and is borne by the heads of the families of Sinclair of Rosslyn, and Scott of Harden. Two mermaids crowned are the supporters of the Boston arms."

Artificial mermaids, claiming to be preserved realities, have formed a part of the stock of curiosities of wonder-shows since time immemorial; and most of those exhibited since the days of Barnum have been the products of Japanese ingenuity.

ERNEST INGERSOLL.

MERMAID'S HEAD, a globose sea urchin, as one of the heart urchins.

MERMAID'S PURSE, the egg case of the skate (or shark), which is often cast up empty on the shore.

MERMAN. See MERMAID.

MERO, or **MEROU,** a West Indian name for a jewfish (q.v.).

MEROBAUDES, Flavius, a Spanish rhetorician and poet of the first half of the 5th century A.D., eminent also as a general, has left us a short hymn in honor of Christ and fragments of five historical poems. L. Jeep in his edition of Claudian (Leipzig 1876–1879) publishes four of these poems.

MEROE, mĕr'ō-ē, ancient city and state of Ethiopia, in the northeastern part of Africa. The city is still represented by ruins and pyramids near Kabushia, on the Nile north of Khartum, and the state forms the district often spoken of as the Isle of Meroë, extending southeast to Abyssinia, and in the

northwest forming a part of Nubia. It was distinguished for its mineral and cereal wealth and at an early date was the centre of an active and varied commerce including the great caravan trade between Ethiopia, Egypt, Arabia, northern Africa and India. The government was in the hands of a caste of priests, who chose a king who was obliged to live and act according to certain prescribed rules. The priests could sentence the king to death in the name of the gods, and he was forced to submit. The priests were of a lighter complexion than the other inhabitants and may have come from India. Ergamenes, king of Meroë in the 3d century B.C., during the reign of Ptolemy II in Egypt, first made himself independent of this oppressive priesthood by murdering the priests in the golden temple. Meroë and Axum (in Abyssinia), which appears to have been a colony of Meroë, remained the centre of the southern commerce till the time of the Arabians. The existing monuments of their architecture, and many other vestiges, exhibit an advanced religious and social cultivation. The University of Liverpool in 1910–11 financed excavations here, interesting ruins were uncovered and many valued relics obtained. Consult Budge, 'The Egyptian Sudan' (London 1907).

MEROPE, the title of an Italian tragedy in blank verse by the Marquis Francisco Scipione Maffei (1675–1755), first performed at Modena in 1713. Appearing just after the dreary period of 17th century stagnation in Italian letters, it obtained a European reputation. More than 60 editions were published and it was widely translated. It attained in Italy an unprecedented success on the stage and is important also for its influence upon the development of the Italian theatre, whose standard Maffei raised perceptibly.

The subject of the play is taken from Greek mythology as related by Apollodoro (II, 8–5) and Pausanias (IV, 3–6). Merope is the queen of Messena whose husband, Cresfonte, and two children have been murdered by her brother-in-law, Polifonte, who then usurps the royal power and attempts to force the queen to marry him. On this tragic story Euripides wrote his 'Cresfonte,' which is not extant. Maffei was the first modern dramatist to handle the material and reveal its superb possibilities. He dispenses with the love element so prevalent at that time in the French theatre and proves that without it a play can retain the interest of the spectator. His idea is that such a play shall depict but a single passion, in this case a mother's love for her son. The scene (III, 4) in which Merope, believing that she has in her grasp her son's slayer, discovers in him her own son, the transition from anger and vengeance to surprise and then to the motherly love, is profoundly impressive. The dénouement, the death of the tyrant (V, 6), at the foot of the altar, is equally effective. Notable as are the tragedies of Voltaire and of Alfieri dealing with the same subject with the power characteristic of each of these master minds, nevertheless in intensity of plot interest and in dramatic treatment, Maffei's 'Merope' remains unsurpassed. Consult 'Opuscoli e lettere di Maffei' (Milan 1844), for the text and interesting material. A school edition, edited by A. C. Clapin was published in London in 1890. The text, with variations and introduction, appeared later in No. 108 of the 'Bibliotheca Romanica.'

JAMES GEDDES, JR.

MEROSTOMATA, a sub-class of arthropods, allied to the *Crustacea,* and represented by only a single survivor (the horsefoot crab), but including a large series of fossil forms which flourished in the Palæozoic Age from mid-Cambrian onward. They were somewhat scorpion-like in form, although sometimes of gigantic size, and ranked between the superior trilobites and inferior arachnids. The Merostomata are characterized by having six pairs of ambulatory limbs about the mouth, the first of which terminate in some, if not in all, cases in chiliceræ. The others serve as organs of locomotion, and their coxal joints for prehension and mastication. The prevailing opinion is that the body is divided into two parts (cephalothorax and abdomen) instead of three (headshield, thorax and abdomen) has been changed by recent discoveries that make the trilobate character of the structure indubitable, and establish a close relationship with the trilobites. The sub-class comprises three orders, *Xiphosura,* the horsefoot crabs (q.v.); several species of which still exist; the *Synxiphosura,* Silurian and Cambrian fossil forms; and *Eurypterida* (see EURYPTERUS). Consult Packard, 'Zoology' (1897), and Zittel-Eastman, 'Textbook of Paleontology' (Vol. 1, 1900), which contains an extensive bibliography.

MEROVINGIANS, mĕr-ō-vĭn'jĭ-ąnz, the first dynasty of Frankish kings which ruled in the northern part of Gaul, since called France. They derived their name from Merowig (Merovæus), the grandfather of Clovis. They ruled from 496 till 752, when they were supplanted by the Carlovingians. Pepin the Short caused the overthrow by deposing Childeric III, and sending him to a monastery. See FRANCE.

MERRELL, John Porter, American naval officer: b. Auburn, N. Y., 7 Sept. 1846; d. New London, Conn., 8 Dec. 1916. He was graduated at the United States Naval Academy in 1867, served with the European fleet 1867–70; was on signal duty on the Washington and Darien expedition of 1870–71, was in charge of the naval ordnance proving grounds 1877–79. He was also for a time an instructor at Annapolis and had command of the Atlantic fleet. He also did active work in the Department at Washington. He was retired by operation of law 7 Sept. 1908. In 1895–96 he was a member of the State Department Commission to investigate anti-foreign riots in the province of Szechuen, China.

MERRIAM, Augustus Chapman, American classical scholar: b. Locust Grove, N. Y., 1843; d. Athens, Greece, 1895. He was graduated at Columbia University in 1866 and after 1868 was connected with that institution successively as tutor, adjunct professor of Greek, and professor of Greek archæology and epigraphy. Dr. Merriam did much to promote the study of classical archæology in the United States. In 1887–88 he was director of the American School at Athens. He published 'The Phæacians of Homer' (1880); 'The Greek and Latin Inscriptions on the Obelisk Crab in Central Park' (1883); 'The Sixth and Seventh Books of Herodotus' (1885); 'The

Law Code of Gortyna in Crete (1886); *Telegraphy among the Ancients,* Papers of the Archaeological Institute of America, Classical Series 3 (Cambridge 1890).

MERRIAM, Clinton Hart, American naturalist: b. New York City, Dec. 5, 1855; d. Berkeley, Calif., March 19, 1942. He studied at Sheffield Scientific School, Yale University, during 1874–1877, and secured a medical degree at Columbia University in 1879. Thereafter he was in medical practice until 1885, when he was appointed chief of the United States Biological Survey. In 1910 he resigned this post to undertake biological and ethnological investigations under a trust fund established by Mrs. E. H. Harriman. For many years he participated in biological surveys in the United States and elsewhere, retiring in 1939. His numerous books included *Birds of Connecticut* (1877); *Mammals of the Adirondacks* (1882–1884); *Life Zones and Crop Zones of the United States* (1898); *Review of the Grizzly and Big Brown Bears of America* (1917); *The Buffalo in Northern California* (1926). He was the brother of Florence Augusta Bailey (q.v.).

MERRIAM, John Campbell, American paleontologist: b. Hopkinton, Iowa, Oct. 20, 1869; d. Oakland, Calif., Oct. 30, 1945. He graduated at Lenox College, Iowa, in 1887, and in 1893 he obtained a Ph.D. at the University of Munich. In 1894 he joined the faculty of the University of California, where he became professor of paleontology in 1905. He resigned this chair in 1920 to take the presidency of the Carnegie Institution of Washington, and he continued in this post until his retirement in 1938. He published many works on fossil reptiles, fossil mammals, and general historical geology, including *The Occurrence of Human Remains in California Caves* (1909); *The Emergence of Man* (1919); *Spiritual Values and the Constructive Life* (1933); *Science and Human Values: Time and Change in History* (1936).

MERRIAM, William Rush, American politician: b. Wadham's Mills, N. Y., July 26, 1849; d. Feb. 18, 1931. After graduating at Racine College, Wisconsin, in 1871, he entered the First National Bank of Saint Paul, Minn., becoming cashier in 1873. In 1880 he was elected president of the Merchants' National Bank, Saint Paul, and in 1882 he became a member of the Minnesota state legislature; he was chosen speaker in 1886. From 1889 until 1893 he served as governor of Minnesota; and from 1899 until 1903 he was director of the twelfth United States census.

MERRICK, Leonard, English novelist and playwright: b. London, Feb. 21, 1864; d. there, Aug. 7, 1939. After attending Brighton College he was employed for a time in South Africa and then went on the London stage, using the surname of Merrick in place of his family name of Miller; later he changed his name to Merrick by legal process. He turned to writing after two years as an actor, the first of his books to attain any measure of success being *The Man Who Was Good,* published in 1892. Numerous later novels included *Cynthia* (1897); *The Worldlings* (1900); *The Quaint Companions* (1903); *The Position of Peggy* (1911); *A Chair on the Boulevard* (1921); *The Little Dog Laughed* (1930). With collaborators, he also wrote five plays.

MERRILL, George Perkins, American geologist: b. Auburn, Me., May 31, 1854; d. Aug. 15, 1929. After graduating at the University of Maine in 1879 he became assistant in chemistry at Wesleyan University, Connecticut. In 1881 he joined the staff of the United States National Museum, and in 1887 became curator of the department of geology; from 1897 until his death he served as head curator of the department. During 1893–1915 he was also professor of geology and mineralogy at George Washington University. He did much pioneer research work on meteorites and the history of American physical geology, and developed the museum's geological and paleontological collections. His works included *Stones for Building and Decoration* (1891); *A Treatise on Rocks, Rock-weathering, and Soils* (1897); *The Non-Metallic Minerals* (1904); *The First One Hundred Years of American Geology* (1924).

MERRILL, Selah, American Congregational clergyman: b. Canton, Conn., May 2, 1837; d. Jan. 22, 1909. He studied at Yale Divinity School, and after ordination in 1864 he spent a year as chaplain of the 49th United States Colored Infantry. During 1874–1877 he was archaeologist of the American Palestine Exploration Society, and he served as United States consul in Jerusalem in 1882–1886, 1891–1894, and 1898–1907. He located the second wall of Jerusalem, outside of which Jesus was crucified. During 1907–1908 he was United States consul at Georgetown, British Guiana. His writings included *Galilee in the Time of Christ* (1881); *The Site of Calvary* (1885); *Ancient Jerusalem* (1905).

MERRILL, city, Wisconsin, seat of Lincoln County, on the Wisconsin River 15 miles north of Wausau; it is served by the Chicago, Milwaukee, St. Paul and Pacific Railroad. The city is located in an old lumbering region. There are manufactures of paper, doors and sash, shoes, dairy products, canned foods, and knit goods. Père René Menard, early French priest, had a mission here in 1661. The place was settled under another name in 1875 and was incorporated as a village in 1880; it took the name of Merrill when chartered as a city in 1883. It has government by mayor and council. Pop. (1950) 8,951.

MERRIMAC, The, a frigate of the United States Navy. See MONITOR AND MERRIMAC, THE.

MERRIMACK, river of the United States, formed by the junction of the Pemigewasset and Winnipesaukee rivers at Franklin, N. H. The Pemigewasset has its rise in the northern part of Grafton County, N. H., in the White Mountains; the Winnipesaukee is the outlet for the lake of the same name. The Merrimack flows nearly due south into Massachusetts when it turns, continuing its course east, then northeast into the Atlantic Ocean at Newburyport, Mass. The mouth of the river is a tidal estuary; the Merrimack is navigable for small vessels as far as Haverhill, Mass. A sand bar at the entrance to the river is constantly changing, proving a hindrance to navigation. The extensive water power of the Merrimack has been the main cause

of the development and prosperity of the entire region. Some of the country's cotton mills were erected on its banks, as well as woolen mills, carpet mills, and other manufactories. Besides Haverhill, other important towns on its banks in Massachusetts include Lawrence and Lowell; in New Hampshire, Nashua, Manchester, and Concord. The Merrimack has a length of 110 miles from the confluence of the Pemigewasset and Winnipesaukee to its mouth; the drainage area of the river covers 5,000 square miles.

MERRIMAN, Henry Seton. See SCOTT, HUGH STOWELL.

MERRIMAN, John Xavier, South African statesman: b. Street, Somersetshire, England, March 15, 1841; d. Aug. 2, 1926. He went to South Africa with his parents in 1849, and was educated at Rondebosch, near Capetown. In 1871 he was a diamond dealer in Kimberley, and during 1874–1875 he was a wine merchant in Capetown. Meanwhile he had entered political life in Cape Colony, and he became commissioner of public works during 1881–1884 and treasurer general in 1890–1893. A close friend of Prime Minister Cecil Rhodes, he headed the Cape parliamentary committee which inquired into the Jameson raid of 1895. During 1898–1900 he was again treasurer general, and in 1908 he became prime minister of Cape Colony. As leader of the South African Party (formerly the Afrikaner Bond) he took a prominent part in formulating the constitution for a united South Africa. He vacated the Cape premiership when the Union of South Africa was constituted in 1910, and thereafter was a staunch supporter of the Union government headed by Louis Botha.

MERRIMAN, Mansfield, American civil engineer: b. Southington, Conn., 1848; d. June 7, 1925. He graduated at the Sheffield Scientific School, Yale University, in 1871, and during 1873–1875 he was a member of the United States Corps of Engineers. In 1875 he returned to Yale as instructor in civil engineering, and in 1878 he was appointed professor of civil engineering at Lehigh University; he vacated this chair in 1907 in order to devote his time to consultation, mainly in hydraulics. For five years he was associated with the geodetic survey of Pennsylvania, having charge of primary triangulation. He also conducted research in the fields of hydraulics, strength of materials, and pure mathematics. His works included *Elements of the Method of Least Squares* (1877); *The Mechanics of Materials* (1885); *Strength of Materials* (1897); *Elements of Sanitary Engineering* (1898); *Elements of Hydraulics* (1912).

MERRITT, Anna Lea, American artist: b. Philadelphia, Pa., Sept. 13, 1844; d. April 7, 1930. She studied in Dresden, Germany, under Heinrich Hoffman, and in England under Henry Merritt, whom she married in 1877. Thereafter most of her life was spent in London. She exhibited at the Royal Academy, and her *Love Locked Out* was the first work by a woman artist to be purchased by the Tate Gallery, London. Other examples of her paintings included *Piping Shepherd* (in the Pennsylvania Academy of Fine Arts, Philadelphia), *A Scene on the Grand Canal,* and *Venice.* Her portrait of James Russell Lowell hangs in the Memorial Hall, Harvard University. She also took up etching, executing a portrait of Sir Gilbert Scott and two portraits of Mary Wollstonecraft. In 1879 she published *Henry Merritt's Art Criticism and Romance;* she also wrote *A Hamlet in Old Hampshire* (1902) and *An Artist's Garden* (1908).

MERRITT, Wesley, American army officer: b. New York City, June 16, 1834; d. Washington, D.C., Dec. 3, 1910. He graduated at West Point in 1860, and served through the American Civil War. In 1863 he was promoted brigadier general of volunteers, and the next year he became brigadier general. From the close of the war he was chiefly on frontier duty down to 1879, and during 1882–1887 he served as superintendent of West Point. In 1887 he became a brigadier general in the United States Army, and in 1895 he was promoted major general. As commander in chief of United States forces in the Philippines in 1898, he cooperated with Admiral George Dewey in the capture of the city of Manila. He was retired in 1900.

MERRITT, William Hamilton, Canadian mining engineer: b. Saint Catherines, Ontario, 1855; d. Toronto, 1918. He was educated at Upper Canada College, the Royal Military School, and the Royal School of Mines, London. After his return to Canada he practiced in Toronto as a mining engineer, and subsequently he lectured in mining engineering at the Kingston School of Mines. In 1885 he took part in the operations to suppress the rebellion in Manitoba of Louis Riel, and during 1899–1902 he served with the Canadian forces in the South African War. He contributed papers to numerous learned societies, and published *Economic Minerals of Ontario* (1896) and *Field Testing for Gold and Silver* (1900).

MERRITTON, town, Ontario, Canada, in Lincoln County on the Welland Ship Canal just south of Saint Catherines. Just to the east of the town, on June 24, 1813, the Battle of Beaver Dams was fought; 40 British soldiers and 200 Indians captured an American force totaling 650 men.

MERRY DEL VAL, mĕr'rē thĕl väl', **Rafael,** Roman Catholic prelate: b. London, England, Oct. 10, 1865; d. Rome, Italy, Feb. 26, 1930. His father was secretary to the Spanish legation in London. He accompanied his father to Rome when the latter was named Spanish ambassador to the Vatican, and in 1888 he was ordained in the priesthood. In 1892 he was appointed master of the robes and privy chamberlain to Leo XIII, and in 1897 he was papal delegate to Canada to investigate the question of separate Roman Catholic schools in Manitoba. He was consecrated titular archbishop of Nicaea in 1900, and in August 1903 he served as secretary of the conclave which elected Pope Pius X. In October of the latter year he succeeded Cardinal Mariano Rampolla as papal secretary of state, and he was created cardinal in November. From October 1914 until his death he was secretary of the congregation of the Holy Office. He wrote *The Truth of the Papal Claims* (1909).

MERRY WIVES OF WINDSOR, The, was Shakespeare's greatest prose play. It contains only about 15 per cent of verse lines, and

in the spirit of its scenes it is equally subdued, save for a flash of the old fire in the fairy poetry at the close. John Dennis and Nicholas Rowe report a story, current at the opening of the 18th century and inherently plausible, to the effect that this play was written within two weeks to the special order of Queen Elizabeth, who desired to see Sir John Falstaff in love. The wish is worthy of the queen's taste, and the manner in which it was satisfied indicates that Shakespeare did not work spontaneously. In point of time the play belongs with the greatest comedies—with *Much Ado About Nothing, Twelfth Night,* and *As You Like It.* It was licensed for publication in January 1602 and most likely composed shortly before, for it is hard to believe that the Falstaff of this play can have been created while recollection of the great Falstaff of *Henry IV* (1597, 1598) was very fresh in the author's mind. There is a radical difference between the two characters. In the *Merry Wives* Falstaff loses most of his peculiar wit and all the graver, pathetic side of his character. He loses his charm, not only for the spectator but for his companions. There is a sense of positive disaster in seeing the invincibly lovable knight of *Henry IV* and *Henry V* betrayed by his own creatures, Nym and Pistol, just as there is in hearing the Titanic liar of the Gadshill episode ignominiously relating to Brook-Ford the whole sorry truth of his discomfiture. "I do begin to perceive that I am made an ass," he is forced to say in the final scene, and Shakespeare must have felt as keenly as his readers the pity of thus reducing Falstaff to the level of Dogberry and Bottom. The play is brisk and entertaining, and is constructed with masterly technique, but it deals wholly with the externals of character and with unlikely incidents. Its type-figures—Slender, Sir Hugh Evans, Dr. Caius, the Host—when compared with Mercutio, Sir Toby, or the old Falstaff, are like pygmies after giants. There is no reason to believe that *The Merry Wives of Windsor* was regarded with special favor by the Elizabethans. After the Restoration it seems to have become one of the most popular of Shakespeare's comedies, though Samuel Pepys registers emphatic dissent when noting in his diary that on Aug. 15, 1667, he saw *The Merry Wives of Windsor,* "which did not please me at all, in no part of it." Precisely a century after its first publication, in 1702, a revised version by Dennis was brought out with the title, *The Comical Gallant, or The Amours of Sir John Falstaff.* Since the rise of the romantic movement, it has been one of the least liked of Shakespeare's comedies.

TUCKER BROOKE.

MERSEN, Treaty of, effected Aug. 8, 870, at Mersen (Meerssen), Netherlands, between Charles the Bald of France and his half brother Louis of Germany by which Lotharingia or Lorraine, the kingdom of their nephew Lothair II (d. 869), was divided between the east and west Frankish realms—France and Germany. From this date the history of the two national divisions and of the European state system begins.

MERSEY, mûr'zĭ, river in northwest England formed by the junction of the rivers Goyt and Etherow in Derbyshire. It flows northwest and west between Cheshire and Lancashire into the Irish Sea through a large estuary that forms the harbor of Liverpool. From the right it receives the Tame, at Stockport, and the Irwell; and on the left its chief tributaries are the Bollin and the Weaver. At Eastham, on the estuary, is the entrance to the Manchester Ship Canal, 35½ miles in length, through which large ocean steamers have direct access to Manchester. Beneath the bed of the river, extending from Birkenhead to Liverpool, are a railway tunnel (opened in 1886) and a road tunnel (completed in 1930). The length of the Mersey, including the estuary, is 70 miles.

MERSHON, mĕr-shŏn', **Ralph Davenport,** American electrical engineer and inventor: b. Zanesville, Ohio, July 14, 1868; d. Miami, Fla., Feb. 14, 1952. He graduated at Ohio State University in 1890, and the following year joined the staff of the Westinghouse Electric Company. Westinghouse transformers designed by him received an award at the Chicago Exposition in 1893. He retained his connection with the company, at Pittsburgh, Pa., and New York City until 1900, when he entered private practice as a consulting engineer. He designed and built several important high voltage transmission plants in Japan, South Africa, Canada, and various parts of the United States. His inventions included the six-phase rotary converter, a compounded rotary converter, a system of lightning protection for electrical apparatus, and a compensating voltmeter.

MERSIN, mĕr-sēn', or **ICEL,** ê-chĕl', seaport city, Turkey, seat of Içel vilayet, on the Mediterranean 40 miles west-southwest of Adana. Although the harbor is an open roadstead there is a considerable shipping trade. An American mission is located here. Pop. (1945) 33,148.

MERSON, mĕr-sôn', **Luc Olivier** (also LUC OLIVIER-MERSON), French painter: b. Paris, May 21, 1846; d. Nov. 14, 1920. His first picture exhibited in the Salon was *Leucothea and Anaxandros* (1867). In 1869 he carried off the Grand Prix de Rome, the supreme ambition of art students, by his painting *The Soldier of Marathon.* He produced the same year *Apollo the Destroyer,* now in the Museum of Castres. In 1872 he painted *The Martyrdom of Saint Edmund of England* (Museum of Troyes). Thereafter he devoted his pencil to the portrayal of legendary and mythological scenes and incidents. His chief works in this class are *The Vision, a Legend of the 14th Century* (1873); *A Patriot Sacrifice* (1874); *Saint Michael* (1875); *Saint Francis and the Wolf of Agubbio* (1878); *Saint Isidore* (a triptych) (1879); *The Judgment of Paris witnessed by Eros* (1884); *Mankind and Fortune* (1892); *The Annunciation* (1903). He also frescoed with scenes from the life of Louis IX the walls of the Saint Louis gallery in the Palais de Justice at Paris.

MERTHYR TYDFIL, mûr'thĕr tĭd'vĭl, county borough, Wales, in Glamorganshire 24 miles by rail northwest of Cardiff. From an unimportant village in 1780, it became a prosperous center of iron and steel manufacturing owing to its situation near the valuable coal and mineral fields of South Wales. The industrial depression after World War I seriously affected the borough. Richard Trevithick's steam locomotive, the first to be tried on rails, successfully hauled a train of 10 tons of iron and 70 men on

the Merthyr Tydfil-Pontypridd tramway in 1804. At the Dowlais iron works of Merthyr Tydfil, in 1856, Bessemer steel was first rolled into rails. The name of the borough is said to commemorate the martyrdom of Saint Tydfil, daughter of Brychan, who was put to death by the Saxons in the 5th century. Pop. (1951) 61,093.

MERTON, Walter de, English prelate: d. about Oct. 27, 1277. He served as chancellor of England during 1261–1263, and again in 1272–1274. In 1271 he was appointed justiciar, and from 1274 he was bishop of Rochester. He is best remembered as the founder of Merton College (q.v.).

MERTON COLLEGE. See OXFORD UNIVERSITY.

MERV, former name of the town of Mary, Turkmen Soviet Socialist Republic. See MARY.

MERWIN, Samuel, American author and editor: b. Evanston, Ill., Oct. 6, 1874; d. New York City, Oct. 17, 1936. He was educated at Northwestern University. In collaboration with Henry Kitchell Webster (q.v.), a friend from his boyhood days, he later wrote fiction about railroad-building in the United States, attaining some success with *The Short Line War* (1899) and *Calumet K* (1901). He also published in 1901 a novel entitled *The Road to Frontenac,* and this was followed by others which included *His Little World* (1903) and *The Merry Anne* (1904). From 1905 to 1909 he was associate editor of *Success Magazine,* and he was editor for the next two years. During 1907 he visited China to study the trade in opium, an account of which he gave in the book *Drugging a Nation* (1908). His subsequent novels included *The Trufflers* (1916); *The Passionate Pilgrim* (1919); *The Moment of Beauty* (1924); *Lady Can Do* (1929); *Bad Penny* (1933). He was a nephew of Frances Elizabeth Willard (q.v.), whose views on woman suffrage he espoused.

MERYON, mā-ryôn′, **Charles,** French etcher and engraver: b. Paris, Nov. 24, 1821; d. Charenton, Feb. 14, 1868. As a young man he served in the French Navy, which he was compelled to leave on account of ill health. Thereupon he turned to etching as a career, his chief works being picturesque spots in old Paris, many of which were subsequently destroyed. Between 1850 and 1854 he executed a series of 23 etchings known as *Eaux-fortes sur Paris,* by which he is best remembered. He met with little success, however, and lived in poverty until his mind failed and he was confined in a mental hospital, where he died.

MESA, mā′sà, city, Arizona, in Maricopa County 15 miles east of Phoenix; it is served by the Southern Pacific Railroad. Industrial activities are connected with the packing of vegetables and citrus fruits, and the ginning of cotton. The city was founded by Mormons in 1878. Government is by mayor and council. Pop. (1950) 16,790.

MESA, in geography, large, tabular, steep-sided blocks of land produced by the dissection of a plateau by the agency of rivers. The term is in common use in the great plateaus in the southwestern area of the United States. Smaller and less precipitous formations of the same type are frequently termed buttes.

MESA VERDE NATIONAL PARK, administered for the people of the United States by the National Park Service, a bureau of the Department of the Interior, is situated in southwestern Colorado. This area, comprising more than 51,000 acres, is a high tableland, rising abruptly from the floors of the Montezuma Valley on one side and the Mancos Valley on the other. Geologically it is the type locality of the Mesaverde formation of sandstones and shale that overlie the rocks of the Mancos formation, the whole exemplifying in striking scenic effects the forces of erosion which have worked upon the Rocky Mountain uplift. The surface of this mesa is broken by many canyons, the more rugged as they descend toward the Mancos. It is along these canyons, and in the great caverns of their sidewalls, with the overhanging rock serving as roofs, that the many hundreds of ancient villages of prehistoric Indians are found, to be visited yearly by an ever increasing number of tourists, and to be under constant study by those archaeologists whose patient research is slowly revealing the pattern of a fascinating phase of our pre-Columbian history.

Abandoned by the prehistoric people many centuries ago, and subject not only to the ravages of time but also to the unconscious vandalism of early plunderers, the cliff houses, pueblos, and pit houses are now given adequate federal protection. Visitors, though given every reasonable facility for enjoying the park, are required to observe the rules made necessary in pursuing the intent of the congressional organic act: the preservation of such park areas for the enjoyment and education of future generations. No cliff dwelling may be entered except in company of a park ranger. This rule does not apply to the ruins on the top of the mesa, which may be freely visited any time during the daylight hours by those who register at the park entrance or at the excellent Museum. For more than a thousand years sedentary Indians, unwarlike and mainly subsistent upon agriculture, lived in the Mesa Verde and surrounding regions. The discovery of the more important Mesa Verde pueblos was made in December 1888 by Richard Wetherell and Charles Mason, local cattlemen who were hunting stray stock on the mesa top. Later, Mason said "We had heard of Cliff Palace before we saw it. A Ute Indian named Acowitz had told us about it and we had always hoped to find it. The Utes were afraid of the ruins because of the spirits of the old people they believed to be there."

Beginning with a simple culture at about the opening of the Christian era, these people had reached by the end of the 13th century a high level that had even spread in some small degree to the wild tribes with whom they had contact. [The contact was not fortunate for the peaceable Pueblo people, as we shall see as we consider the four periods of progress that have been identified by the archaeologist.] Up to about the year 400 the outstanding craft of the Mesa Verde people was the weaving of baskets. They seem not to have had pottery, and their only missile weapon was the atlatl (throwing-stick). They lived in huts over shallow pits or in rough shelters on the floors of caves. Cooking, aside from

roasting over coals, was done by means of putting hot stones in their well-made baskets. In the floors of their cave houses they stored some of the products of their meager fields on the mesa. The years from about 400 to 700 are known as the Modified Basket Maker period. Here we begin to encounter pottery of a plain gray type that supplanted baskets for such use as cooking and water carrying. The folk either invented for themselves the bow and arrow, or received it from the outside. Most important, they built houses. These were only head-high roofs over shallow pits, but they were homes for single families, in a total population that seems to have greatly increased. Weaving was practiced, and the farming had become more important. Toward the end of this period the roofed pits gave way to rectangular rooms with vertical walls, and these, grouped together, formed large villages. What is known as the Developmental Pueblo Period occupied the years from about 700 to 1000 A.D. The villages became more compact. The "pueblo" (giving it the Spanish word for village) was about to come to the full fruition of the Classic and final period in the culture of these people. It was a time of eager experiment. Many kinds of house walls were tried—adobe, adobe and poles, combination of stones and adobe —until they finally arrived at coursed masonry of superior artisanship. In the cluster of houses around open courts were pit houses for ceremonial purposes, now called kivas. The pottery was not only greatly improved, but each area had its own definite type. Cotton was woven. A strange innovation appeared, whereby a cradle made of wood was adopted, which had the effect of deforming the heads of the infants, flattening them on the back of the skull. At this point of the cultural development of the Mesa Verde people, and probably just about as their great period was beginning, this nonwarlike prosperous folk had become targets for nomadic bandits. The cliff dwellings that attract most attention from the modern visitor thus came into being. (See CLIFF DWELLERS.) Clearly these cave pueblos, or cliff houses, were a defensive step. Such impressive structures as Cliff Palace, Square Tower House, Spruce Tree House, and Long House were the product of this flowering period. A rigid social structure, with a highly ritualized religious ceremony had evolved from the first rude social behavior and beliefs. Now the pottery was not only more efficient, but the artist in the potter was achieving animal figures and geometrical designs, the finest ware having black figures upon light gray. There was a profusion of jewelry of turquoise and other colored stones. However, the end of the pueblo life was now in sight. What the invasion of hostile tribes could not do, the phenomenon of a radical climatic change did. Beginning about 1276 and continuing for 24 consecutive years there was insufficient moisture to grow crops. The springs failed and the rivers ceased to flow. One by one the villages were abandoned. The pueblo people simply shouldered what belongings they could carry and moved on, perhaps to the southward and eastward.

Consult Watson, Don, *Cliff Palace* (Ann Arbor 1940); Radin, Paul, *The Story of the American Indian* (New York 1944); National Park Service folder, Washington, revised and reprinted frequently.

FREEMAN TILDEN,
Author, "The National Parks."

MESCAL, měs-kăl′, a fiery liquor produced in Mexico from several species of agave. The most famous liquor, however, is made from the "hearts" of the species *Agave tequileana.* The city of Tequila, in the state of Jalisco, is the center of this particular industry. The Tequila agave resembles in the appearance of its stiff lancelike leaves the sisal hemp plant, though it sends out its leaves from a great bulb-like cellular mass which forms the heart of the plant. This heart, when denuded from its leaves and detached from the root, is cleft in two, and a dozen of these pieces make a fair load for a mule, for they must be transported from the fields where grown to the city, sometimes a journey of several miles. These hearts are roasted in pits, within the distillery enclosures, dug four or five feet deep and considerably wider. A hot fire is built of mesquite wood, and large stones distributed through the fuel. The "heads" are then heaped over the burning mass until a huge mound is formed, which is covered first with grass and then with earth, and the mass left several days to cook. When the mound is opened the raw product is found to have changed to a dull brown in color, and the juices to have been converted into sugar. White hot and steaming, the mass is taken to another pit, stone-paved, on the bottom of which revolves a heavy stone crusher, really an arrester operated by mule power. Here it is ground into pulp and the semi-liquid mass carried in deep trays on the heads of Indians to the vats where it remains to ferment. Then it goes to the rude stills, and is run off as mescal.

The commercial mescal is a colorless liquor sometimes with a slight amber tint, though much of it is like alcohol. Some of the higher grades are given fancy names which serve as trademarks. It is far too strong a liquor to be drunk with impunity, though its fiery quality seems to suit the Mexican taste for hot things. Zotol is another liquor, made in the same way from the bulblike heart of a species of *Dasylirion,* which is said to be as strong as 95 per cent alcohol. These liquors should not be confounded with aguardiente, which is made from sugar cane. The Mexican name means burning water.

MESDAG, Hendrik Willem, měs′dăĸ, Dutch marine painter: b. Groningen, Feb. 23, 1831; d. 1915. He was a banker, following in his father's footsteps, until his 36th year, when he devoted himself to art, studied under Alma-Tadema, who was a relative, and under Roelofs, and lived at The Hague, with a studio at Scheveningen. He took a foremost rank among modern painters of the sea, and conveyed the idea of water-masses and motions very felicitously. He presented his splendid collection of paintings and art objects to the nation. His pictures include *Fishing Boats at Scheveningen, Strand of Scheveningen, Morning on the Scheldt,* and *In Peril.*

MESENTERY, měs′ĕn-tĕr-ĭ, a double fold of the peritoneum which attaches the small intestine to the spinal column, but in such a manner as to permit great freedom of motion. The corresponding support of the large intestine is the mesocolon, with the mesorectum. The mesentery contains between its folds several blood-vessels, lacteals, lymphatics, nerves, and the ganglia called mesenteric glands, which are connected with the lymphatico-lacteal system.

It is about four inches wide, and extends nearly the whole length of the intestine. It is subject to several diseases, the most frequent of which is tubercular degeneration of some of its numerous glands. For this and other diseases of the mesentery, see PERITONITIS.

MESHA, king of Moab mentioned in II Kings iii, 2–27. This monarch threw off the yoke of Israel, then ruled by Ahab and the latter's sons, Ahaziah and Jehoram. Later Jehoram, with the aid of the kings of Judah and Edom, defeated Mesha and his hosts. Mesha was defeated and besieged in Kir-hareseth, but managed to hold out against his enemies although his country was overrun. See MOABITE STONE.

MESHED, mĕsh'ĕd, or **MESHHED,** mĕsh'-hĕd, Persia, capital of the province of Khorasan, in an extensive valley 500 miles northeast of Ispahan. It is surrounded by walls, and has many ruined houses, but its principal street is spacious and handsome, having a water-course, the banks of which are shaded by trees, passing through it, while at its extremity are seen the splendid cupola and gilded minarets of the mosque containing the shrine of Iman Riza, the son of Ali, the founder of the Shiites. This tomb has a gorgeous interior, a vast hall, like the central nave of a cathedral, rising loftily into a central dome ornamented with the richest colors and a profusion of gilding. This shrine attracts a vast number of pilgrims. Here also is the mosque of Gohur Shah, considered one of the most beautiful and splendid in Persia. The chief manufactures are velvets, sword-blades and some silk and cotton goods. A considerable number of the inhabitants are employed in cutting the turquoises obtained in the vicinity. The situation of Meshed on several great caravan routes makes it an important entrepôt for the produce of surrounding countries. The customs receipts for the territory approximated $250,000 annually up to 1914, were much lower during the World War, but have increased since. Pop. about 85,000.

MESHTROVITCH, Ivan, Jugoslav sculptor: b. Otavice, Northern Dalmatia, 1883, the son of a Croat. He was educated at the Vienna Academy of Arts and first exhibited his work in that city in 1902, and in 1911 his studies for the Serbian National Temple at Kossovo were shown in Rome. An artist of the highest type, endowed with astonishing ability, he is regarded in Europe — especially in England — as one of the greatest sculptors that ever lived. In 1915 a representative committee brought him to London and organized an exhibition of his works at the Victoria and Albert Museum. Art, political idealism, mythology and religious mysticism are inseparably bound up in his creations. His remarkable talent is expressed in the eclectic variety of styles of which he is master; it would seem that all known styles culminate in Meshtrovitch: Egyptian, Greek, Baroque, Byzantine, Assyrian and the most violently realistic modernism. Consult 'Ivan Meštrovič: A Monograph' (London 1919), by Sir John Lavery, Dr. Seton-Watson and others, with 68 photographic plates.

MESMER, Friedrich (or **Franz**) **Anton,** frēd'riç än'tōn mĕs'mĕr, German physician: b. Itzmang, near Constance, Baden, 23 May 1733; d. Meersburg, Baden, 5 March 1815. He was educated in medicine by Van Swieten and De Haen of the University of Vienna, made some study of astrology, came to believe in the influence of the stars, and attributed this supposed influence to magnetism. Having at first believed in the cure of diseased bodies by the use of magnets, he came wholly to discard the magnets and declared that an occult force, which he called animal magnetism, pervading the universe, resided in himself and afforded him an influence over others. In 1778 he went to Paris and set the town astir. He had undoubtedly an honest belief in the efficacy of his discoveries; but he took advantage of popular interest to enshroud his methods with mystery. Finally the government appointed a committee of noted physicians and members of the Academy of Sciences, including Benjamin Franklin, to investigate the matter; and the committee in a report, admitting many facts but attributing them to physiological causes and not to any such supposed agency as animal magnetism, so discredited Mesmer that he went to London, and later to Germany. The name mesmerism was formerly applied to the entire class of phenomena now known as hypnotism (q.v.). It is now claimed that there is a force in the human body generally called magnetiscor, which is under the control of the human will, and that when the control of this force passes to another hypnotism occurs. Among his writings are 'Mémoires sur la Découverte du Magnétisme Animal' (1779); 'Histoire Abrégée du Magnétisme Animal' (1783); and the 'Mémoire de F. A. Mesmer sur ses Découvertes' (1799). See HYPNOTISM.

MESMERISM. See HYPNOTISM.

MESNE (mēn) **PROCESS,** *in law,* an intermediate process which issues pending the suit upon some collateral interlocutory matter. Sometimes it is put in contradistinction to primary and final process, or process of execution, and then it signifies all such processes as intervene between the beginning and end of a suit.

MESODERM. See ANATOMY, COMPARATIVE; EMBRYOLOGY.

MESOHIPPUS. See HORSE, EVOLUTION OF THE.

MESONERO ROMANOS, mā-sō-nā'rō rō-mä'nōs, **Ramon,** Spanish writer: b. Madrid, 1803; d. 1882. After a short time spent in mercantile life he turned to journalism, and after some time spent on the Madrid *Press* he founded the *Semanario Pintoresco Español* which he continued to edit and manage until 1842. Mesonero was a great lover of his native city which, in his youth, was still the old-fashioned Spanish capital teeming with true native life, before it had begun to reflect the fashions, customs and manners of Paris. He rubbed elbows with his fellow city-dwellers everywhere and on every occasion; and out of this intimacy sprang interesting and well-written sketches of popular types, manners and customs. His comprehensive knowledge of his native city appears in 'Manual de Madrid'; 'Escenas Matritenses' (2 vols., 1836); 'Memorias de un setentón' (1880), and 'El Antigno Madrid.' Mesonero is one of the masters of modern Spanish. His language is ever graceful, tending to a slight diffuseness; but always preserving its purity and idiomatic

complexion and force. A collected edition of his works was published in Madrid in 1881 under the title 'Obras completas de Ramón Mesonero Romanos.' In 1903–05 two volumes more of his hitherto unpublished writings also appeared in Madrid. Consult for biographical sketch, Northup, G. T., 'Selections from Mesonero Romanos' (New York 1913).

MESONYCHIDÆ, a family of Creodonts, prevailingly North American, which were more highly specialized than any other. They acquired a wolf-like form, with a very long slender tail, and legs and feet digitigrade gait indicating powers of speed beyond those of any other creodont. Their heads, however, were disproportionately large and bear-like. The general structure, nevertheless, shows that they could not have been rapid and aggressive in their habits, and their teeth suggest that they lived principally on vegetable diet. Their development into hyenalike creatures may be traced to nearly the close of the Eocene.

MESONYX, a primitive carnivorous animal of the group *Creodonta* (q.v.), which must have resembled in external aspects, when alive, the modern Tasmanian wolf of Australia. Its remains are found fossil in the fresh-water formations of Eocene Age along the eastern base of the Rocky Mountains, and a complete skeleton is mounted in the museum of Princeton University, and a restoration is exhibited in the American Museum of Natural History in New York. This specimen (*Mesonyx obtusidens*) indicates an animal as large as a Saint Bernard dog, with its hindquarters drooped somewhat, like those of a hyena and a very long, slender tail. It is the type of a large family (*Mesonychidæ*) of wolf-like beasts widely distributed in Eocene time. Consult Woodward, 'Vertebrate Palæontology' (London 1898); Osborn, 'Age of Mammals' (New York 1910).

MESOPHYTE (Gr. "mid-grower"), *in botany and forestry,* a term used of plants which grow naturally in soil of moderate moisture. Thus the term is contrasted on the one hand with xerophyte, "dry-grower," and hydrophyte, "wet-grower," these latter terms being applied to plants requiring very little or very much moisture. Since soil of moderate moisture varies from moist to dry, whereas both the dryer and wetter soils are comparatively invariable in this respect, it naturally follows that Mesophytic plants show more adaptability to conditions of moisture than either hydrophytes or xerophytes. For the same reason, no doubt, the mesophytic flora, being comparatively stronger, is denser and marked by much wider variations of species, than the scanty and monotonous growths of poorer, because of wetter or dryer, soils.

MESOPOTAMIA or **IRAQ,** an independent state under a mandatory power, comprising the territory lying between the Euphrates and Tigris in Western Asia. The Arabs call those rivers El-Frat and Shatt respectively; the latter is also called Ed-Dijleh in its lower course. This region, extending from Arabia to Persia, was formerly included in the Ottoman empire. Its independence was recognized in the treaty of peace with Turkey, after the World War, and it was placed under mandate to Great Britain. A council of state was formed in 1920 and administered the country under the mandate provisions. On 23 Aug. 1921 the British High Commissioner proclaimed the Emir Faisal King of the Iraq, 96 per cent of the populace having voted for him. The territory is divided into the vilayets of Mosul, 35,130 square miles, Bagdad, 54,540 square miles; and Basra, 53,580 square miles; total, 143,250 square miles. The population of Mesopotamia, or Iraq, according to the census of 1932, was 2,857,077—Bagdad, 1,362,800; Basra, 789,800, and Mosul, 704,688. The country to which the name properly applies as extending between the two rivers has a gradual fall of nearly 1,000 feet from the spurs of the Taurus range to an old coastline south of Hit, whence an almost unbroken plain stretches to the Persian Gulf. The natives give the name of El Jezireh (the island) to the upper or northwestern portion, and that of Irâk Arabi (the ancient Babylon) to the lower or southeastern section. This latter, indeed, is often excluded as being beyond the confines of Mesopotamia proper. Low ranges of hills break the great plain of Upper Mesopotamia; between them the Khabur and its tributaries flow to the Euphrates, through a desolate region that was once thickly populated. The mountain district bordering the plain and stretching to the Persian frontier forms part of "Kurdistan," a mere name that has no concrete geographical existence, being mostly comprised in the vilayet of Diarbekr and belonging mainly to Mesopotamia. Ethnically it includes the Kurdish and the Arab nomad tribes — respectively of Iranian and Semitic stock. Upper Mesopotamia is rich in grain, wine and pasturage; the lower is flat, dry and unfruitful. Between the Khabur and the Euphrates lies the Biblical *Aram-Naharaim,* or Syria of the Two Waters, also called *Padan-Aram,* or Syria of the Plain. It is mentioned in the Old Testament in connection with Isaac and Jacob (Gen. 24 and 27). The Greek title was probably not in use till after Alexander the Great invaded the East. The soil consists of a sandy clay of excellent agricultural properties; only where water fails is it incapable of cultivation. Its remarkable fertility is shown by the fact that it still remains unexhausted after having supported through many centuries the Assyrian, Babylonian and Persian empires. The number and vastness of the ruins that lie scattered over this region from Babylon to Nineveh still bear silent testimony to its former flourishing condition. Since the cuneiform inscriptions gathered from these ruins have yielded up their secret to the researches of modern science, we have learnt with certainty that the plains of Mesopotamia were the scenes of successive civilizations, rivaled in splendor and antiquity only by those of ancient Egypt. To-day, in certain localities, may be found lions, leopards, wild asses, boars and gazelles.

Mesopotamia is essentially a land of origins; so far as we know it cradled the human race and nurtured it for centuries until a new era was introduced by the Flood incidents, which are recorded not only in the Hebrew Scriptures, but also in the cuneiform inscriptions. Its early history is one of constant struggles for supremacy between contending nations. Mesopotamia and its adjacent plains have been associated with some of the most important turning-points of human history; for milleniums

these lands contained the capitals of great world-empires and have been closely connected with the most thrilling epochs of history. Even in the World War of 1914–18, Mesopotamia — by reason of the Bagdad Railway schemes — played a rôle the importance of which is as yet but inadequately recognized, for that railroad was the keystone in the German aspirations toward a world-empire. The Mesopotamians sprang from the Chaldæans, the primitive inhabitants; from the Cushites, who in the reign of Nimrod built the cities of Edessa and Nisibis; and from the descendants of Shem, of the tribe of Thara. The Hebrew race took its rise from this land when Abraham came from Ur of the Chaldees and settled in Canaan. It was also in this plain of Shinar that the confusion of tongues occurred. Babylonia was the mother of astronomy, and the 12 divisions on the dials of our clocks originated there, while the influence of Hammurabi's famous laws has penetrated down the ages into the legal codes of modern times through the intricate systems of Greek and Roman legislators. Mesopotamia was originally a part of Nimrod's dominions, the founder of Calneh or Nippur. After an interval of more than 700 years (2000 B.C.) Cushan Rishathaim reigned in Mesopotamia, who extended his territory over the Euphrates. The Israelites, who then possessed Palestine, were compelled to pay him tribute for the space of eight years. In the Golden Age of the Assyrian power (790 B.C.) Mesopotamia was entirely subjected to that empire, and suffered the fate of its subsequent conquerors. Trajan brought it under Roman dominion in 106 A.D., but the Persians did not permit the Romans to remain long in undisturbed possession, for it was a constant cause of war between the Roman and Persian empires, and at last Jovian surrendered it to the Persians in 363 A.D. When the Arabs in 651 established a new empire upon the ruins of the Sassanide kingdom, Mesopotamia was also obliged to submit to the storm. In 1040 it fell into the hands of the Seljuks. From that time it had many rulers in rapid succession. Genghiz Khan made himself master of it in 1218, but in 1360 it fell into the hands of Tur Ali Bey. Timur conquered it 40 years later, and in 1514 it was incorporated in the Persian Empire under Ismael Sophi. In 1554, however, the Persians were compelled to surrender more than half of it to the Turks; and though they again recovered the lost portion in 1613, they were unable to withstand the attacks of Amurath IV, who united this in 1637, with many other provinces, to his empire. Despite its vicissitudes and the wars fought on its soil, the country remained rich and prosperous until the battle of Kadisia (635 A.D.) placed it at the mercy of the Arabs. Assyria and Babylonia were the wealthiest countries of antiquity, and Mesopotamia was the richest part of the great Persian Empire. In olden times Babylonia was perfectly irrigated, but the wonderful system of canals fell into ruins under the Turks. As the nomads pressed forward the peasants were driven from their lands, and the great irrigation works were neglected, and the Euphrates, no longer controlled, spread out into wide fever-bearing marshes. The work of devastation commenced by the Arabs was completed by the Tartars, Mongols and Turks, with the result that one of the most fertile regions in the world became practically a desert abandoned to nomads. Arabs now form the majority of the population, though the original inhabitants are still represented by Kurds, Yezidis or "devil worshipers," Nestorians, Chaldæans or Roman Catholic Aramœans and Jacobites in the north; and by Salians in the south. There are about 80,000 Arabic-speaking Jews resident in Mesopotamia who guard with reverence the traditional tombs of Joshua near Bagdad, of the prophet Ezekiel near the banks of the Euphrates, and of Ezra the Scribe on the Tigris near Kurnah. Besides its wealth of biblical associations, Mesopotamia is a land of sacred memories to hundreds of millions of Mohammedans. Two gilded domes on the splendid mosque at Kazmain cover the tombs of eminent teachers; this and the mosque at Samarra are Shiah shrines. A mile away, on the left bank of the Tigris, is the stately Hanifi mosque of the Sunnis at Muaththam, and the famous mosque of Abd ul Kadir is in Bagdad. The tomb of Mohammed's barber, Salman Pâk, is near the ruined arch of Ctesiphon. The holy Mohammedan cities of Kerbela and Nejif are near the banks of the Euphrates, to which thousands of embalmed corpses are brought by pilgrims every year from India and Persia for interment. Under the blighting misrule of the Turk Mesopotamia became one of the most desolate countries on earth, swarming with vermin and insects. What little manufacture is carried on is used for home consumption. Sugar, cloth, coffee, iron, indigo and copper are imported; the chief exports are dates, wool, cereals, gum, rice and hides. The foreign trade is mainly with Great Britain, India and Persia. From ancient times the country has been noted for its oil springs. The wells at Kirkuk and Jibbeh and others have been producing oil for centuries. The modern fields are on the Persian Gulf and in the Mosul region. Steamers can navigate the Euphrates as far up as Meskineh. The principal towns are Diarbekr, Urfa (Edessa), Harran, Mosûl and Bagdad. Basra, on the Shatt el-Arab (the confluence of the Tigris and Euphrates from Kurna) is the port of transhipment from river to ocean craft. The standard of education in Iraq is being steadily raised and public interest is increasing. In 1922 the foundation stone of the future Bagdad University was laid and construction was begun.

Mesopotamia and the War.— It has already been mentioned that Mesopotamia was the keystone of the Pan-German scheme by reason of the Bagdad Railway. According to German authorities on the subject, there were three alternative plans to promote the expansion of Germany into a great world-empire. In the early stages of the Pan-German movement, the vision of its advocates was fixed upon South America as the most promising territory upon which a Greater Germany might be built. Here, however, the Monroe Doctrine stood in the way. The British Empire, as the largest landholder in the world, then became the focus of the Pan-Germanists, and here, again, a formidable barrier stood in the path — the British navy. Two avenues being thus barred by obstacles which could only be removed by an overwhelmingly powerful fleet, a third plan presented itself, a plan which provided for an

Primitive native Mesopotamian oil refineries have been used for centuries.

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Mounds of grain awaiting shipment from Basra in Iraq (Mesopotamia).

MESOPOTAMIA

Native oil dealer repairing containers for his product.

Modern petroleum plant near Kirkuk, Iraq (Mesopotamia).

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Shipping barreled oil from Iraq (Mesopotamia).

overland expansion where no Monroe Doctrine existed and no British navy could intervene. The scheme was to gain control of the Balkan peninsula by the elimination of Serbia, the only hostile barrier separating the Central Powers from a friendly power, Bulgaria. This accomplished, the road lay open to Constantinople, a junction which, in its turn, opened the door to Asia, via the Persian Gulf; to East Africa and Australia. The principal artery of communication lay in Mesopotamia — the Bagdad Railway. It was calculated that this project could be carried out without coming into physical contact with either British territory or navy, and would place Germany in a position eventually to strike both at India and Egypt, a variation of Napoleon's plan of campaign for breaking the power of Britain. According to Prince Bülow, former German chancellor, this undertaking "threw open to German influence and German enterprise a field of activity between the Mediterranean Sea and the Persian Gulf, on the rivers Euphrates and Tigris, and along their banks. If one can speak of boundless prospects anywhere, it is in Mesopotamia" ('Imperial Germany,' p. 116). These words were no exaggeration, for Sir William Willcocks, an English engineer who had surveyed the country and planned a gigantic system of irrigation, part of which he had carried out before the war, had said, in 1903, that "Of all the regions of the earth, no region is more favored by nature for the production of cereals than the lands on the Tigris." This authority stated that the irrigable area of Mesopotamia was from two to three times as large as that of Egypt, which leads to the presumption that the country could support some 30,000,000 people. Persia and Turkey being decrepit and moribund states, the Pan-Germanists saw in Mesopotamia a field for exploitation which would make it for Germany what Egypt was to Great Britain or Morocco to France. German professors had painted the possibilities of this region to enthusiastic audiences in glowing colors, and had not omitted to point out that a German foothold on the Persian Gulf would imperil the position of Great Britain in India and Egypt. Now the most important route of the British Empire is the sea-route from England to India and Australia via the Suez Canal. The value of the Persian Gulf as a strategical British position has been pointed out by Admiral Mahan, on account of the Red Sea being merely a continuation of the Suez Canal, both of which could be dominated by a hostile power holding the gulf. The British, however, have not awakened to the importance of the gulf only in recent years, for already in the days of Queen Elizabeth it was visited by English vessels; before ever the Turkish crescent appeared on the shore of Arabia the English flag was known and respected in the Persian Gulf. The East India Company planted a depôt at Bandar Abbas in its early days and for nearly two centuries fought with Dutch and Portuguese rivals. The Anglo-Indian navy first surveyed the gulf and provided for its lighting to guide navigation. For 50 years the British hunted the pirates in the gulf and destroyed their strongholds. Altogether, for 300 years the British have been the guardians of the gulf, by protecting Persia, suppressing gun-running and slavery, fighting the plague and introducing the elements of sanitation among the natives on the coastline. All that Great Britain took in return was a spot on an island for a telegraph station; but she allowed no compromise on one point — that no power should be permitted to seize territory and no other flag should dominate those waters: The future of India and of the empire was bound up with British prestige in the Persian Gulf. These considerations explain the suspicion and mistrust of Great Britain regarding the absorption of Mesopotamia by Germany — an avowedly hostile power. In 1899 a German company obtained a concession from the Sultan to build a railroad from Konieh — the terminal of the Anatolian Railway — to Bagdad and Basra on the Persian Gulf, and from that year dates the German penetration of Mesopotamia. On realizing the political objects underlying the scheme, Great Britain protested and a diplomatic conflict began which was still in progress when the war broke out. During 1913–14 a strange medley of diplomatic negotiations were being held on the question of Mesopotamia and the railway, in which England, France, Russia, Germany and Turkey were involved, with the result that Germany obtained the acquiescence of the powers to be the sole *concessionnaire* of the railroad, though England forced Germany and Turkey to fix the terminal well inland at Basra. The lighting, marking and policing of the gulf by England was confirmed by Turkey. Meanwhile, Russian diplomacy had succeeded in creating intangible "spheres of influence" in Turkish territory by which the German railroad through Mesopotamia was hemmed in on either side, while Great Britain held the key of the exit. As compensation for being restricted at that exit, Germany received a concession to build a line from the Bagdad Railway to Alexandretta on the Mediterranean. At a later date Great Britain was apparently willing to grant an extension of the German sphere, for Prince Lichnowsky (q.v.) records in his famous Memorandum that "the greatest concession Sir Edward Grey made to me personally was the continuation of the line to Basra. We had not insisted on this terminus in order to establish connection with Alexandretta. Hitherto Bagdad had been the terminus of the line. In April 1941 the Regent of Iraq, Prince Abdul Illah was deposed following a coup d'etat by Rashid Ali al-Gailani, a pro-Nazi. The latter started an undeclared war against the British who landed forces at Basra on 19 April. Iraqi forces attacked the British airdrome at Habbaniyeh near Bagdad but were repulsed with severe losses. Nazi aid arrived soon after via Syrian airfields and the conflict became largely one of air battles between the Nazis and the R.A.F. On 24 May 1941 it was reported that the regent Prince Abdul Illah had returned to Iraq and was setting up a new administration. For details of the fighting see WAR, EUROPEAN, 1939—Vol. 28, p. 782.

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MESOZOIC ERA, *in geology,* the mid-period of life in geologic time, also called the Secondary Period. Paleozoic precedes and Cenozoic follows this era, these two terms referring respectively to "older" and "newer," or "earlier" and "later," forms of prehistoric life. The subdivisions of the Mesozoic are the Triassic, Jurassic and Cretaceous periods (qq.v.).

The Life of the Mesozoic.—The life history of the era can be best understood, by first referring to the life of the Paleozoic (q.v.). That era was closed under conditions (aridity, glaciation and mountain making) unfavorable to plant and animal life, and as a result many unfit genera failed to live from Paleozoic on into Mesozoic. The long-hinged brachiopods, so characteristic of the earlier era, became extinct early in the latter. A few of the more primitive types persisted, but brachiopods became relatively unimportant. The old straight cephalopods practically became extinct with the passing of the Paleozoic. The nautilus type lived on through, even to the present time, but the era was characterized particularly by the dominance of a type called the ammonites, which appeared in late Paleozoic and died out at the close of the Cretaceous. They evolved rapidly and are valuable time markers. The Mesozoic has often been called the age of reptiles. This group of vertebrates, which appeared toward the close of the Paleozoic, in primitive form, developed rapidly into a number of highly specialized types. The Dinosaurs (terrible reptiles) developed along several lines. The carnivorous group walked on two legs, the two front limbs being very short. It was this reptile that made the famous three-toed tracks of the Connecticut Valley. Some of these Dinosaurs got to be as long as 40 feet. Herbivorous types also developed, great awkward beasts, some of them 80 feet long, 16 feet high and weighing probably 30 tons or more. This type were the largest land animals that ever lived. Late in the era peculiar armored Dinosaurs also appeared, with great horns on their heads and spikes on their tails. The Ichthyosaurs (fish reptiles) took to the sea and developed fins, much after the manner of modern fish. The Pterosaur (wing reptiles) developed the power of flight, some of them having a wing spread of 20 feet. These unusual reptiles all died off suddenly at the close of the Cretaceous, and in the following era reptiles took on a modern aspect. Peculiar birds with teeth, the first known representatives of the feathered world, are found fossil in Jurassic and Cretaceous rocks. A few primitive mammals, mostly of very small size, are known in the Mesozoic, but the group did not develop rapidly until after the close of this era. Among plants, the common groups of flowering plants did not appear until Cretaceous times.

Paleogeography of the Mesozoic in United States.— During Triassic and Jurassic times practically all of the United States east of the Mississippi was land. During Cretaceous the sea encroached on the coastal plain but did not reach the eastern interior region. The history of the west was more complex. During the Triassic a considerable part of the Pacific Coast region was under water but most of the interior was land. Similar conditions prevailed during early Jurassic, but late in the period a great arm of the sea encroached from the Arctic, reaching as far south as northern Colorado. The great differences in fossils seem to indicate that this bay was not connected with the Pacific directly. This arm of the sea withdrew before the end of the period which was marked in California and Oregon by great folding and intrusions of igneous rocks, making the mountain ranges known as the Sierra Nevada and Cascades. In the west the Upper Cretaceous was marked by a great inland sea, over the site of the Great Plains and Rocky Mountains, reaching from the Gulf of Mexico to the Arctic Ocean. Toward the close of the period this sea retreated, leaving great swamps in which coal was formed. The Era was brought to a close by a great period of folding known as the Lanamide Revolution which uplifted the Rocky Mountain Range.

MESQUITA, mās-kē'tä, **Salvador de,** Brazilian poet: b. Rio de Janeiro, 1646; d. Rome, in the early 18th century. He went to Rome, where he entered holy orders and was well known for his Latin scholarship. His 'Sacrificium Jephthæ' (1680), a sacred drama, established his poetic fame among contemporaries. His tragedies from profane history, 'Demetrius,' 'Perseus' and 'Prasias Bithyni,' all appearing at Rome between 1690 and 1700, also had once high rank.

MESQUITE, a tree or shrub (*Prosopis glandulosa* and *P. juliflora*) of the family *Mimosaceæ.* Several species of mesquite are very common in the southwestern United States from Texas to California, extending southward through Mexico and tropical America. In the United States they are usually shrubs, but farther south large trees. The branches are armed with spine, the leaves compound, of numerous leaflets, the flowers small and greenish, in spikes, and the fruit of long indehiscent pods. In the arid southwest the mesquite is often the only source of firewood, which is not obtained from the branches, but from the very large roots. The pods are eaten by cattle, and sometimes by people, for their sweet pulp and seeds. The screw-pod mesquite or tornillo is *Prosopis pubescens,* another southwestern plant, whose pods are coiled in a tight spiral, resembling a screw.

MESS, in the army and navy, and particularly the latter, a company of officers, or crew of a ship, who eat, drink and associate together; in military language, a sort of military

ordinary, established and regulated by the rules of the service, for all the officers in a regiment, and supported by their joint subscriptions, supplemented by a small government allowance. Similar institutions are extended to the non-commissioned officers of a regiment. The enlisted men mess by companies as a rule, but often it is desirable to cut the company into squads for mess purposes. The post commander usually appoints some officer to take charge of mess arrangements. In active service the officers are apt to mess with their own troops, but in camps they have their separate mess. In the navy it is usually convenient to have a captain's mess, another for the wardroom officers, another for the junior officers, another for the warrant officers, etc. The men's mess for the sailors or marines is styled the "general mess," but this is usually divided into sections, as a matter of convenience. It has become common to employ ammunition passers as mess attendants.

MESSAGER, André Charles, French composer: b. Montluçon, 30 Dec. 1853. He received his musical education at École Niedermeyer, Paris, and subsequently studied under Saint-Saëns in the same city. He was appointed organist at Saint Sulpice in 1874. A symphony of his won the gold medal of the Société des Compositeurs in 1876. In 1880 Messager became music director at Sainte Marie-des-Batignolles. Three years later he completed the comic opera by Bernicat, 'François des bas bleus,' and in 1885 produced his own operettas, 'La Fauvette du temple' and 'La Béarnaise.' The following year saw the production of his ballet, 'Les deux pigeons' at the Opéra. Messager's reputation, however, was most enhanced by the comic opera 'La Basoche,' produced at the Opéra Comique in 1890 and in English in London in 1891. It was followed by the operas 'Madame Chrysanthème' (1893); 'Mirette' (1894); 'Les petites Michus' (1897) and 'Véronique' (1898); 'Les dragons de l'impératrice' (1905); 'Fortunio' (1907); 'Béatrice' (1914). Messager became conductor at the Opéra Comique in 1898; was one of the directors of the Covent Garden Opera in 1901–07, and first conductor at the Paris Grand Opéra after 1907. From 1907 to 1914 he was also joint director with Broussan of the Grand Opéra and after 1908 was conductor of the Concerts du Conservatoire. Died, 24 Feb. 1929.

MESSALA (mĕ-sā'lą) **CORVINUS, Marcus Valerius,** Roman soldier, orator and writer: b. about 65 B.C.; d. about 2 B.C. He received a part of his education in Athens, returned to Rome before the second triumvirate and joined the Senatorial party. He fought with Brutus and Cassius at Philippi, 42 B.C., and afterward attached himself successively to Antony and Octavius, served at the battle of Actium, 31 B.C., and the same year was chosen consul. He subdued Aquitania, of which he was made proconsul and was honored with a triumph. For a time he was a prefect of Rome and held the office of augur. Messala was the friend of Horace and other distinguished men of the age, a zealous patron of literature and art, notably of the poet Tibullus, and one of the most eminent of Roman orators.

MESSALINA, Valeria, Roman empress. She married Claudius (later emperor) in 38 A.D.; bore him a daughter, Octavia, and a son, Britannicus; proved herself vicious, licentious and vulgar by her many open amours; and in her husband's absence formally married Gaius Silius, whom she attempted to make emperor. Claudius refused or delayed to punish her, and Narcissus, the emperor's favorite, had her put to death (whether with Claudius' knowledge or not is not known) in 48 A.D. Her reputation was whitewashed in Stahr's 'Agrippina, die Mutter Neros' (1880).

MESSENE, mĕ-sē'nē, the capital of Messenia in Peloponnesus, founded by Epaminondas (369 B.C.) after his victory of Leuctra over the Lacedæmonians, and situated at the foot of the hill of Ithome, the fortress of which formed the acropolis of the new capital. The latter was surrounded by massive stone walls, flanked with towers, of which there are still considerable remains at the modern village of Mavromati. The Greek Archæological Society, in 1895, excavated a colonnade and other parts of the ancient agora. Messene with its acropolis was, next to Corinth, the strongest city of Peloponnesus. It was supplied with water from a fountain called Clepsydra, the spring of which still exists.

MESSENIA, mĕ'sē'nĭ-a, Greece, a department in the western part of Morea (Peloponnesus), bounded on the south and west by the Ionian Sea. The population of this administrative division, including the refugees from Asia Minor, is 248,000. The greater part of the surface is a fertile plain, but there are mountainous lands in the east and northeast. Kalamata, the capital, is in the southeast on the Gulf of Koron (Messenian Gulf). When Messenia was a state of ancient Greece its chief cities were Methone and Pylos (Navarino). Later Messene (Mavromati) was the capital, and the strong mountain fortress was Ithome. A ridge of Mount Taygetus separated Messenia from Sparta. Messenia is celebrated for the long struggle of the inhabitants with the Lacedæmonians in defense of their liberty. In the first Messenian War (743–723 B.C.) the Lacedæmonians, with the Athenians, invaded Messenia. For 20 years the Messenians defended themselves valiantly under their king Aristodemus, who in consequence of an answer of the Delphic oracle which promised them the victory on condition of the sacrifice of a virgin of the royal family, offered his own daughter as the victim. Her lover, to save her life, declared her to be pregnant by himself; and Aristodemus, to prove her innocence, stabbed her with his own hand, and caused her to be opened and sacrificed. The Messenians, though for some time successful, were finally obliged to submit by the loss of Ithome. About 40 years after they again rose, and thus commenced the second Messenian War (685 B.C.), which ended in their entire subjugation. A part of the Messenians emigrated to Sicily, and there founded Messana (see Messina) on the site of the ancient Zancle (668 B.C.). Those who remained were reduced to the state of helots. After 200 years of servitude they again took up arms. This third Messenian War lasted 10 years (465–455 B.C.), and resulted in the expulsion of the Messenians from the Peloponnesus. Epaminondas restored them, gathering together the exiles from the various lands

in which they were scattered. Within the space of 85 days they completed and fortified Messene (369 B.C.) and maintained their independence till the country was conquered by the Romans (146 B.C.). The Messenians remained true to their customs, manners and language through all changes of fortune.

MESSHED. See MESHED.

MESSIAH, The, is a term which is, in John i, 41, and, in John iv, 25, but without the article, applied to Jesus of Nazareth, as the appointed king of the Kingdom of God. The Greek word which is the translation of the Aramaic term meaning Messiah, namely, *χριστός*, in English Christ, is used of Jesu in this same sense throughout the New Testament. The word Messiah itself is a modified transcription of the Greek word *Μεσσίας*. The extract transcription would be Messias, as the word appears in the Authorized Version in both the passages cited above, and the form Messiah is due to the influence of the form of the original Aramaic and Hebrew word. For the word which appears in Greek as *Μεσσία* was, in Aramaic and Hebrew, מָשִׁיחַ (Māšîᵊḥ). All the forms of the term Messiah, as well as the Greek equivalent, *χριστός*, and the English Christ, mean Anointed One, and refer to Jesus, when applied to him, as God's Anointed King.

In the Old Testament, מָשִׁיחַ (Māšîᵊḥ) (English Messiah) is used, in a few cases, without the article, and as an adjective, of priests, who were anointed to their office (Lev. iv, 5 and 16, vi, 22). But, in the definite sense of the Anointed One, or the Messiah of Jehovah (the Lord's Anointed), it is used, with a very few possible exceptions, only of kings. Thus, in 1 Sam. ii, 35, it is used of the kings of Israel in general. In 1 Sam. xii, 3 and 5, xxiv, 6 and 10, it is used of Saul; and, in 2 Sam. xiv, 21, xxiii, 1, it is applied to David. In Lam. iv, 20, it denotes Zedekiah, King of Judah; and, in Isa, xlv, 1, it is applied to Cyrus, King of Persia. Two possible exceptions to its use to denote kings may be found in Psa. cv, 15 (quoted in 1 Chron. xvi, 22) and Hab. iii, 13, where it seems to be used to mean the nation of Israel as the priest people of Jehovah, although, even in these cases, it may refer only to the king. In Daniel ix, 25 and 26, it is very difficult to decide the true meaning of this word, because of the great uncertainty in relation to the correct interpretation of these verses. According to the various interpretations which have been given to them this word would mean a high priest, a royal ruler, or that great king of the kingdom of God known to us as Jesus of Nazareth. It is not certain, however, that both times it is used in these verses it has the same meaning. In Psalm ii, 2, the best and most probable interpretation would make the term denote the great coming king known to us as Jesus the Christ. This is the only passage in the Old Testament in which this term can be taken with any reasonable degree of probability to refer to our Saviour.

In the post-canonical literature, the first clear application of the term Messiah to the great coming king of Israel is found in the Psalter of Solomon, dating from about 63 B.C. In this poetical collection we have a full and clear description of this king and his work under this title. There are, indeed, in the Sibylline Oracles and the Book of Enoch, expressions and terms which must be supposed to refer to the coming and expected king of Israel, but the name Messiah is not used in these writings.

While the pre-Christian use of the term Messiah to denote the divinely appointed and eternal king of the Kingdom of God is thus limited, the Old Testament abounds in statements and teachings relating to this king, and that form of the Kingdom of God in which he is to be ruler and sovereign. In some of the passages relating to this final form of the Kingdom of God it is said that Jehovah himself will be the king, as he was, in reality, in all the history of the kindom of Israel. Consult as examples of passages of this kind, Isa. ii, 2–4, Isa. xxxiii, 22, Ezek. xx, 33, Ezek. xxxiv, 15, Zeph. iii, 15, Zech. xiv, 16. In other passages, in harmony with the idea that, while Jehovah was always the real king of Israel, he was represented in the government by a vicegerent king, his anointed on the throne of David at Jerusalem, it is declared that a great and eternal coming king, who, in some of the passages, is stated to be of the line of David, shall reign as king in the final form of the Kingdom of God. Among the passages of this kind may be cited Psa. cx, Isa. ix, 6 and 7, Jer. xxiii, 5–8, Jer. xxx, 8 and 9, Ezek. xxxiv, 23 and 24, Ezek. xxxvii, 24 Hosea iii, 4, Micah v, 2–5, Zech. ix, 9. Just what will be the relation, in person and in nature, between Jehovah and this Davidic king, is not made clear, or even asserted, in the Old Testament.

Independently, therefore, of the use of the term Messiah, there was a natural and sufficient basis in the Old Testament for the widely-spread belief in regard to the coming of a future Davidic king called the Messiah, which appears to have existed in the time of Jesus. In this belief Jesus himself shared, and this king Messiah, or Christ, he both virtually and formally claimed that he himself was. A virtual claim of this kind is found in Matt. xvi, 13–20, and in the parallel passages, Mark viii, 27–30, and Luke ix, 18–21, and also in the act done by Jesus, of which we have the record in Matt. xxi, 1–11, and the parallel passages, Mark xi, 1–10, and Luke xix, 29–40. A formal claim of Jesus to be the Messiah is found in John iv, 25 and 26.

The rejection of the claims of Jesus by the Jewish nation, and the continuation in that nation of the belief in a coming Messiah, were the occasion of the appearance in Jewish history of several who claimed to be the Messiah after the time of Jesus. Of all these the one who was most generally received as the Messiah by the nation, and who accomplished the most for his people, was Simon bar Cochba (or bar Kozeba), who flourished 130–35 A.D., in the reign of the Emperor Hadrian. For two years and a half, bar Cochba reigned as king, and, at the head of an army of 200,000 men, defied the might of Rome. But, in the end, he and his nation were both crushed beneath the power of Rome.

The Jews of the present day are not all of the same opinion in regard to the Messianic hope. The conservative, or Orthodox, Jews are still looking for the coming of the Messiah, the

great king of the line of David. With the liberal, or Reformed, Jews, so far as the term Messiah is used at all, it is made to stand for a personification of a system of ideas and doctrines, and the coming of the Messiah will be the universal acceptance and the world-wide domination of Jewish ideas and the Jewish religion.

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MESSIAH, The ('Der Messias'). Klopstock's 'Messiah' is German Pietism's most important contribution to literature and modern Germany's most pretentious epic poem, consisting of 19,458 dactylic hexameters as compared with the 12,310 of Homer's 'Odyssey.' When the first three cantos appeared in 1748 in the 'Bremer Beiträge ('Bremen Contributions') it took the public a year to get accustomed to the novelty of its form and content, after which its success was unprecedented, its readers awaiting with impatience the next two cantos, which appeared in 1750, and the next five, which appeared in 1755. On these 10 the fame of the work must rest; for the following cantos, appearing five in 1768 and five in 1773, were probably as disappointing then as tiresome now.

The theme is the redemption of mankind, and the poem starts with Christ's entry into Jerusalem on Palm Sunday, the most exalted subject at hand for the young Jena student of theology, who at the academy of Pforta had come under the influence of Milton through the writings of Bodmer. On going to Leipzig in 1747 Klopstock recast the prose beginnings into hexameters, thus breaking with the traditional Alexandrines and loosing a storm of criticism on his head from the school of Gottsched, while that of Bodmer applauded. It has been said that the work of no German poet before Richard Wagner aroused such controversy. Goethe's Autobiography tells us that his father banished the book from the house because of its blank verse. However, Klopstock broke the sway of the French in epic verse as Lessing did later in the drama, demonstrating the nearer affinity of German to English. He learned a great deal from Milton, but his nature was essentially lyrical, contemplative, mystic, and he often smothers the epic possibilities of his subject in a flood of fervent, more or less seraphic, religious ecstasy, which exhausts the reader. Instead of strong contrasts, going from darkness to light, from misery to bliss, he attempts to portray a mental state of continuous, dazzling brilliancy. Instead of an alternation of clashes there is a contemplative passivity, from which result endless repetitions and long drawn out speeches; so to speak, a massive elaboration of the text of Händel's oratorio, which was but seven years older. Certain descriptions, however, are very successful, such as those of hell, the council of the devils, their punishment through transformation, the trips through the universe made by angels and devils, and especially the vision of the last judgment. Klopstock's taking over of the Miltonic cosmography gave him the opportunity of portraying a great struggle between the powers of light and darkness for the soul of Christ and therefore of man, but instead his angels paralyze their adversaries with a look, which method of warfare is not epic, though perhaps pietistic.

His forte is to excite feeling and to lend expression to the inexpressible even when his characters become speechless. No German poet before him had so mastered the capacities of the language, whether in choice of words or in rhythmic cadence. In a sense he became the creator of modern poetic diction. A flood of epic imitations on various biblical subjects attested his contemporary influence, and all the younger poets of his day learned from him, but the 19th century admired him from an ever increasing distance. Edition: 'Werke,' Franz Muncker (Vols. I and II, Stuttgart 1893); 'Messias und Oden' (Halle 1910). Critical: Wilhelm Scherer, 'Geschichte der deutschen Literatur' (12th ed., 1910); Franz Muncker, 'Klopstocks Leben' (Chap. 4, Stuttgart 1893); G. E. Lessing 'Briefe,' XV, 'Brief: Ueber das Heldengedicht: Der Messias' (1753).

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MESSINA, mĕs-sē'nä, Sicily, town and seaport, capital of the province and on the strait of the same name. Messina is walled, flanked by bastions and defended by a citadel on the south and several forts both on the east and west. The harbor is one of the best in the Mediterranean and so much resembles a sickle that the town took its original Greek name from that implement, called *zancle.* Fronting the harbor is a broad quay called the Marina, adorned with statues and fountains and forming a favorite promenade. The streets of the old town are narrow and dirty, but the modern town, built

since the earthquake of 1783, is generally composed of houses of two stories and has spacious streets, well paved with blocks of lava. Among the public edifices are included nearly 50 churches, many of them of great beauty and adorned with fine sculptures and paintings. The cathedral is a Gothic structure, with a somewhat heavy exterior, but supported within by vast pillars of granite, supposed to have belonged to a temple of Neptune. The viceroy's palace, the archiepiscopal palace, the senate house, grand seminary, college, large and well-endowed hospital, numerous convents, two theatres, lazaretto and arsenals are some of the other buildings worthy of notice. The manufactures consist chiefly of silk goods. The trade, both transit and general, is extensive. The principal exports are silks, olive oil, linseed and other seeds, wheat, wine and spirits; salted fish, licorice, lemon-juice, sumac, essences, rags, sulphur, etc. The tunny and other fisheries are carried on to a considerable extent. A destructive earthquake visited the locality Dec. 28, 1908 destroying about half of the buildings and causing the loss of more than 77,000 lives. Messina has a government university, founded in 1549, which had 10,664 students in 1948, in departments of law, medicine, science and classics. It has also a naval seminary and a number of elementary schools. Messina, under the name of Zancle, is said to have been founded 1004 B.C.; the Messenians obtained possession 668 B.C.; it became a free city of Rome 241 B.C.; the Saracens captured it in 831; Richard I of England with his Crusaders spent six months there in 1191, sacking the town on leaving; from 1282 to 1713 the Spaniards ruled, though the French held it briefly 1676–1678; in 1743 a plague killed 40,000 of the inhabitants; in 1783 an earthquake caused large loss of life; in 1854, 15,000 died of the cholera; in 1860 the city came under Italian rule, and was peaceful and prosperous until the 1908 tragedy. In World War II the Germans made their last stand in Sicily at Messina. Soon after it was abandoned, it was occupied by Allied forces. Pop. (1943) 192,051.

MESSINA, Strait of (ancient SICULUM FRETUM), a channel which separates Sicily from Italy and connects the Tyrrhenian and the Ionian Sea. It has a length of about 20 miles, and gradually widening toward the south, attains a width of 12 miles; but in the north, where it is narrowest, does not exceed two miles. The depth is great, in some parts over 4,000 feet, and a strong current continually running with the tide makes the navigation somewhat difficult, but by no means so formidable as was fabled by the ancients, to whom the rock of Scylla, and the whirlpool of Charybdis, on the opposite side, but at some distance to the south, seemed so dangerous that it was generally believed to be almost impossible to avoid the two.

MESSMATES, Animal. See COMMENSALISM.

MESTA, Perle, American public official: b. Sturgis, Mich., c. 1890. Her father William B. Skirvin made a fortune in real estate and oil in the Southwest in the 1890's. His daughter, educated in private schools at Galveston, Texas, accompanied him in 1906 to Oklahoma City where he organized the American Oil and Refining Company, some of the profits of which he invested in constructing the 14-story Skirvin Hotel. Perle Skirvin, ambitious to become a singer, studied voice and piano until her marriage in 1916 to George Mesta, president of a Pittsburgh machine-tool manufacturing company. During World War I Mr. Mesta was a dollar-a-year man in Washington, while his wife directed the Washington Stage Door Canteen. After the war Mrs. Mesta became a member of the board of directors of her husband's company and they traveled extensively in Europe, generally on business trips. Until Mr. Mesta's death in 1925 they were frequent guests of President Calvin Coolidge at the White House. A few years later, on her father's death, Mrs. Mesta fell heir to a second large fortune. In 1929 she acquired a mansion at Newport and became known as a society hostess. Two years later she was presented at the Court of St. James's. Active in the American Women's Party since 1935, she was chairman of its public relations committee and council member in 1949. Believing the Republican Party had rejected Wendell Willkie's liberal principles, Mrs. Mesta changed her political faith in 1941. She moved from New York to Washington and in a few years gained the reputation of the foremost unofficial hostess in the national capital. Before his nomination for the vice presidency she became acquainted with Senator Truman and his family and was the first to entertain him after his election. Remarkably successful as a fund raiser for the 1948 campaign, she was co-chairman of President Truman's inaugural ball in January 1949. The following June she was nominated minister to the Grand Duchy of Luxembourg, the Senate confirming on July 5. The third American woman to attain so high a rank in the diplomatic service, her resignation was accepted, effective April 13, 1953.

MESTIZOS, mĕs-tē′zōs, or **METIS** (Spanish, mixed), half-breeds; those of mixed blood, especially those descended from Indian and Spanish or Indian and Portuguese.

MESURADO, mĕs-ŭ-rä′dō, **Cape,** Republic of Liberia, West Africa, on the west coast, near the seaport of Monrovia.

MESZAROS, mä′sä-rôsh, **Lázár,** Hungarian revolutionary soldier and patriot: b. Baja, County of Bács, Feb. 20, 1796; d. Eywood, Herefordshire, England, Nov. 16, 1858. He was first educated for the church, but subsequently studied law at Pest. In 1813 he was summoned to join the Hungarian Army by the Emperor Francis I; later entered the Austrian Army, taking part in the campaigns of 1814–1815 against Napoleon, and subsequently in Italy; and several years later was appointed colonel. He was in Italy in 1848, serving as a colonel in a Hussar regiment, when he was chosen by Count Batthyány, who had formed a new Cabinet, for the portfolio of minister of war. Acting in this capacity he was largely instrumental in bringing the Hungarian Army to a high degree of efficiency. In September of that year, having gone to the scene of war in the south, he was defeated before the Rascian ramparts of Szent Tamas. When Austria purposed the subjugation of Hungary, Mészáros took command of

the Hungarian forces in the north, but on 4 January his army was routed at Kaschu. In April 1849 after the declaration of independence he again took command of the Hungarian forces, but after the defeats at Szöreg and Temesvár in August he fled to Turkey. He subsequently lived in England, France, the island of Jersey, and in 1853 came to the United States.

META, mā'tä, a river of South America, which has its rise on the eastern slope of the Andes Mountains near Bogotá in Colombia. It is formed by the junction of two small mountain streams, which unite about 40 miles southeast of Bogotá; then flows east-northeast into the Orinoco; a course of about 650 miles.

METABETCHOUAN, mĕt''ą-bĕt-choo-ăn', Canada, a river of Quebec flowing into Lake Saint John from the south. It is a broad stream, 90 miles long, and navigable for a considerable distance. The celebrated Falls of Metabetchouan over 230 feet high are near its mouth.

METABOLISM (Greek *μεταβολή* a change), the whole series of physico-chemical processes connected with the manufacture of protoplasm and with nutrition and growth. Under the term is included all those changes by which various energy transformations are made possible in the human body. It has been divided into constructive metabolism (anabolism), and destructive metabolism (katabolism). The former comprises the processes by which the substances taken as food are converted into protoplasm, while katabolism is the means by which the protoplasm is broken down into simpler products, such as the excretory or waste matters. Metabolism thus comprises the elementary vital phenomena of plant and animal life. These are the occurrences associated with changes of substance, of form and of energy. All organisms undergo continual changes of their substance or protoplasm, etc., alterations of their form and transformations of the energy which they get from the environment. The human body is essentially an energy transformer. Thus as regards food, since all living matter is continually undergoing decomposition, it must take in substances that contain all the chemical elements of which it is constructed, but the food differs with every form of cell. Plants live chiefly on inorganic substances and animals on organic, that is, material already prepared; no animal being able to live on simple inorganic compounds. Among animals there is a remarkable adaptation to a single kind of food. For example the larva of the fur-moth lives exclusively upon the hairs of fur, which consist of pure keratin; this substance, which is closely allied to proteid, is therefore capable of furnishing all the elements necessary for the formation of the protoplasm of this caterpillar. Dogs when worked hard have been found to be able to live on pure proteid food. On the other hand, according to Verworn, it is impossible for an animal to live solely on carbohydrates or fats, or even on the two together, since there is no nitrogen in these substances.

Vital motion or metabolism is a complex sharply characterizing living organisms, and the taking in of food and the excretion of waste products give to the organism the material with which to regenerate itself and to grow. Metabolism is increased by heat, the consumption of oxygen being increased in cold-blooded animals, but warm-blooded animals undergo a decrease under heat. Thus man in winter has a much more active metabolism than in summer, since he consumes more food at low temperatures.

It is claimed by Verworn that every species of animal possesses a specific metabolism, and that under certain conditions products of metabolism may stimulate an animal to increased growth, while under other circumstances they may retard growth. Thus the usually deadly uric acid in moderate amounts exerts a favorable influence on the size of larvæ of sea-urchins. Illustrations are afforded by experiments in raising snails and water-fleas (*Daphnia*) in small volumes of water; besides the diminished volume, the water fouled by their excretions may not only dwarf but gradually kill them, or produce changes of form. Metabolism is more active in the young than in the adult. Between 9 and 14 a boy requires as much food as a full-grown man, and during the next five years more than a man. The same is not true of girls who increase the amount of metabolism up to the 11th year.

Consult Verworn, 'General Physiology' (New York 1899); Bayliss, 'Principles of General Physiology' (New York 1915); Du Bois, E. F., 'Basal Metabolism in Health and Disease' (3d ed. 1936); Macleod, J. J. R., 'Carbohydrate Metabolism and Insulin' (1926).

METACENTRE, *in hydrostatics,* the point of intersection of a vertical line passing through the centre of gravity of a floating body as a ship *in equilibrio,* and a vertical line through the centre of gravity of the fluid displaced, if the body be turned through a small angle, so that the axis takes a position inclined to the vertical. If the metacentre is above the centre of gravity, the position of the body is stable; if below it, it is unstable. In shipbuilding a vessel must be so designed that its metacentre (its changing centre of buoyancy) is not likely to oscillate so as to permit capsizing.

METACHROSIS, the change of color brought about in the surface of certain animals, either voluntarily or involuntarily, to make them conform to their surroundings. It is exhibited in many of the lower animals as a protective device, especially in cuttlefishes, caterpillars, various amphibians, especially frogs and certain lizards, notably the chameleons. The dark pigment to which the brown or gray colors of metachroic caterpillars are due is deposited in the cells of the outer skin, while the green coloring matter is found in the underlying fat; and, as Carpenter says, experiments have shown that the presence or absence of both kinds of pigment is determined by the surrounding objects through the quality of the light reflected from them, the suppression of the superficial dark pigment allowing the deeper green to show through the skin, and thus give its hue to the caterpillar. It has been shown that the formation of the dark pigment is hindered by the action of certain yellow rays which are absorbed by dark objects, but reflected from green leaves and shoots. The process of change in squids, frogs, etc., through nervous and muscular control of pigment sacs, called chromatophores, is somewhat different, and is explained in the article CHAMELEON.

The power possessed by these animals of adapting their color to their surroundings is of value in insuring protection from enemies. Consult F. E. Beddard, *Animal Coloration* (New York 1892).

METACINNABARITE, a native sulphide of mercury, occurring amorphously, when it is dark gray or black, or in tetrahedral crystals. To its black color it owes its early popular name, ethiops mineral.

METAGENES, Cretan architect of the 6th century B.C. He and his father, Chersiphron, both of Knossus, collaborating possibly with Teodoro di Samo, were the architects of the Artemision (Temple of Artemis) at Ephesus.

METAGENESIS, or **HETEROGONY,** a form of parthenogenesis. It is that type of alternation of generations (q.v.) in which one generation produces only asexually, by division or budding, the other generation exclusively by laying eggs. It occurs during the life history of a number of scattered species of Metazoa, including the coelenterate, *Obelia; Salpa,* the tunicate (a chordate animal); and two or three marine worms. In the *Obelia* there is a plant-like asexual form which gives rise to sexual, free-swimming medusae. The medusae produce eggs and sperms which unite in water and develop into asexual colonies. Another case is that of the aphids, whose asexual individuals produce multitudes of young by budding, the next generation consisting of males and females, the latter laying fertilized eggs. An individual of the first generation is called the nurse; of the second, the sexual animal. The special significance of metagenesis has not been determined, although the process possibly insures better and wider distribution of individuals than could be effected by only the budding colony. In many sexually producing plants there is a similar alternation of asexual and sexual generations.

Another term for this phase of reproduction is heterogony (or heterogenesis), which Hertwig defines as "regressive alternation of generations." He mentions another form of heterogony where two generations with different forms and structure alternate. For example, a hermaphroditic threadworm (*Ascans nigrovenosa*) lives in the lungs of frogs; it produces a form (*Rhabdonema nigrovenosum*) which lives in mud, and which lays eggs giving rise to the ascaris of the frog.

METAHEWETTITE, a dark red mineral consisting of hydrous calcium vanadinite occurring in microscopic crystals with uraninite and carnotite at several localities in Utah. Probable composition $CaO.3V_2O_6.9H_2O$; a source of vanadium.

METAL WORK, any work done in metals, but especially handiwork practiced as a decorative art, in which the materials are metal and the designs are executed in repoussé or relief. This may be accomplished either by carving or expert hammering as of thin sheet metal. The term includes jewelry (q.v.) and goldsmith's work; hence its materials are often precious metals and its end personal adornment. But it is often applied to larger work and especially to metal decoration in architecture, apparently a later development in the arts than was the jeweler's trade, which flourished in classical antiquity, and everywhere seems to have quickly followed the most primary knowledge of metallurgy in industrial evolution. The Middle Ages were the great period of metal work, notably in connection with Gothic art. Even the more valuable metals were lavishly used in this epoch, as before in the Byzantine period, and since in the architecture of the Greek Church, above all in Russia. One of the foremost instances of Italian metal work is to be found in the altars of St. James at Pistoria and of the baptistery of St. John in Florence. Each of these was the work of a line of great artists, whose elaborate work upon them covered more than a century. Cellini (q.v.) was the greatest metal worker of the 16th century. Even more important than this work in silver and gold are the great bronze doors in the Florence baptistery, one by Ghiberti and another by Pisano, each the product of a score of years of labor, and both dating from the 15th century. Wrought iron work began to be used in the 12th century; between the 13th and the 18th centuries in the shape of gates, grilles and screens in ecclesiastical art, and in German locks and hinges of great beauty, it came to its most perfect form. The sepulchral brasses of German, French and English churches should also be mentioned. See BRASSES.

METAL-WORKING, a term describing any method by which the shape, size, physical form, or contour of metal is changed. This change can be the result of hammering, filing, rolling, machining, casting, grinding, stamping, forging, extruding, cold-heading, or any of several other hand or mechanical methods. It embraces every forming process from the handicrafts to the most complicated mechanical forming. Metal-working includes the manufacture of jewelry (using precious metals) and the production of components of such items as automobiles, radios, toasters, business machinery, railroad equipment, home appliances, industrial equipment, and any item or commodity made of metal or having metal in its make-up.

Lathes.—Lathes machine or turn work of cylindrical section by rotating it against a tool. The lathe holds the work between two rigid supports called centers or in such devices as the faceplate or chuck, attached to the end of the spindle. Operations performed on a lathe include turning, facing, drilling, boring, threading, spinning, and skiving. Since the lathe is probably the most versatile machine in a machine shop, there are a variety of types, all of which operate on the same basic principles.

The principal parts of a lathe are the headstock, holding the driving mechanism and rotated spindle; the tailstock, supporting the back center and capable of being clamped at any point along the bed or frame; and the carriage or turret, carrying the tools. On some lathes, where the work is chucked on the headstock, a tool turret is substituted for the tailstock.

The capacity of a lathe is designated by the maximum diameter of work which can be rotated and the maximum distance between centers. Lathes with collet-type or hollow chucks are rated by the maximum bar diameter which will go through the largest collet capable of being taken by the hollow spindle.

The speed lathe is the lathe in its simplest

form, with a simple headstock, tailstock, and tool post for wood turning, metal spinning, and polishing. Work of large diameter can be mounted on the left end of the headstock, outside the bed. Tools are hand actuated.

The engine lathe, most common of all, chucks work or holds it between centers. The cutting tool is power actuated.

The toolroom lathe is a conventional machine with accessories necessary for accurate toolroom work. It usually is equipped with a wide range of spindle speeds and has a relatively short bed

The duplicating lathe is for duplicating the shape of flat or round templates on the workpiece. Air, hydraulic, or electric mechanisms control the tool movement to reproduce the template shape. Irregular contours, steps, tapers, shoul ders, recesses, radii-formed surfaces, and bore contours can be made.

The gap lathe is a variation of the engine lathe in which the ways are stopped short of the headstock, far enough to provide a gap in the bed for swinging large-diameter work.

Spinning lathes are those in which a chuck or a pattern of the part is attached to the spindle and a blank or disk of metal is held against the form by the tailstock support. With the workpiece revolving, a spinning tool is applied to the work from the center outward, forcing the metal against the form.

Turret lathes are special production lathes They are basically the engine lathe with a multifaced toolholder (turret) mounted across the bed and another turret, usually square, mounted on the tool cross slide. Turrets can be rotated to present different tools to the work. The turret lathe can be horizontal or vertical.

Semiautomatic lathes are machines into whicl the operator loads the work and starts the cutting cycle. The machine completes a series of predetermined cutting operations automatically, then stops itself. As many as 10 or 20 tools may operate on the part from front and rear toolslides.

The screw machine, either hand or automatic, is a machine which handles round, hexagonal, or square bar stock. A variation, the chucking machine, is equipped to handle castings or forgings In the class of the automatic screw machine there are two types, the single spindle and the multiple spindle. These machines are designed for production work. The principle of design is the use of a chucking or work-holding means with a slide for carrying the end-working tool turret and a carriage or cross slide on the bed for mounting either a second turret or some other form of cross slide toolholder. These toolholding devices are adapted for mounting a variety of tools, which are applied singly or in groups to the work.

The single spindle machine provides for feeding one piece of bar stock through the spindle for machining. The multiple spindle type has a series of spindles, each carrying a bar of stock. These bars are presented in turn by an indexing mechanism to the successive tools, each tool taking a cut. The operation is automatic. Finished parts, as they are cut off the bar stock, drop into collecting trays. In the chucking machine, parts are machined in a similar manner, but usually are loaded into and removed from the machine by hand.

Milling.—The milling machine ranks with the lathe in usefulness. It consists fundamentally of a power-driven, rotating spindle, which drives the cutter; and a movable table, which holds the work. There are three basic milling machines: knee and column, manufacturing, special. Many variations and combinations of these basic machines consist of features of one type combined with features of others for special work. The milling machine produces accurately one or more machined surfaces on a piece of work by one or more rotary milling cutters having single or multiple teeth or cutter blades. It machines flat or irregularly shaped surfaces, cuts gear teeth and threads, and performs drilling, boring, and slotting operations.

The knee and column type is the standard, general purpose machine made in three styles: plain, universal, vertical. Manufacturing millers are standard machines for quantity production of identical parts. These are made in several styles, including plain milling machines with horizontal spindles, duplex machines with opposing horizontal spindles, the automatic knee and column, the automatic fixed bed, the automatic rise and fall, the tracer controlled, and the hydraulic controlled equipment. Special types are those in which units of standard machines are assembled in different arrangements for certain classes of work. Typical of such special equipment is the planer miller, incorporating the reciprocating action of the planer table with the cutting action of one or more milling heads.

The classification of a machine having as many variations and combinations as the milling machine is extremely difficult. However, on the basis of appearance, design, and use, there are several comparative classifications: knee and column and fixed bed, plain and universal, bench and floor mounting, horizontal and vertical spindle, hand or power feed, jobbing and manufacturing, reciprocating and rotary table, thread milling and planetary milling, and diesinking. Milling machines frequently are incorporated into transfer lines, automatically performing multiple milling, facing, boring, and other machining operations.

Drilling.—This operation is accomplished on a variety of types of equipment and has several allied operations. Boring, reaming, counterboring, and spot-facing are operations dealing with the formation and finishing of holes. A drilling machine is basically a machine designed to hold a tool and to provide means for furnishing it the proper rotating speed and axial feed. Stationary, portable, bench, floor mounted, round column, box column, horizontal, vertical, fixed position spindle, radially adjustable spindle, fixed head, sliding head, table feed, spindle feed, single spindle, multiple gang spindle, multiple cluster spindle, single way, multiple way, and spindle reversing for threading are included in the types of drilling equipment. Drilling can be performed also on boring machines, lathes, milling machines, and jig borers. The distinction between boring and drilling, generally, is that a fluted tool, rotating on its own axis, is used in drilling, whereas in boring a single pointed tool is used which rotates on the axis of a spindle carrying the tool.

On the basis of types of drilling equipment there are many major classes of drilling machines. The sensitive drill is hand fed. The standard drill is similar to it, except that it is built to handle heavier work and has a power feed. The gang drill has a number of spindle machines mounted on a common base with a common worktable, where speed and feed of each spindle

is independent. The adjustable multiple spindle drill consists of a number of spindles operated simultaneously from a single drive through a gear box and universal joints. The radial drill is equipped with a vertical spindle tool carried on a horizontal arm, which may be swiveled about a vertical column, and the spindle can be adjusted radially on the arm. The horizontal drill is a special purpose machine with horizontal spindle movement. The way drill is an arrangement of spindles on machine ways with adjustable spindle position.

Since drilling is probably the most common of machining operations, extremely diversified methods have been developed for this operation. In cases where precision accuracy of hole size, concentricity, taper, and location are required, jig boring machines frequently are employed.

Closely allied to drilling, other machining functions are done on the same type of equipment. Reaming is the finishing and final sizing of holes drilled. Counterboring often is performed to act as a recess for bolt heads. Machined parts frequently are spot-faced for work location in subsequent machining operations or for providing a more suitable area to drill. Drilling machines with reversible spindles often are used in tapping or threading holes to receive bolts because the reversing feature permits the tap or threading tool to be retracted from the hole without destruction of the threads.

Boring.—Boring machines normally are used to form holes of larger diameter than can be drilled and for extreme accuracy. Drill diameters are somewhat limited, but single-point tools can be mounted on spindle extensions or boring bars of any diameter. Also single-point tools can be mounted on stationary toolholders and the work can be revolved against the tool. There are several types of boring machines, including the horizontal boring, drilling, and milling machine; the table, floor, planer, and vertical kinds; and a variety of special types.

One type of vertical boring machine is the vertical turret lathe, which is simply a large lathe stood on end with the headstock on the floor and rotating the work in a horizontal plane. A turret carries the tools. The standard or best-known vertical boring mill handles work of large size. The rating of its machine capacity depends upon the diameter of the largest piece which can be accommodated on the table. The jig borer is basically a vertical spindle milling machine, but is the ultimate in machine tools from the standpoint of accuracy. It will locate accurately and make holes in dies, jigs, fixtures, and gages. Three systems of precision measurement are used in jig boring: end-measure location, precision lead-screw location, and scale and microscopic location.

One specially designed boring machine of high accuracy, using the end-measure system of tool locating, is a patented combination boring and milling machine known as the Jig-Mil. Special boring machines include those employed for such work as boring automotive and Diesel cylinders, locomotive connecting rods, and locomotive steam cylinders.

Grinding.—This is a metal-working technique which removes material with an abrasive wheel instead of a cutting tool. It does not wear down the metal, but actually cuts it away in very small chips. Closely allied to grinding are polishing, honing, lapping, and buffing. In polishing and buffing the abrasive wheel is replaced with cloth, rawhide, or composition wheels, and the abrasive is applied to the wheel or work in liquid, paste, or stick form.

There are many types of grinding machines, ranging from a grinding wheel placed on a hand drill, or on a foot-operated whetstone to a highly complicated machine for special form-grinding. Power for grinding may be electricity, air, or mechanical shaft drive, and operation may range from complete hand control to complete automatic control.

Snaggers and swing frame grinders are used to dress or to clean up castings or billets of metal in a reducing mill. Plain and universal center-type cylindrical grinders, through-feed or in-feed centerless, and both horizontal and vertical spindle surface grinders are common production equipment in machine shops.

Grinding machines provide both a means of rotating a solid or segmented grinding wheel and a method of positioning work against the rotating wheel. Cylindrical grinders are used to grind work of a generally cylindrical cross section, as it is held in position between centers. Centerless grinders grind work of a cylindrical cross section, but the work is held in position by a combination of the grinding wheel, a back-up or driving wheel, and a bar mounted just below and between the two wheels. Work placed on the bar is held between the wheels and the driving wheel rotates it against the rotating grinding wheel. Surface grinders are used to grind flat surfaces either with the periphery of the wheel (horizontal spindle machine) or the face of the wheel (vertical spindle machine).

Included in a numerous assortment of types of grinding machines are: internal grinders for grinding holes, and centerless, cylindrical, portable, disk, and belt grinders. Belt grinding employs an endless belt, usually cloth, to which abrasive particles have been glued. The belt is driven over sheaves and the work to be ground is held against the moving belt.

The type of work performed on grinders is practically limitless. Snaggers, offhand grinders, swing frame, portable, flexible shaft, and disk grinders are used for rough work. Very thin abrasive wheels are employed for cutting to length such items as bar stock and tubes. Belt grinders, polishers, buffers, vertical and horizontal grinding machines are used for surface grinding. Precision work is done on tool-post, cylindrical, centerless, internal, surface, and belt grinders. Special grinders are built for such precision work as finishing crankshafts, camshafts, gears and worms, ball-bearing balls, cams, and threads. Special grinders are in frequent use also for grinding single-point cutting tools, drills, milling cutters, reamers, taps, dies, and knives. Crush grinding, wherein a special form or shape is maintained in the grinding wheel by a device which trues the wheel form automatically, often is employed for grinding special contours.

Face grinders resemble the planer in operation and may employ cup, circular, or segmented grinding wheels. The table, on which the work is mounted, or the wheel may be movable. The way grinder is a special machine for grinding the ways or beds of machines. Profile or contour grinding is similar to pantograph milling, in that models or templates guide the grinding wheel.

Cast-iron or bronze laps or shoes, to which is added oil containing an abrasive, frequently are

METAL WORKING EQUIPMENT

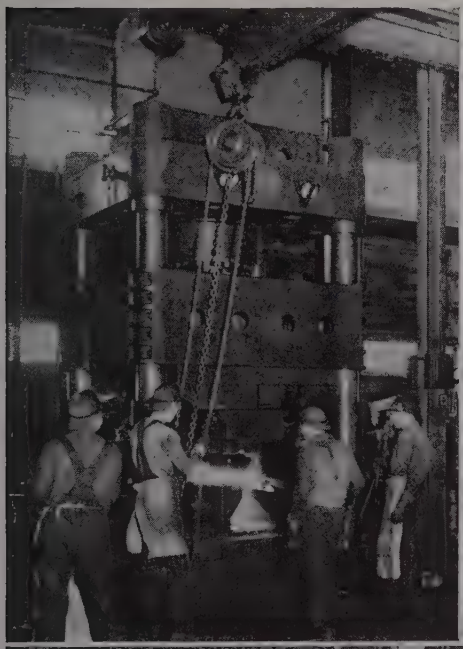
Right: **Sheet metal is often shaped in presses powered by gravity or by mechanical or hydraulic means. This hydraulic press is set up to form the pan-shaped sections shown.**

Center left: **Thick sections of metal are shaped by forging while still hot. This is a hydraulic forging press.**

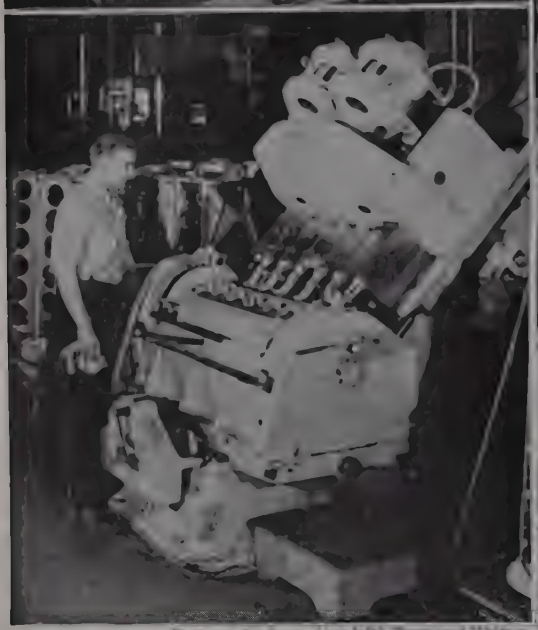
Center right: **This horizontal forging press shapes hot metal slugs by an even application of pressure.**

Bottom: **An open-sided planer. A base for a stamping die is being planed. Mounted on the table, the work is drawn under the planer tool that is mounted on the crossarm.**

Photographs from: (right and center left) Hydraulic Press Manufacturing Company; (center right) Ajax Manufacturing Company; (bottom) Liberty Planer Company



METAL WORKING EQUIPMENT



Photographs from (top left) Rivet and Whitney Div., Niles-Bement-Pond Corp., The [illegible] Co., (bottom left) Excello Machine Co., (bottom right) Cincinnati Milling Machine Co.

Top left— In this Keller-type profiling machine the milling cutter on the lower spindle duplicates the contour of the wooden template by means of a tracer finger. The template is at the top of the column. *Top right*— A band saw cutting off the flange of a metal section. *Center right*— Screw machines are variations of the lathe. This is a single spindle Swiss type. *Bottom left*— This six spindle precision boring mill is finishing the holes in automotive engine cylinders. *Bottom right*— A knee and column type plain miller.

METAL WORKING EQUIPMENT

Right: **The swing frame grinder is generally employed for heavy duty work. Here a line of such grinders is being used to snag billets in a steel plant.**

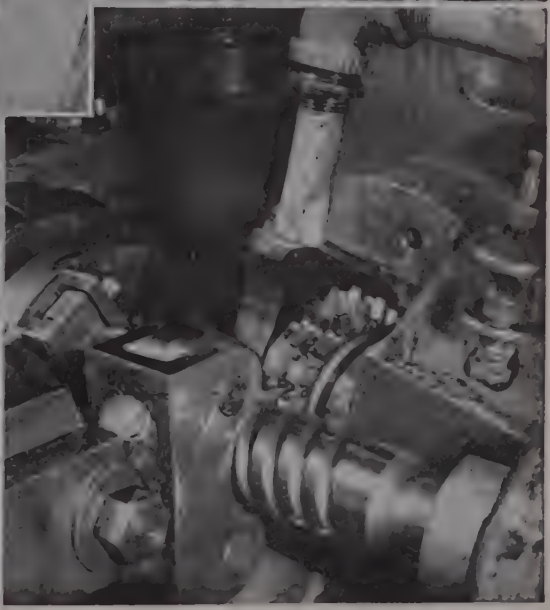
Center left: **Belt grinding is becoming more popular as a grinding and finishing method. Here connecting rods are being belt ground.**

Center right: **Set up to rough grind the needle-bearing end of an engine crankshaft, this cylindrical grinder can finish grind to a tolerance of 0.0003 inches.**

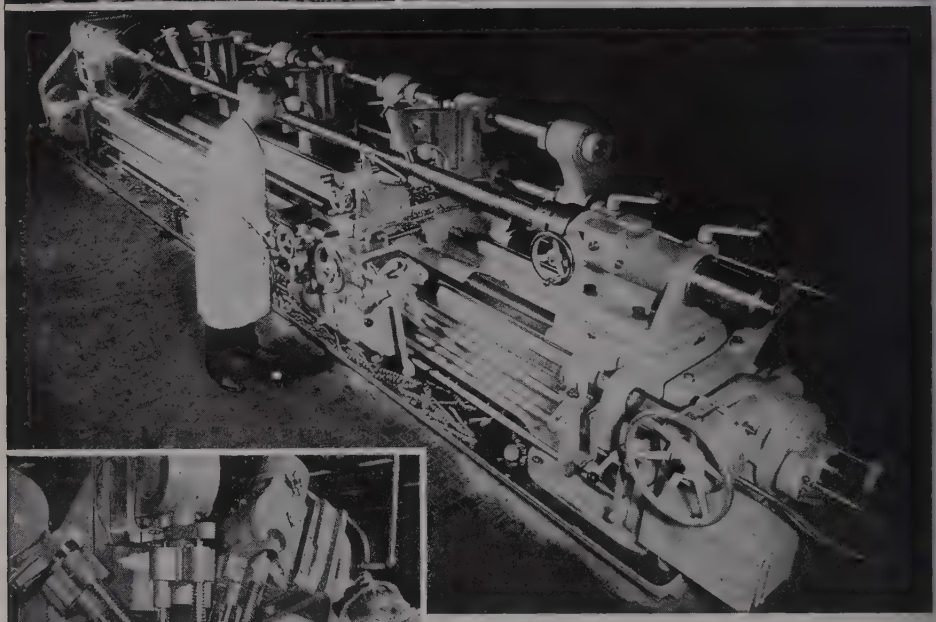
Bottom left: **A precision tapping and threading machine designed for fast and accurate cutting of threads to a Class 5 tolerance.**

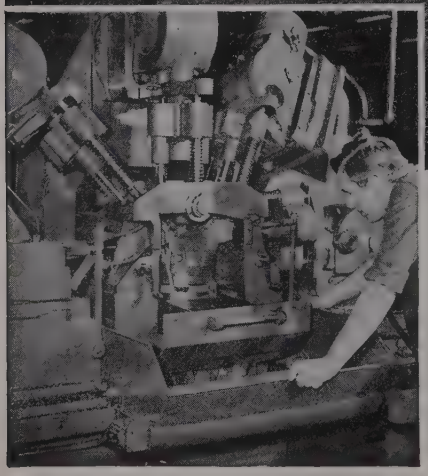
Bottom right: **A double-thread worm gear is being cut by this thread milling machine.**

Photographs from: (right) Carborundum Company; (center left) Porter-Cable Company; (center right) Norton Company; (bottom left) Warner and Swasey Company; (bottom right) Lees-Bradner Company.



METAL WORKING EQUIPMENT





Top left: **This lathe is being used to spin aluminum into a cylindrical shape. The tools used are hand fed, and spinning requires considerable operator skill.**

Top right: **A radial drill. Drilling is the most common of machining operations.**

Center: **The capability of a lathe in performing precision work is typified in the turning of this 15-foot precision lead screw. Critical tolerances are maintained for the length and pitch of the screw and for all threads.**

Bottom left: **Drill heads positioned at various angles drill the required holes in this aircraft engine cylinder.**

Photographs from: (center) Monarch Machine Tool Company; (bottom) Kingsbury Machine Tool Company.

used in lapping. Abrasive sticks are usually employed in honing, and are reciprocated in a bore to finish it.

Broaching.—A machining method which increased in popularity during World War II is broaching. This is a technique in which one or more cutters having a series of teeth are drawn across the surface to bring that surface to a desired shape and finish. The teeth of the broaching tool are arranged one behind the other. They increase in height from the first or roughing teeth to the last or finishing teeth, so that each tooth removes the same amount of metal. The last or finishing teeth bring work to finished size. The tool, which may be pulled or pushed through the work, may be mounted horizontally or vertically. The press is used as the motive power for the tool.

Advantages of broaching are several. It permits high production, extreme accuracy, good work finish, and requires little in the way of operative skill. Except in hole broaching, where the broaching tool locates itself, fixtures are necessary to position the work against the cutting tool.

Normally the tool is pulled through the work in horizontal broaching, but in vertical broaching the tool may be pushed or pulled through the work. Several separate broaching tools may be mounted in the machine so that a number of parts may be finished in one complete cycle of the tools. Continuous broaching machines are special machines which provide means of carrying the work past the tool.

The broaching tool ranges from a tool of the size and shape of a hack-saw blade to one, six, or eight inches wide for finishing in one pass the head of an automobile engine. Tools completely surrounded by teeth are frequently used in finishing holes and in cutting internal gears or internal splines.

Gear Cutting.—Gear cutters are special metal-working machines and are of three types: nongenerating, generating, and profiling or tracing. Machines which form teeth by cutting spaces in the gear blank are nongenerating machines. These spaces are the shape of the cutter. These nongenerating machines use three types of tools: the single-point cutter on a planer or shaper; the circular-form cutter for rough and finish cutting of spur and helical gears, and rough-bevel gears; and the broach-form cutter for internal and external gears.

Machines of the generator type form the gear tooth by a relative rolling motion of the cutter and work. The rack-shaped cutter is employed for spur, helical, and herringbone gears; the pinion-shaped cutter is for internal and external spur, helical, and herringbone gears; the hobbing cutter is used for spur, helical, herringbone, and worm gears; one or more single-point tools serving as a rack can cut bevel, internal-spur, and helical gears; the circular side-cutting tools are for cutting spiral-bevel or hypoid gears.

Gears are cut also in machines using templates or master forms. Bevel and coarse-pitched spur gears often are cut in this manner, using single or double tools.

Planers, Shapers, Slotters.—These are classed in one group, because they perform the same general type of work, that of machining flat surfaces with a single-point tool. The tool is stationary in planing and the work is moved past it by a reciprocating table. The work is held stationary in shaping and slotting and the tool is pulled or pushed over it. Planers are generally employed on large pieces. In handling small pieces the choice depends upon the number of pieces desired. If only a few pieces are necessary, the shaper is likely used. If many are required, they may be mounted in tandem on a planer bed and planed. The fundamental difference between the shaper and the slotter is that the shaper tool travels horizontally and the slotter tool travels vertically or, by a machine adjustment, slightly off the vertical.

Ordinarily on all three machines the tool is pushed through the work. However, a draw-cut arrangement is possible. Planers ordinarily machine flat surfaces on work too large for milling or shaping, the tool being supported on a cross-rail extending over the reciprocating table from one or between two columns. Single-column planers are called open-side planers.

By mounting a spindle rotating mechanism and a milling cutter on the crossrail or the column, a combination-type machine can be built. Such a machine may plane, mill, drill, or bore without changes in setting of the tools or work.

A gear shaper, using a circular cutting tool shaped like a gear, is a special vertical shaper for cutting gear teeth. For large gears the gear shaper may be operated horizontally.

Pressworking.—Under the classification of pressworking of sheet metal are such processes as punching, stamping, drawing, and blanking. Presses may be actuated manually, by gravity, mechanically, hydraulically, or by steam. The operation of a press is basically the reciprocating movement of a ram and a stationary table. A forming punch is attached to the ram, and a hollow die, into which the punch nests with proper clearance, is positioned in the table. Sheet metal, placed over the die, is forced by the punch into the die, assuming its shape, or is sheared as in trimming or blanking.

Presses may have multiple rams which have a combination of actions: single, double, triple. This feature provides for a combination of actions on the workmetal. For example, when a deep cup-shaped part or a part of deep contour, such as an automobile fender, is to be formed, one ram descends and firmly grips the sheet around the edges. The second ram descends subsequently and forms the part. The first ram is known as the hold-down and keeps the metal from being drawn unevenly into the die. This type of press is known as a double-action press.

In mechanical presses application of power can be by gears, screws, cranks, cams, toggles, and knuckle joints. Pneumatic, steam, and hydraulic presses are actuated by air, steam, and oil or water (as the names imply). The position of the ram with respect to its direction of travel can be vertical, horizontal, or inclined. Presses are also identifiable by the design of the frame or housing of the equipment. Such designs include bench, floor, inclinable, open back, straight side, arch, gap, adjustable bed, horning, wiring, shearing, trimming, and gang types.

Presses are used for many other purposes in addition to the forming of sheet metal. Actually, as the word press implies, the machine performs a pressing or squeezing action. Consequently any working of metal by pressure is usually done in a press. Such operations include: straightening of sheet or metal sections, hot or cold forging, extruding, trimming, swaging, up-

setting, blanking, shaving, punching, piercing, bending, drawing, embossing, coining, shearing, sizing. Metal may be broached by placing a broaching tool in proper position in a press and, by special arrangements of the ram and bed, metal parts may be staked or assembled by bending edges or flanges in such a manner as to hold rigidly the metal assembly.

Rolling Mills and Draw Benches.—Into a special category of metal-working machines falls equipment usually found in metal-producing plants. These machines comprise principally rolling mills and drawing equipment. Rolling mills consist of an arrangement of two rolls, between which metal is passed for reduction in cross-sectional area, change in cross-sectional shape, or reduction in thickness. In the mill, provision is made to apply pressure through the rolls to the metal being rolled. Metal may be rolled either hot or cold.

Billet, blooming, plate, bar, pipe, sheet, strip, and structural mills are rolling mills. When rolling mills are arranged one behind the other (in tandem), connected by conveyor equipment, and properly controlled, the arrangement is called a continuous mill, because the work proceeds from one stand of rolls to another automatically, each stand successively working on the material. In rolling material of uniform cross section the rolls are cylindrical in shape. In rolling products such as channels, railroad rails, angles, channels, and I-beams, the rolls are shaped to produce the desired forms. Frequently the rolls coming into contact with the work are backed up by heavier rolls which aid in applying the desired pressures. Such mills are known as four-high mills, because four rolls are arranged vertically one above the other.

Hot-rolled bars, tubes, and rods often are cold-drawn to reduce diameter, to increase the strength of the product and to improve its finish. Hard Tool steel, tungsten carbides, and diamonds are materials used as dies. Holes of precise diameter are pierced in the dies, and the work is pulled through these holes. By making these holes slightly smaller in diameter than the starting material, the work diameter is reduced. The action of the die on the workmetal, called cold working, increases its strength and tends to make the surface bright and smooth. Tool steel and carbides are employed as die materials for drawing bars, tubes, and wire; occasionally diamonds are used in drawing fine wire. In wire drawing, a series of draw dies often is arranged in such a manner that the wire passes through the successive dies, each die further reducing the thickness or gage of the wire.

Other Metal-working Machinery.—There are several other classes of metal-working equipment for sawing, thread cutting, die casting, extruding, cold heading, and casting. Sawing is common and well known in woodworking, and the technique applied in metal-working is similar. Familiar types of saws include the hack saw, the band saw, the circular saw, and the abrasive disk.

Threading machines are of two basic types: those which cut threads and those which form threads by rolling the metal between two dies. Tapping machines, pipe threaders, lathes, milling machines, and special machines are employed in cutting threads. The thread rolling machine places an external thread on a part by rolling the part between two dies, either flat or circular, in which threads already have been cut, and the pressure forces the metal in the part into the grooves of the die.

Casting is a process by which liquid metal is either poured or forced into a sand, plaster, or metal mold, which is hollow, and to which the metal conforms in shape. In die casting, metal is forced into a die chamber under pressure, thus forming a part to rather exacting dimensions.

Extrusion is an operation by which metal, either hot or cold, is forced through a die, to which shape it conforms. A ram forces a metal slug, placed in a hollow chamber, forward through the die. The fundamental difference between drawing and extruding is that in the former the metal moves backward over the punch of the press, whereas in the latter the metal is forced forward ahead of the punch or ram.

Cold heading is used in the manufacture of such common items as bolt heads, nuts, bearing balls. In this process the cold metal is forced by pressure into hollow dies and assumes the shape of the die.

No description of metal-working machinery could include all the types and combinations of types. The job to be done determines what machine shall be used, and if the job is big enough special machines often will be built to do it. Also, necessity will occasionally develop new uses for old machines, especially where experimental work is being done with equipment on hand.

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THOMAS E. LLOYD,
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METALLIC CURRENCY. See CURRENCY.

METALLOGRAPHY, study of the structure and construction of metals by the combined aid of the microscope and photography. It grew naturally out of the microscopic study of the structure, first of wood, next of rock, then of meteorites, and appears to have been first applied to metals by Henry Clifton Sorby, of Sheffield, in 1864, immediately following his study of the microscopic character of meteorites.

The process of micrometallography consists simply in photographing a picture of a small portion of a prepared section of a metal, magnified by the microscope to anything from 20 to 1,000 times.

The section of metal is first polished by means of emery, etc., according to the character of the section, and generally the polishing is followed by etching of the surface of the section, by a solution of nitric or other acid; or the section may be treated electrolytically by being exposed for a brief period in a bath of dilute sulphuric acid through which a current is passed. By etching the section it is thoroughly cleaned, and the actual structure of the metal is thus much more clearly revealed.

Photographic pictures obtained have thrown an entirely new light on the microstructure of metals. Taken systematically at each stage in the smelting, working, or heat treatment of a

metal, they enable us to watch, in effect, what goes on in the metallic mass when passing from the molten to the solid state; when cooling in the solid; when under mechanical treatment as in rolling, drawing, or hammering; when stressed beyond its elastic limits; and in the process of tempering. The results of micrometallography as applied to the study of the formation of alloys, particularly those of steel and aluminum, have proved of exceptional importance.

Indeed, our real knowledge of the formation of alloys only began with the introduction of this process, which has demonstrated that all metals when solid are crystalline, and that the structure of a metal must, therefore, be in accordance with the laws which govern the formation, growth, and arrangement of crystals. See also IRON; METALLURGY.

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See also IRON.—*Iron and Steel, Metallography of.*

METALLOID, mĕt"l-oid, *in chemistry,* any nonmetallic element. These are 13, namely, sulphur, phosphorous, fluorine, chlorine, iodine, bromine, silicon, boron, carbon, nitrogen, hydrogen, oxygen, and selenium. The distinction between the metalloids and the metals is slight. The former, excepting selenium and phosphorus, do not have a metallic luster; they are poor conductors of heat and electricity, are generally not reflectors of light and not electropositive; that is, no metalloid fails of all these tests. The term seems to have been introduced into modern usage instead of nonmetals for the very reason that there is no hard and fast line between metals and nonmetals, so that metal-like or resembling metals is a better description of the class than the purely negative nonmetals. Originally it was applied to the nonmetals which are solid at ordinary temperatures.

METALLOPHOBIA, a morbid fear of metals or metallic objects.

METALLOSCOPY, *in medicine,* study of the influence that the contact of certain metals is capable of exercising on the human body, especially on the nervous system. The study was initiated by the French physician Dr. V. J. A. Burq (1822–1884) in 1849 upon observing that application of plates of certain metals (gold, platinum, copper, iron) on anaesthetized parts of the bodies of hysterics restored cutaneous sensibility. This led to his originating the therapeutic method called metallotherapy (q.v.).

METALLOTHERAPY, *in medicine,* the treatment of diseases, especially neuroses, by applying metallic discs to the skin and by the ingestion of metallic solutions. It was originated by a French physician, V. J. A. Burq.

METALLURGY, formerly defined as "the art of extracting metals from their ores"; now broadened to include "and the fitting of them to industrial uses." It therefore comprises the various types of smelting and metal extraction; the production and refining of metals and alloys; casting, rolling, and forging; heat treatment and such matters as welding, brazing, and soldering. Many of these branches of metallurgy are themselves large industries.

When a company covers all the activities from mining the ore and smelting to fabricating and finishing final products, it is known as an "integrated" company . A good example is Anaconda Copper Mining Company which with its chief subsidiary, American Brass Company, embraces all phases of the industry from mining to finishing and selling the semifinished and final products made from copper and its alloys. Steel foundries and iron foundries are examples of "nonintegrated" companies, because they start with such raw materials as pig iron and scrap, and usually do not mine ore and smelt their own pig iron.

The two broad divisions are often described as *process metallurgy* and *physical metallurgy,* the first covering smelting and the operation of foundries, rolling mills, and producing plants; the second covering the treatment, handling, and fabrication of metals after they have been produced. A process metallurgist must be familiar with chemistry, particularly at high temperatures, because he is usually dealing with molten metal and slags and their reaction on each other. He must also be a fuel technologist and understand the principles of furnace design.

A physical metallurgist is mainly concerned with the internal constitution of the metals and alloys he is dealing with, and such subjects as heat treatment, plastic flow of metals, and the effect of stresses on metals. His work is based principally on physics as well as chemistry, and he must be familar with modern research tools, such as the microscope, the use of X-rays, and the spectroscope. This branch of the industry attracts many women as well as men. Indeed, both major divisions (which interlock in many cases) make use of all the teachings of science, and almost every metallurgical company either has its own research laboratories, or employs people with scientific training to keep informed on new developments and adapt them to its own operations.

Physical metallurgists are also employed by many industries that are not thought of as strictly metallurgical, such as automobile and tractor companies, or the electrical companies like General Electric or Westinghouse. This is because such companies use various metals and alloys in large quantities and have to test them and investigate their properties so as to employ them to the best advantage; also to carry out research work to discover new alloys with properties needed for new products. One of the most interesting developments in recent years has been the production of metals to resist high temperatures and still remain strong, which metals are making possible the development of gas turbines and jet propulsion. Much of this work has been done by the research departments of the large electrical companies with assistance from the makers of tool steels and of metals and alloys already used for high temperature and corrosion-resistant applications.

The history of metallurgy is very long and of great interest. It is true that metallurgy goes back far beyond recorded history. Man became

a tool-and-metal-using being very early in his development, and his continued progress depended very largely on his ability to produce and fabricate metals. The first major use of metals was for offensive and defensive weapons, such as swords, spears, and shields, and this still continues. Everyone realizes how dependent modern armies are on the metals and alloys that go into tanks and guns, projectiles and bombs, modern airplanes, as well as such equipment as radar, proximity fuzes, and signalling devices.

Our civilization, as we know it, depends on modern farming; on transportation by land, sea, and air; on rapid methods of communication; on books and newspapers; on good roads and highways; on machine tools and tools in general, whether they are saws and hammers or bulldozers and tractors; on homes and buildings equipped with modern plumbing, radiators, elevators, and washing machines, along with numerous other pieces of equipment. All of these, together with almost every feature of our civilization, depend on metals in one form or another, such as copper and steel wire, cast iron radiators, tungsten filaments in incandescent bulbs, or steel reinforcing rods in concrete roads and buildings, or steel plate in bridges, ships, and freight cars. The list of metals and alloys and their uses is almost unlimited.

The metallurgist has reason to feel proud of his contributions to these various fields. Many examples could be given. For instance, newspapers, books and printed or typewritten material of every kind depends very largely on type-metal, a direct contribution of applied metallurgy, and of the work of men in many countries. One of the great inventors of the world was Sir Henry Bessemer (q.v.), who as a boy spent many hours in his father's type-metal foundry and there learned the art of founding and the mixing and alloying of metals. This experience stood him in good stead later in life when he was trying to develop improved metal for cannon, which lead to the discovery of the Bessemer process of steelmaking. The great development of this country after the Civil War was largely due to improved transportation helped by the manufacture of rails and other railroad material by the Bessemer process, which was able to turn out the enormous tonnage of steel that was needed at relatively low cost.

Our enormous petroleum industry depends very largely on the cheap transportation afforded by pipelines carrying crude oil and refinery products such as gasoline and kerosine. During the war one became impressed with the importance of this method of transportation when the Big Inch (24-inch diameter), and the Little Big Inch (20-inch diameter), lines were constructed to carry crude oil from Texas to the Atlantic Coast, a distance of about 1,400 miles. Pipeline transportation carries about one ninth of the freight tonnage moved in the country. It has been made possible by the development of seamless and welded pipe, and also by the development of welding lengths of pipe together by means of the oxyacetylene torch and the use of proper welding rods.

The gradual discovery of new metals, or of metals and alloys with new properties, was responsible for most of the development of mankind. Economists measure the importance of countries and races of people by their use of metals; and in the daily and weekly discussions of business, among the most important factors are the production and use of metals or the condition of the industries that produce them or depend on them.

The first important use of metals is often referred to as the Bronze Age when stone implements and weapons were replaced by those of metal. Bronze, an alloy of copper and tin, was not the only metal of this period; gold and some of its alloys were used for jewelry and ornaments; native copper was used in addition to bronze; and steel was undoubtedly used, but rusted away, while bronze resisted the elements. The Bronze Age was succeeded by the Iron Age, then the "steel age," and it is often stated that we are now living in the "alloy steel age," because of the great development of special or alloy steels in recent years. Everyone remembers the great growth of the automobile industry since about 1900 or 1905, but very few know how this was due in large part to the development and application of alloy steels. The Model "T" Ford when first introduced was not a success because the springs would not stand up and many broke. This serious problem was solved by the use of chrome-vanadium steel for springs, properly heat treated. Mr. Kent-Smith, an English metallurgist, came to Detroit and helped work out this problem, because of the experience he had gained in England with this new steel. Then as the automotive industry grew, there also developed the wide application of many alloy steels, and of heat treatment, one development helping the other to their great mutual advantage.

Machine-shop practice has been revolutionized by the use of alloy tool steels and of special materials known as sintered carbides. It is said, even now, that modern machine tools do not develop all the advantages that high-speed tool steels and sintered carbides offer when compared with the old carbon tool steels of 40 to 50 years ago.

Properties of Metals.—Metals have characteristic properties distinguishing them from other materials. We usually think of them as relatively heavy, and with the exception of magnesium and aluminum, their density is fairly high, ranging from a specific gravity of 1.74 for magnesium to 22.4 for iridium and 22.5 for osmium. Of the well-known metals, tin is 7.3; iron, 7.87; copper, 8.94; lead, 11.34; and gold, 19.3. Mercury, or quicksilver, which is the only metal liquid at ordinary temperatures, is 13.55. Uranium is a heavy metal with a density of 18.7.

Most metals have a characteristic luster, generally regarded as their most striking quality, and usually accompanied by a particular color. For instance, everyone associates copper or silver, gold or platinum, with their respective colors, and the colors of many metals and alloys determine their use in industry or art.

All metals are crystalline, that is, their atoms are arranged in a regular order, and this property is of great importance in the study and application of metals and alloys. The atom arrangement is spoken of as the crystal lattice, and by means of examination with X-rays the size of the crystal cube or hexagon or rhomb can be determined, as well as the distribution of the atoms within the cube or other shape. Many metals exist in allotropic forms and the crystal lattice is different in these various forms. Sometimes the external crystal forms are very beautiful and easily visible, as in the case of antimony when slowly cooled from fusion, or such alloys as ferrochrome; but even if the crystal form is not apparent to the eye, it is made evident when specimens are properly prepared and examined with the microscope or by means of X-rays. One result of this crystal formation is that metals and alloys often have directional properties, that is, the physical values vary in different directions, and advantage is taken of this property many times in using them.

The internal structure of metals is closely

allied with the physical properties and is greatly influenced by the treatment the metal has undergone. If cooled slowly from the molten condition, the structure is usually coarse and the material is brittle with little toughness. If, however, the metal is cooled quickly as in the case of die castings poured into a metal mold, then the structure is usually fine and the material has considerable toughness. The coarse cast structure of steel ingots and many other cast materials is broken up by forging and rolling, with corresponding improvements in physical properties, but the greatest and most striking change in the structure of metals is brought about by heat treatment; the variations in physical properties brought about by the latter method are amazing. This is one of the great fields of work of the physical metallurgist.

The hardness of metals varies greatly. Some, like lead, can be indented with the thumbnail. Others, like properly made tungsten carbide, approach the diamond in hardness and are of great value as dies for the drawing of wire, or as tools for machine-shop use in cutting other metals and materials. Here again, proper heat treatment causes great changes in hardness. Properly annealed tool steel can be readily machined and shaped, but after hardening and tempering it is one of the hardest of materials. Many metals vary greatly in hardness according to the work imposed on them. Annealed brass is comparatively soft, but if cold-worked between rolls, or drawn through dies, the hardness is greatly increased. Brass sheet is sold and used in various hardnesses or tempers.

One very important property of metals is plasticity. Some, like gold and lead, can be readily shaped because they are plastic, and even steel has a plastic range. Because of this property, sheet metal can be shaped by deforming between dies, as in the case of automobile bodies and fenders, or brass cartridge cases. Also many sheet metals are "spun" into various symmetrical shapes such as reflectors. This property is influenced by temperature, and most metals are heated to make them more plastic before they are rolled or forged.

Many other properties of metals might be mentioned, such as corrosion resistance. The great growth in the use of stainless steel is familiar to everyone and is largely due to its resistance to the corrosion of the atmosphere and of many liquids (such as milk), of foods and of chemical solutions. The petroleum refining industry makes use of many metals and alloys because of their corrosion resistance, and this is true of various other industries, such as the production of synthetic fibers like rayon and nylon.

Fuels.—Both the process and the physical metallurgist depend on high temperatures in many of their operations for the attainment of which fuels are needed. Every type of fuel is used in some operation or other, and improvements in the use of fuels, or availability of new fuels, register advances in both practice and economy. A good metallurgist must be thoroughly familiar with the fuels available and adapted to the particular operation he has in mind.

The usual classification of fuels is solid, liquid, and gaseous. Typical examples of solids are coal and coke; of liquids are fuel oil and tar; and natural gas, city gas, producer gas, coke oven gas or blast furnace gas are typical gaseous fuels. However, many others are used for particular purposes, such as hydrogen or acetylene for welding, cutting, and brazing operations, and wood or charcoal in certain cases. Electricity is used as a source of heat to an increasing extent. There are many kinds of electric furnaces, depending on the heat of the electric arc. The aluminum industry is based on its own type of arc furnace. The steel industry makes use of arc furnaces in the production of stainless steel, most types of tool steel, and a very large tonnage of alloy steels. A great many heat treating furnaces are of the resistance type, the electric current passing through resistors made of many different materials. Such furnaces can be automatically controlled with great precision. Since about 1935 high frequency heating has come into rapidly increasing use, where again electricity is the source of heat.

The subject of fuels is of increasing importance because the cost of metallurgical operations depends very largely on the kind and amount of fuel used. All fuels possess certain advantages over others. Metallurgical coke is strong and porous. It supports the weight of the charge in a blast furnace or a foundry cupola, and when subject to the blast of cold or hot air near the bottom of the furnace burns very readily, giving the heat necessary for the operation. Nothing has been found so far to replace it economically.

Gaseous fuel can be stored and transported very easily. It also burns readily and leaves no ash. Both gas and the air for combustion can be closely controlled, and burners can be automatically regulated, which means that furnace temperatures can be controlled. The furnace atmosphere can be made oxidizing or reducing as needed, or even neutral in character. Long furnaces can be designed which have burners at the proper intervals.

Most important of all, when using gaseous fuels, the principle of regeneration of heat can be applied. The hot waste furnace gases can pass through chambers filled with a checkerwork of fire brick, and the bricks heated, before the gases pass to the chimney stack. Then by means of suitable valves, the gaseous fuel and air for combustion can pass through such chambers before entering the furnace, and to the heat of combustion is added the physical heat from the bricks. This was the principle discovered by Friedrich Siemens in England in 1856 which made possible the construction of improved glass-melting furnaces and the open hearth furnace for steel making, and this principle is used in coke ovens and many types of heating furnaces.

The subject of fuels and their proper and economical use is so important that most metallurgical plants, especially steel plants, have a fuel engineer with a well staffed department.

Refractories.—Mention should be made of refractory materials which can resist heat and the corrosive action of molten slags and hot gases. They vary from natural sandstones and fireclays to artificial refractories of many kinds. Every advance or improvement in refractories leads to improvement in furnace design and construction, with consequent development of better metals and alloys, or to reduction in costs.

The usual classification is acid, basic and neutral. Typical examples of acid materials are fireclay and firebrick, silica brick and silica sand. The only basic refractories used in industry are calcined magnesite and either raw or calcined dolomite, although Henri Moissan, the French

scientist, did much of his research work with the use of blocks of burnt lime. Chromite, graphite, carbon blocks, and water-cooled metal shapes are among the neutral refractories. Another refractory greatly used in foundry work is molding sand, which stands the temperature of molten metals and forms the molds into which such metal is poured. All of these refractories are important. They form the hearths, walls, and roofs of furnaces; mixtures of fireclay and graphite are used for crucibles; ladles are lined with firebrick or with fireclay, and without refractories metallurgical operations could not be carried on. Research in the field of refractory materials is extensive, and many metallurgical plants carry on their staff a refractories engineer.

The reason for the designation "acid" and "basic" is that such materials have an acid or basic chemical reaction at the working temperature of the operations. For instance, an electric steelmaking furnace usually has a basic hearth of calcined magnesite. This allows and requires that the molten slag covering the bath of molten steel must be basic in character, which in practice means it is rich in lime and can absorb and hold impurities removed from the liquid steel during the refining operation.

The discovery of successful basic refractories to be used in steelmaking practice was made by a young Englishman, Sidney Gilchrist Thomas, about 1875, and was one of the great inventions of the world, making possible basic open hearth and basic electric steel production, and also the basic Bessemer or Thomas process so widely used in Europe.

Fluxes.—Among the raw materials used in process metallurgy are fluxes. Limestone is the most widely used, particularly for blast furnace operations, and burnt lime is used a great deal in other operations. The functions of a flux are to unite with waste materials in the charge at the working temperatures and form a fusible, readily flowing slag which can be easily tapped from the furnace and removed. Calcium fluoride or fluorspar is another flux used in foundry operations, open hearth and electric steelmaking, and also in the production of aluminum.

Furnaces and Equipment.—The types of furnaces and equipment used in metallurgical operations vary tremendously. There are many kinds of blast furnaces. In the production of tin, lead, copper matte, and pig iron, for instance, the size and design vary according to the materials being treated, the fuels used, and the daily tonnage desired. An iron blast furnace is circular in cross section. At the bottom is the hearth or crucible in which the molten materials accumulate, metal on the bottom covered by the lighter slag. The time of tapping varies; slag may be removed every two hours, and the iron every four hours. The lines or design of the furnace vary with the kind of ore being treated. The daily tonnage output also varies from 5 tons to 1,600 tons, according to the size of the furnace and how it is blown or operated. The products of an iron blast furnace must all be either liquid or gaseous, otherwise the furnace would choke up and have to shut down.

A copper blast furnace, on the other hand, is usually rectangular in cross section. A lead blast furnace is generally circular; the molten lead does not collect in the furnace but flows continuously.

The products of these furnaces may be used as such, but in general have to be refined. For instance, lead is treated in large kettles, as they are called. Pig iron is made into steel in various ways: by melting with steel scrap and refining in open hearth furnaces, or by blowing air through it in Bessemer converters. Tool steel is usually made by melting carefully selected scrap steel with some pig iron in electric furnaces and refining under the proper slags. In all these stages of the refining operations, many varied and particular types of furnaces are employed.

For the further working up of the materials, the metals are melted in crucibles, reverberatory furnaces, cupolas, open hearth furnaces, or electric furnaces; then they are cast into the required shape, with the use of many special types of equipment particular to foundries, varying in accordance with the kind of castings being produced, such as magnesium alloys, aluminum alloys, brass or bronze, cast iron, or the many varieties of steel. Or again, the metals may be cast into ingots and fabricated into a great variety of rolled or forged shapes, with the required variety of heating furnaces and forging equipment, such as hammers or presses, drop hammers or forging machines. In regard to rolling mills, there are a great many different kinds turning out sheet, strip, bars, rails, plate, or structural shapes. Other types of mills produce pipe or seamless tubes, while different kinds of equipment are required for cold rolled sheet, extruded bars and shapes, or cold rolled bars. Then again there are the special drawing machines for producing wire, some of them small in size, while others are assembled in groups and cover a great deal of ground.

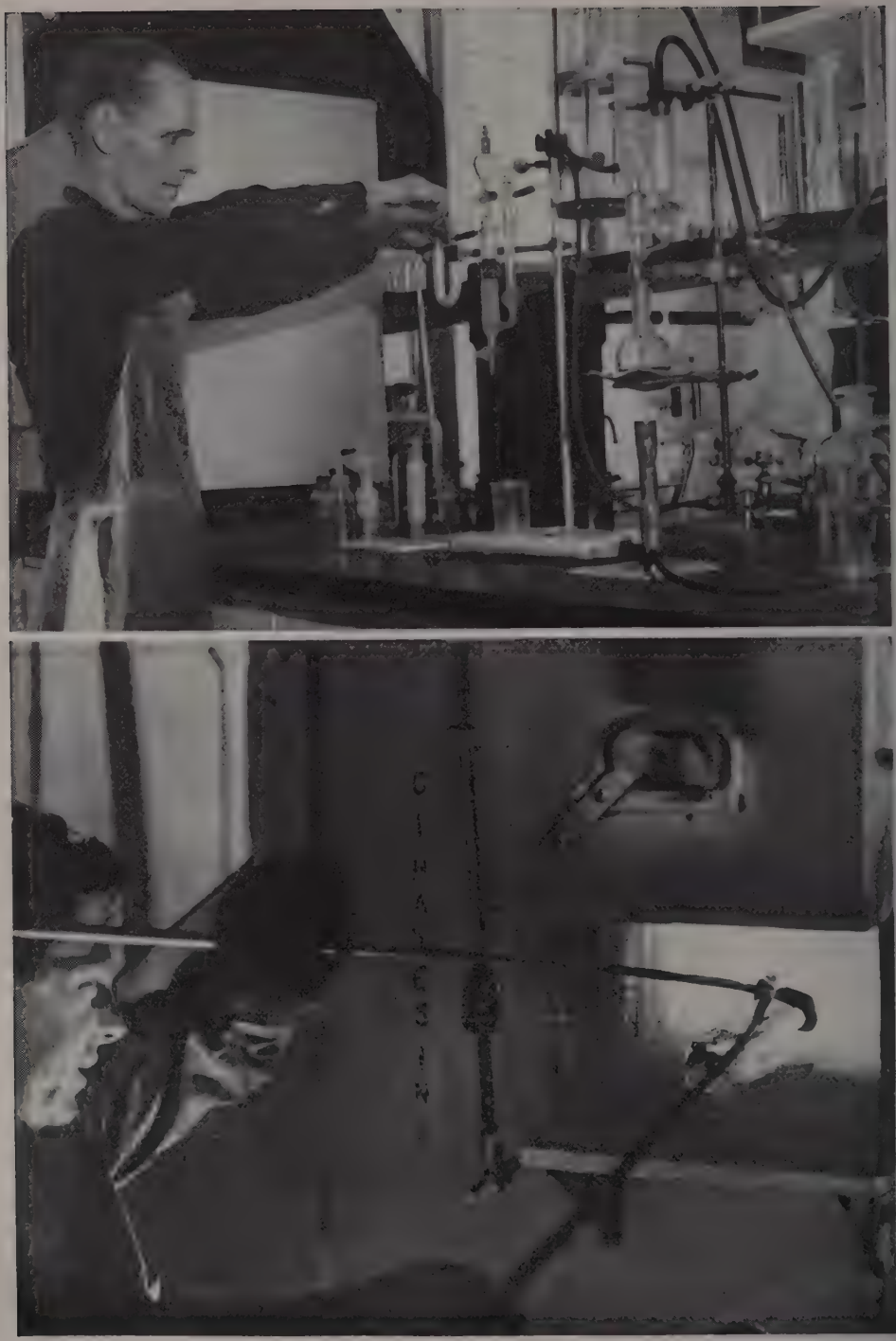
All such equipment requires the trained experience of mechanical and electrical engineers for design and operation, and the metallurgist must be able to understand their work and cooperate with them.

In addition to these types of equipment, an entirely different approach is seen in the field of wet metallurgy, which is closely akin in its methods to the work of the chemical engineer. In such cases the ores or raw materials are usually finely ground and concentrated by various methods such as flotation. Then the concentrates are often roasted or calcined to put them into suitable condition, after which they are leached with various solutions, such as dilute acids or solutions of various salts. The solutions containing the metals are then filtered and subject to precipitation, or the metal salts may be crystallized from solution, after which the precipitates or crystals may be again dissolved and the solutions subject to electrolysis in special cells.

Summary.—This brief presentation of metallurgy attempts to show what a broad field of work is covered by the metallurgist. It gives an explanation of why men specialize in their own small part of this field, and why large companies devote all their activities to the metallurgy of a particular metal, or even to one actively connected with one metal, such as the production of brass or bronze castings, or the manufacture of wire rope. It also shows that there is ample scope for the inventive genius of mankind and for efforts in the line of administration, business, and production. See also articles ALUMINUM; BLAST FURNACE; COPPER; COPPER AND BRASS INDUSTRY; ELECTRIC FURNACES; ELECTROCHEMICAL INDUSTRIES; ELECTROMETALLURGY; IRON; STEEL; also on the separate metals.

Courtesy Anaconda Copper Mining Company

Blister copper being poured from the converter in the foreground. The converting process is the last in the series of elimination processes which finally leave metallic copper. It is now about 99 per cent pure and will be further refined electrolytically.



United States Steel Corporation

Above: By chemical analysis in the research laboratory, the content of crude ore and finished concentrates is determined.
Below: Steel specimen is heated in "muffle" furnace for study in developing its most useful properties.

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GEORGE B. WATERHOUSE.

METALS. Chemists and physicists usually divide the elements into three classes: metals, nonmetals, and inert gases. Metals constitute by far the largest group. At present the periodic table is based on 96 elements; and of these, 73 are considered as metals, including arsenic and silicon (sometimes classed as metalloids), and also including the new elements neptunium and plutonium; 13 as nonmetals including boron and carbon (also sometimes classed as metalloids); 6 as inert gases; and there are still two ill-defined spaces (atomic numbers 85 and 87). The metals are subdivided into light metals, heavy metals, and rare earth elements.

Metals were formerly considered to be those elements which had a metallic luster and were good conductors of heat and electricity; this is still the standard adopted by the average person, to whom metals are not merely elements such as iron, copper, or gold, but also the great class of alloys including such materials as steel, brass, bronze, pewter, or cast iron. The chemists define metals as those elements giving hydroxides which form bases such as sodium or potassium, while the nonmetals give hydroxides which form acids, such as sulphur. It is difficult to make a sharp, clear distinction, since some of the elements meet both requirements.

The following classification is a modern acceptation of the metal grouping in the periodic chart:

Class 1a. Light Metals: lithium, sodium, potassium, rubidium, cesium, and the recently undiscovered atomic number 87, francium.

Class 2a. Light Metals: beryllium (or glucinum), magnesium, calcium, strontium, barium, and radium.

Class 1b. Heavy Metals: copper, silver, and gold. These are typical metals and were known to the ancients. They exhibit the traditional qualities of metals. They are hard, heavy, opaque, malleable and ductile, take a good polish, and are good conductors of heat and electricity. The other three traditional metals are iron, tin, and lead. The properties of these six gave rise to the general classification of metals.

Class 2b. Heavy Metals: zinc, cadmium, and mercury.

Class 3. Heavy Metals and Rare Earth Elements: (3a) aluminum, gallium, indium, and thallium; (3b) scandium, yttrium, lanthanum, and actinium; rare earth elements, cerium, praseodymium, neodymium, illinium (atomic number 61), samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutecium.

Class 4. Heavy Metals: (4a) silicon, germanium, tin, and lead; (4b) titanium, zirconium, hafnium, and thorium.

Class 5. Heavy Metals: (5a) arsenic, antimony, and bismuth; (5b) vanadium, columbium (or niobium), tantalum, and protactinium.

Class 6. Heavy Metals: (6a) polonium (atomic number 84); (6b) chromium, molybdenum, tungsten, and uranium. All of these 6b metals have been used as alloying agents in steel, the first three being extremely important in this respect. Uranium was the heaviest known metal until the production of neptunium and plutonium which are made from uranium.

Class 7b. Heavy Metals: manganese, masurium, rhenium, and neptunium.

Class 8. Heavy Metals: iron, ruthenium, osmium, and plutonium; cobalt, rhodium, and indium; nickel, palladium, and platinum. It will be noticed this class contains the so-called platinum group of metals.

Properties.—Bismuth has the peculiar property of being heavier when liquid than when solid. Like water, it reaches its greatest density just before becoming solid. The relative densities of some common metals in the solid and liquid state are shown in the following table, compiled by the English metallurgist, Sir William Roberts-Austen, working with metals of the purity available to him years ago.

Metal	Specific gravity of solid	Specific gravity of liquid
Iron (pig)	6.95	6.880
Zinc	7.20	6.480
Tin	7.50	7.025
Copper	8.50	8.217
Bismuth	9.82	10.550
Silver	10.57	9.510
Lead	11.40	10.370

As mentioned in the article on metallurgy (q.v.), all metals are crystalline. This is often shown when metals or alloys are fractured. Fracture may be brought about by repeated shock or vibration. Such a fracture is now spoken of as a "fatigue fracture" and is often shown by broken automobile axles or railroad rails. The shock and vibration have not induced the crystalline structure, which was there already, but have brought about the failure.

When heated, metals show a red, then yellow, and finally a clear dazzling white color. The temperatures corresponding to these colors are approximately:

Colors	Degrees C.	Degrees F.
Visible color, black red	525	970
Dull red, low red	700	1290
Red, incipient blood red	800	1470
Cherry, bright red	900	1650
Bright cherry	1000	1830
Dull orange	1100	2010
Bright orange	1200	2190
White	1300	2370
Bright white	1400	2550
Dazzling white	1500	2730

A similar visual color scale is used extensively in the drawing or tempering of carbon tool steels. These temperatures are approximately:

Color	Degrees C.	Degrees F.
Faint straw	205	400
Straw	227	440
Deep straw	246	475
Bronze	270	520
Peacock blue	282	540
Full blue	310	590
Light blue	338	640

Two important properties of metals are malleability and ductility. Both are dependent on the strength and toughness of the metal. Malleability permits metal to be hammered or rolled into thin sheets or foil; ductility permits it to be drawn into wire. The relative malleability and ductility of the common metals, as given by Charles H. Fulton, are shown below:

Order	Malleability	Ductility
1	Gold	Gold
2	Silver	Silver
3	Copper	Platinum
4	Platinum	Iron
5	Palladium	Nickel
6	Iron	Copper
7	Aluminum	Palladium
8	Tin	Aluminum
9	Zinc	Zinc
10	Lead	Tin
11	Nickel	Lead

The malleability of gold is well known. When beaten into gold leaf, it is translucent, the transmitted light being a bluish green. Malleability depends on plasticity, which is affected by temperature. If a metal can be rolled or hammered at ordinary temperatures but not at higher temperatures, it is called "red short." This is the case with many alloys such as certain brasses. If the reverse conditions obtain, the metal is called "cold short." This is the case with many

alloys and is one reason why most materials are heated before rolling or forging. In other words, plasticity generally increases with temperature. The malleability and ductility of many metals and alloys are amazing. Everyone is familiar with silver foil, tin foil, or aluminum foil; and in regard to ductility, a great many materials can be drawn into wire too fine to be seen by the unaided eye.

Physical Constants.—Some physical constants of the metals are shown in the following table. The chemical symbol follows the name of the metal. The atomic number is the position in the periodic chart:

Metal (and symbol)	Atomic number	Atomic weight	Specific gravity	Melting point °C.
Actinium (Ac)	89	228.00	*	*
Aluminum (Al)	13	26.97	2.70	657
Antimony (Sb)	51	121.76	6.62	630
Arsenic (As)	33	74.91	5.73	814 [a]
Barium (Ba)	56	137.36	3.50	850
Beryllium (Be)	4	9.02	1.85	1284
Bismuth (Bi)	83	209.00	9.80	271
Cadmium (Cd)	48	112.41	8.65	320.9
Calcium (Ca)	20	40.08	1.55	851
Cerium (Ce)	58	140.13	6.90	775
Cesium (Cs)	55	132.91	1.90	26
Chromium (Cr)	24	52.01	7.14	1550
Cobalt (Co)	27	58.94	8.90	1490
Columbium (Cb)	41	92.91	8.57	1950
Copper (Cu)	29	63.57	8.94	1083
Dysprosium (Dy)	66	162.46	*	*
Erbium (Er)	68	167.20	*	*
Europium (Eu)	63	152.00	*	*
Gadolinium (Gd)	64	157.30	*	*
Gallium (Ga)	31	69.72	5.91	30
Germanium (Ge)	32	72.60	5.36	958
Gold (Au)	79	197.20	19.30	1063
Hafnium (Hf)	72	178.60	11.40	1700
Holmium (Ho)	67	163.50	*	*
Illinium (Il)	61	*	*	*
Indium (In)	49	114.76	7.31	160
Iridium (Ir)	77	193.10	22.42	2410
Iron (Fe)	26	55.84	7.87	1535
Lanthanum (La)	57	138.92	6.15	826
Lead (Pb)	82	207.21	11.34	327.4
Lithium (Li)	3	6.94	0.53	186
Lutecium (Lu)	71	174.99	*	*
Magnesium (Mg)	12	24.32	1.74	651
Manganese (Mn)	25	54.93	7.44	1242
Masurium (Ma)	43	96.00?	*	*
Mercury (Hg)	80	200.61	13.55	−38.87
Molybdenum (Mo)	42	95.95	10.20	2620
Neodymium (Nd)	60	144.27	7.05	840
Neptunium (Np)	93	239.00	*	*
Nickel (Ni)	28	58.69	8.90	1452
Osmium (Os)	76	190.20	22.50	2700
Palladium (Pd)	46	106.70	12.00	1555
Platinum (Pt)	78	195.23	21.45	1773
Plutonium (Pu)	94	239.00	*	*
Polonium (Po)	84	*	*	*
Potassium (K)	19	39.10	0.86	62.3
Praseodymium (Pr)	59	140.92	6.63	940
Protactinium (Pa)	91	231.00	*	*
Radium (Ra)	88	226.05	5.00	960
Rhenium (Re)	75	186.31	20.00	3000
Rhodium (Rh)	45	102.91	12.44	1966
Rubidium (Rb)	37	85.48	1.53	38
Ruthenium (Ru)	44	101.70	12.20	2450
Samarium (Sm)	62	150.43	7.70	*
Scandium (Sc)	21	45.10	2.50	1204
Silicon (Si)	14	28.06	2.42	1420
Silver (Ag)	47	107.88	10.50	960.5
Sodium (Na)	11	22.997	0.97	96
Strontium (Sr)	38	87.63	2.60	770
Tantalum (Ta)	73	180.88	16.60	2850
Terbium (Tb)	65	159.20	*	310
Thallium (Tl)	81	204.39	11.85	303.5
Thorium (Th)	90	232.12	11.50	1845
Thulium (Tm)	69	169.40	*	*
Tin (Sn)	50	118.70	7.30	231.9
Titanium (Ti)	22	47.90	4.50	1800
Tungsten (W)	74	183.92	19.30	3370
Uranium (U)	92	238.07	18.70	1135
Vanadium (V)	23	50.95	5.68	1710
Ytterbium (Yb)	70	173.04	*	*
Yttrium (Y)	39	88.92	5.51	1482
Zinc (Zn)	30	65.38	7.14	419.5
Zirconium (Zr)	40	91.22	6.40	1700

* Not yet determined. [a] Sublimes.

A great many of the metals shown in the preceding table are produced in large quantities in very pure condition, approaching chemical purity. This is particularly true of those which are precipitated by electrolysis from their chemical compounds. This includes a long list of familiar metals, among which are: aluminum, copper, gold, lead, manganese, iron, nickel, platinum, silver, tin, and zinc. All of these find uses as pure metal in addition to the application of much larger amounts of more impure or commercial material.

Alloys.—Mention has been made of alloys, and these should be considered in greater detail. The great consumption of metals in commerce and the arts is as alloys, which are composed of two or more metals or even nonmetals. For instance, carbon (sometimes considered as a metalloid) is present in practically all steels, and the amount and condition in which it exists determine the properties of all the ordinary steels and many of the special or alloy steels. Sulphur, another nonmetal, is found in all steels, and a very large tonnage of steel is made in which it is introduced specially to influence the properties, and the percentage present is carefully controlled.

Most of the metals with which we come in contact are alloys. For instance, pure gold is too soft for jewelry and coins and is generally alloyed with copper. Our standard for coins is 900 fine, that is, 900 parts per 1,000. Gold has remarkable covering power in regard to color. Pure gold is 24 carat; 18 carat gold is generally used for jewelry, that is, 18 parts per 24, or 75 per cent. Even as low as 9 carat, the gold color still persists. Another alloying metal often used with gold is silver. White gold is very familiar. It is usually a complex alloy containing nickel and zinc to give the white color, with copper and often a small percentage of manganese. Another type of white gold is an alloy of gold and palladium. Some gold alloys for use in jewelry are even red or green.

Silver is used in alloy form to a large extent, particularly for coinage and silverware. Sterling as applied to silver was first used in Great Britain, and the standard of fineness was 925 per 1,000. In the United States sterling silver is usually 900 fine. The standard for coins varies greatly in different countries and in different years. In addition to silverware, silver and its alloys are used industrially to an increasing extent, one of the important uses being silver solders which give very strong brazed joints.

Ordinary solders are another important group of alloys, usually consisting of tin and lead; 40 : 60 is 40 per cent tin, 60 per cent lead; another popular composition is 37.5 : 62.5. Both of these are wiping solders which plumbers use to join lead pipes together. The American Society for Testing Materials (ASTM) lists 28 grades of commercial soft solders in their latest specification, B32-46T. The most generally used soft solder is 50 : 50.

A closely related group of alloys are the white metal alloys, consisting chiefly of lead, tin, and antimony. They are used as bearing metals and for different kinds of type metal, such as linotype, stereotype, and monotype. It is hard to conceive of a more important class of metals when we think of the great influence on the world of newspapers, magazines, and books.

One of the oldest of the bearing metals is Babbitt metal, and the latest ASTM specification

lists 14 typical and varied compositions. However, the best known of these white metal alloys is pewter, the composition of which varies considerably, but tin should predominate, with lead not over 37 per cent. Often antimony and copper are also present.

Lead is used to a great extent in the commercially pure form, but also a large tonnage of lead alloys are used in addition to those mentioned above. Among the most important are the lead-antimony alloys used extensively for battery plates.

Babbitt metal has been mentioned, and in addition to this bearing metal there are a host of others consisting of many kinds of alloys, the mere listing of which would require a considerable space. There are special bronzes of many kinds for bronze bearings, which are primarily copper and tin alloys. Many have been refined by the use of phosphorus and are known as phosphor-bronzes. Many, indeed, almost all, contain lead and are known as leaded bronzes.

When we come to the field of copper alloys, we are dealing with probably the oldest and the largest of the alloy groups. Great industries are based on the manufacture, processing, and sale of many of them, such as the extensive and widespread companies in the Connecticut Valley. These probably started with the manufacture of brass for buttons and have grown to cover every phase of the brass and bronze industry. Copper, zinc, and tin are the three basic metals, with many others being used to produce special alloys. In recent years beryllium-copper alloys have found a place of great importance.

The aluminum alloys would require an article to themselves. Some of them are familiar, especially the hard and strong alloys known as duralumin, used extensively in airplane construction. There are many kinds of this type of alloy. Almost all contain copper, manganese, and silicon, and many of them after proper heat treatment have the strength of certain kinds of steel. Many types of aluminum alloys are used for castings, including many kitchen utensils.

Castings are made of almost every kind of alloy. Toy soldiers are often made of solder. Many plumbing fixtures are made of brass or bronze, or even of stainless steel. One class of castings is becoming of increasing importance, and the alloys used cover almost the whole field. They are known as die castings. The molten metal is forced by compressed air into a closed permanent metal mold. When the metal has solidified, the mold is opened, the casting removed, the mold cleaned, prepared and closed, and again filled. Zinc alloys have proved particularly suited for such application. Telephone instrument parts, typewriter parts, automobile grids, hardware, and countless other articles are made. A typical zinc alloy contains 3 per cent copper and 4 per cent aluminum. Die castings are made from many other alloys including brasses, bronzes, aluminum, and magnesium alloys, and even cast iron.

Magnesium alloys are appearing in increasing amounts. Almost all contain aluminum, manganese, and zinc.

Nickel has only been mentioned in connection with white gold. It has many important uses as commercially pure nickel but many nickel alloys are also used. Monel metal is well known and consists chiefly of nickel, copper, and iron. The widely used electrical appliances depend on heating elements made of nickel-chrome, and nickel-chromium-iron alloys. Heat resisting alloys in general are composed largely of nickel-chromium-molybdenum alloys, and only by the use of such alloys are gas turbines and jet propulsion possible.

All the commercial varieties of iron and steel are alloys of iron. The ordinary steels are thought of as iron-carbon alloys, but practically all contain manganese and silicon as well. In addition, there are probably thousands of alloy steels, such as the special tool steels, steels for castings, forgings, and many varieties of rolled shapes. These steels are often called by the principal alloying material present: for instance, manganese steel used because of its great resistance to abrasive wear; silicon steels used largely in sheet form in transformers and electrical motors and machinery because of special magnetic and electrical properties; tungsten steels used in many kinds of tools; nickel steels used in bridges and highly stressed parts of machinery. Some of the chromium steels are now familiar in the form of stainless and heat resisting steels. One of the best-known types is 18:8, containing about 18 per cent chromium and 8 per cent nickel, but there are many other compositions to meet varying conditions of corrosion and exposure.

Metals, therefore, are not only the elements of the periodic chart, such as aluminum, copper, gold, or nickel, but also the vast and constantly increasing class of alloys.

See also ALUMINUM; COPPER; METALLURGY; METALLOGRAPHY; IRON—*Metallography;* STEEL; also articles on the separate metals.

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* TITANIUM

On Sept. 14, 1948, the commercial production of titanium metal in sponge and ingot forms of 99.5 per cent purity was announced. Initial output was 100 pounds daily and the initial price was five dollars per pound. Today titanium is one of the most important metals whose ever-increasing possibilities are attracting widespread interest. Intensive research is under way concerning its sources, chemistry, and technology, and its growing range of applications. This relatively "new" metal is already important commercially, not only as a white pigment material, but also in metallurgy, in ceramics, in the electrical industry, and as the metal itself. Metallic titanium is light, strong, tough, and noncorrosive. It has desirable properties which recommend it for many industrial applications. Very desirable gem stones have been produced from titanium dioxide.

Titanium is ninth in abundance of the elements making up the lithosphere, the ten-mile-thick crust of the earth, and accounts for 0.62 per cent of the total. It is exceeded in amount only by oxygen, silicon, aluminum, iron, magnesium, calcium, sodium, and potassium, and with the exception of these it comprises a larger proportion of the known terrestrial matter than all other metals combined, including zinc, copper, and lead, which are generally thought of as being quite common. Titanium is five to ten times as abundant as the well-known nonmetals, sulphur and phosphorus. In contrast to its widespread occurrence, however, only a few minerals bearing titanium, particularly ilmenite, rutile, arizonite, titanite, and perovskite, are known to occur in

* From *Titanium, Its Occurrence, Chemistry, and Technology,* by Jelks Bardsdale; published by The Ronald Press Company, New York.

bodies large enough to be of economic importance.

Titanium has many actual and potential uses, based for the most part upon its properties as a silvery white, light, corrosion-resistant, tough, strong metal. Among the metals available for construction there is a gap between aluminum and steel. Aluminum, with a desirably low density of 2.7, is easily formed and machined, but it has relatively low strength and is not resistant to corrosion. Iron, at the other extreme, can be alloyed to give high strength and resistance to corrosion, but its greater density, 7.87, is a decided disadvantage where weight is an important factor. Titanium, with a density of 4.5, coupled with its strength, ductility, high melting point, and noncorrosive characteristic, is the outstanding candidate to fill this gap. It combines the properties of stainless steel with those of the strong aluminum alloys and possesses certain definite advantages over both. One outstanding advantage is its high proportional limit which is comparable to that of heat-treated steels and aluminum bronze, while its density is only a little over half that of these materials. As a result, wrought titanium is in a class by itself so far as the weight of a section having a given proportional limit is concerned. Titanium would be a preferred structural material in aircraft design where a minimum weight combined with a continued high stress is important. A potential use of great importance is for making reciprocating mechanical parts in jet engines where heat and pressure are great. The metal seems almost ideal for ocean-going vessels because of its outstanding properties of lightness, strength, and great resistance to corrosion. As the cost of production is decreased, titanium will be used extensively for structural purposes. Titanium seems well suited for textile machinery where a considerable saving of power can be effected by using such a light, strong metal for high-speed spindles, spools, warp beams, and other moving parts. Another use of the future is in suspension-bridge cables. These properties of titanium may prove important in the eventual utilization of atomic energy.

The surface-hardening property of titanium gives it a definite advantage over the really light metals in the construction of parts subject to frictional wear. It seems suited for automobile pistons, because, in addition to the characteristic properties of lightness and strength, it has a coefficient of expansion a little less than that of cast iron which is ordinarily used for cylinders. Combination of stainlessness, high proportional limit, and low modulus makes it an ideal material for springs, and its use should make possible the construction of greatly improved spring balances and watch springs. Its properties also recommend it for use in tool mountings where a certain amount of give is desirable to prevent breakage. X-ray diffraction tubes with titanium targets are in the development stage. Rubbing titanium metal against a hard surface often produces a smear which is difficult to remove, and this characteristic is employed for a variety of purposes, including the production of very stable high electrical resistance glass, simply by marking the surface with a titanium point. Such smears can be used to coat materials with a metallic film and to etch glass without the use of hydrofluoric acid. The really large-scale use of titanium seems to depend only on its availability in suitable form at a price in line with the common metals such as iron and aluminum. It would be a notable exception to technological progress if titanium, with such desirable properties, failed to be an important engineering metal of the future.

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METAMERISM, *in chemistry,* that variety of isomerism in which chemical compounds have identical percentages of composition and also like molecular weight. When two or more chemical compounds have the same empirical formula, but consist of different radicals united by an element (or a radical) that is common to them all, the compounds are said to be "metameric," and the property itself is called "metamerism." The common element that unites the radicals is usually oxygen or nitrogen. Good examples of metamerism are afforded by the compound ethers and amines. Dipropyl ether, methyl-amyl ether, and ethyl-butyl ether, for example, all have the empirical formula $C_6H_{14}O$; but dipropyl ether contains two propyl radicals (C_3H_7), methyl-amyl ether contains one radical of methyl (CH_3), and one of amyl (C_5H_{11}), and ethyl-butyl ether contains one radical of ethyl (C_2H_5) and one of butyl (C_4H_9); the two radicals being connected, in each case, by an oxygen atom. The structural formulae of these respective compounds are therefore as follows:

Dipropyl ether.	Methyl-amyl ether.	Ethyl-butyl ether.
$\begin{matrix}C_3H_7\\C_3H_7\end{matrix}\!>\!O$	$\begin{matrix}CH_3\\C_5H_{11}\end{matrix}\!>\!O$	$\begin{matrix}C_2H_5\\C_4H_9\end{matrix}\!>\!O$

The following amines, which all have the empirical formula C_3H_9N, illustrate metamerism in which nitrogen is the connecting element:

Propylamine	Methylethylamine	Trimethylamine
$N\left\{\begin{matrix}C_3H_7\\H\\H\end{matrix}\right.$	$N\left\{\begin{matrix}CH_3\\C_2H_5\\H\end{matrix}\right.$	$N\left\{\begin{matrix}CH_3\\CH_3\\CH_3\end{matrix}\right.$

Metamerism may be regarded as a species of accidental isomerism. When metameric compounds are treated with reagents which destroy the bonds between the constituent radicals and the atoms (of oxygen or nitrogen) by which they are united, the several members of the metameric group that is so treated yield totally different products, because they contain totally different radicals.

In zoology, metamerism signifies the repetition of parts in an organized body, as in segmented worms, certain vertebrates, arthropods and lobsters. The meres or segments fall into two classes, those in which the meres repeat with no apparent change and those in which there is modification as the series progresses.

METAMORPHIC GEOLOGY. The process by which one rock is altered into another is known as metamorphism, and the branch of geology which treats of the cause and nature of this change is known as metamorphic geology. See also ROCK CLEAVAGE, METAMORPHISM; METAMORPHIC ROCKS; ROCKS.

METAMORPHIC ROCKS, those rocks of either igneous or sedimentary origin which

have undergone sufficient heat and pressure to be altered into a different kind of rock. In this way limestone becomes marble, sandstone is changed to quartzite, and shale passes over into slate or schist. Metamorphic rocks are usually most abundant in regions of mountains where the rocks have undergone much folding and compression. See MARBLE; QUARTZITE, METAMORPHISM, and the section on *Metamorphic Rocks* in the article on ROCKS.

METAMORPHISM. When rocks of either igneous or sedimentary origin undergo sufficient change so that they largely develop new minerals, and become other types of rocks, they are said to be metamorphosed, and the process is called metamorphism. Such changes may be brought about in many ways. One of the most familiar is the process of weathering (q.v.) by which the minerals of a granite, for example, undergo alteration, the quartz remaining behind as quartz, the feldspar altering chiefly to clay, and the soluble lime, magnesia, potash and soda going to the sea, the first two to form limestone, the latter to produce the salt of ocean water. Thus the complete weathering of a granite and the sorting of the products finally results in the formation of shale, sandstone and limestone. This phase of metamorphism is called katamorphism. It is produced by the atmospheric agencies and results in simpler mineral compounds and rocks.

If on the other hand, a sedimentary rock be subjected to intense heat or pressure, or both, the minerals present recombine to form new minerals, usually more complex, which are better suited to conditions of heat and pressure. This phase of metamorphism is usually called anamorphism. In general usage, the term metamorphism is commonly restricted to what is here termed anamorphism, that is, to those changes due to heat and pressure. The term metamorphic rocks (q.v.) is wholly restricted to rocks which have undergone changes of anamorphic nature. Thus, for example, a shale which has resulted from the weathering of a granite, though it has undergone metamorphism in the broadest sense, is not considered a metamorphic rock.

The heat and pressure which cause metamorphism may be produced by compression and folding over large areas, in which case there is said to be dynamic or regional metamorphis; or they may be due to the intrusion of large masses of highly heated igneous rock (magma), in which case there is said to be contact metamorphism.

Regional metamorphism results largely from pressure, heat is only incidental. The most common minerals to result are those which are flat like mica (q.v.), or elongated like hornblende (q.v.). These naturally develop in parallel arrangement with their smallest dimension opposed to the pressure, that is their larger dimension is at right angles to the compression. This seems to be the easiest way in which such minerals can develop. As a result of this arrangement, such rocks split more easily in certain directions, just as wood splits parallel to the grain. This is called cleavage, and is best manifested in slates (q.v.) and schists (q.v.).

Contact metamorphism, on the other hand, is due largely to heat; pressure plays a less important part. The changes at a contact may be of several types. The rocks may be simply baked or they may be actually fused. The minerals present may recombine to form new minerals. There may be much new mineral matter actually added from the igneous mass, as in the case of contact ore deposits, where ore minerals make up a large part of the contact rock. Or the heat of the igneous mass may drive off substances already present, especially water and carbon dioxide. At most contacts these processes have probably all played a part. The intensity of the metamorphism and the width of the altered zone depends on several factors, such as the size and temperature of the igneous body, the amount of the water or steam present, and the resistance of the enclosing wall rock. A quartzite (q.v.) wall rock may be little changed, while a limestone (q.v.), because of its greater solubility, may be profoundly altered. An abundance of steam aids in producing a marked effect, since it readily works its way out through pores in the rock, carrying much mineral matter. Alteration produced largely by steam or hot water is termed hydrothermal metamorphism. Changes produced by ordinary circulating waters are sometimes termed hydrometamorphism. See CLEAVAGE; GEOLOGY; METAMORPHIC ROCKS; ORE DEPOSITS. Consult Van Hise, C. R., 'A Treatise on Metamorphism,' (U. S. Geological Survey, Mon. XLVII, Washington 1904); Leith, C. K., and Mead, W. J., 'Metamorphic Geology' (New York 1915); Leith, C. K., 'Rock Cleavage' (U. S. Geological Survey, Bull. 239 Washington 1905); Grubenmann, U., 'Die Crystallinen Schiefer.'

METAMORPHOSES. Ovid's 'Metamorphoses,' or 'Transformations,' were published in the year 8 A.D., when the poet was 50 years old. They were finished just before the issue of the imperial order which consigned Ovid to banishment at Tomi on the Black Sea for the remaining eight years of his life. In consternation at the punishment which had overtaken him, he elsewhere tells us that he consigned to the flames his own copy of the poem. But other copies were already in the hands of his friends; it is to these that we are indebted for the preservation of the work.

The poem consists of 15 books in hexameter verse descriptive of the various transformations through which various men and women were conceived to have gone. In the conception of the Greeks almost every river, rock, spring, tree and mountain had attached to it the legend of some such wonderful metamorphosis. Thus the poplar trees are the weeping sisters of Phaëthon; the laurel is Daphne; a spring is Arethusa; etc. The source of this multitude of transformations found in ancient legends is doubtless to be sought in the ancient conception of inanimate objects as animate. Each rock and tree and hill with the Greeks and Romans was a personal being endowed with a spirit. Thus the poplar trees and the fountain and the laurel were regarded as animate to start with; they had not merely become so by receiving the souls of certain men and women. To the vivid imagination of the Greek the waving form of rustling tree or shrub, the moving mass of bubbling or falling water suggested life and individual spirit. The problem was to account for the present form. The inanimate objects represented as the result

of transformations had, accordingly, been conceived as animate from the outset, and the stories of their transformations are merely later inventions devised to account for their primitive conception as personal beings.

Some 250 of the stories belonging to the body of Greek and Roman legend and mythology receive treatment in Ovid's work, which thus becomes a fairly complete treatise on the classic myths. Among the most important of these are the stories of Deucalion and Pyrrha, Daphne, Phaëthon, Cadmus, Semele, Echo, Narcissus, Pentheus, Pyramus and Thisbe, Ino, Perseus and Andromeda, Niobe, Procne and Philomela, Medea, Theseus, Scylla, Daedalus, Philemon and Baucis, Hercules, Orpheus, Adonis, Thetis.

Relatively little space is devoted to the actual metamorphosis in Ovid's poem. The transformation is simply the culmination of a story, generally one of some length. Thus after detailing with great fullness the adventures of the ill-fated Phaëthon with the horses of Phœbus, the poet finally concludes by briefly recounting the transformation of Phaëthon's mourning sisters into poplar trees. So with the other stories; the transformation holds an inconspicuous place, being simply the feature common to all. The different narratives are woven together most ingeniously. There is no break. Each is connected with the preceding and following by some natural link, so that we have one continuous narration from the transformation of the stones of Deucalion and Pyrrha into men to the transformation of Julius Cæsar into the comet which appeared after his death. By the poet's fiction, therefore, the treatment is made to assume the illusion of chronological sequence. In the last books Ovid approaches the legends of the Trojan cycle and of early Roman history, gradually bringing the reader to the events of his own day.

With great artistic skill the poet varies the manner of presentation. The larger part of the stories are his own narration, but monotony is avoided by resort to other devices. Thus a number of legends are put in the mouth of Orpheus. Others are recounted by the three daughters of Minyas to while away the time as they sit at their spinning.

The 'Metamorphoses' is Ovid's masterpiece and has always enjoyed high favor. The poet's own faith in his work is indicated by the concluding verses of the final book, in which he gives free expression to his confidence in the immortality which he feels it has won for him: «Over the stars his name shall soar; as far as the Roman dominion reaches his work shall be read, and it shall live for all eternity.»

The most recent translation is by F. J. Miller in the Loeb Library.

CHARLES E. BENNETT.

METAMORPHOSIS IN ANIMALS, the changes which in many animals take place between the time of birth and maturity. The causes are most probably changes of habitat, of seasons, of food and the acceleration in growth resulting from the approach of sexual maturity. Familiar examples are the change of the caterpillar into the butterfly, of the tadpole into the toad or frog.

In the frog and toad, metamorphosis is complete and thoroughgoing. The embryo on hatching from the egg has a large head and body, but no tail; in a few days its tail grows out and it becomes a tadpole, when it is fish-like, but without fins or limbs. With the growth of the tail, the external gills appear, and the mouth is formed, while the intestine becomes very long and closely coiled. The mouth is armed with horny, comb-like plates, on which develop great numbers of microscopic teeth, which are shed continuously. In changing from the tadpole to the toad or frog, the body, including the skull and rest of the skeleton, and the viscera are made over anew; the external gills disappear as the lungs develop, the true teeth appear in the jaw, the intestine becomes short and straight, and the creature instead of nibbling decaying leaves or dead animals feeds on living snails and insects. Soon the tail becomes absorbed, finally the hind legs grow out, the gills disappear, the front legs bud out and the adult form is attained. While most amphibia pass through such a metamorphosis, in a few forms, owing to the absence of water or other changes in the environment, development is direct, the metamorphosis being suppressed. Metamorphosis may be retarded by cold and shortened by hunger, and in the amphibians or in insects the changes are greatest in modern and specialized forms, as frogs and toads.

The metamorphosis of the butterfly is the most complete of those of all insects. The life of the insects is divided into four stages, that is, the egg, larva, pupa and imago or adult. During the larval and pupal periods the insect is, so to speak, a different animal from the adult. The caterpillar is provided with big jaws and eats voraciously; in shape and structure it differs widely from the winged adult. The pupa or chrysalis is also different from the larva, and also from the imago; it takes no food and rests almost motionless. On the other hand, the butterfly has no jaws, while its maxillæ form a long coiled-up tongue, beautifully adapted for probing the corollas of flowers. Though these changes appear to be sudden, the internal alterations of cells and tissue which lead to them are gradual. From one to three days before assuming the pupa state the caterpillar becomes restless and stops eating. If a spinner it spins a cocoon, or if not it enters the earth to undergo its transformation into a chrysalis, or if a larval butterfly it attaches itself to some fixed object, as a tree or fence. Profound changes now take place in the mouth-parts as well as the nervous, muscular and other systems of internal organs.

But the changes are most marked in the flesh flies and their allies. At the end of the maggot stage, the internal organs are destroyed, breaking up and forming a creamy mass, and the appendages and wings arise from minute internal masses of cells called «imaginal buds» which are present in the maggot. The body is thus entirely made over anew. But while the process of destruction of the larval organs and appendages goes on, there is also a constructive process, during which the organs of the adult state are being built up. It is thus evident that the sharp division of the life-history of the insect into larval, pupal and imaginal stages only applies to the external surface of the body. The internal processes of development, on the other hand, form a continuous series of transformations between which is no sharp line of demarcation. Yet as a whole the form of the

larva, pupa and imago are kept distinct in adaptation to their separate environments and habits.

Hypermetamorphosis.— This name is applied to the changes undergone by certain beetles (*Meloë, Stylops,* etc.), in which there are more than the usual number of larval and resting or pupal stages. Thus, in the common oil-beetle (*Meloë*) and in the blister-beetles (*Epicauta*), the larva hatches as a minute, active, triungulin creature which is a parasite in bees' nests, feeding on their eggs; it passes into a second larval stage, when it is grub-like, inactive, the body being thick, cylindrical, soft and fleshy; this passes into a motionless semi-pupa, and thus after molting assumes a footless larval form; it then transforms into a true pupa like other beetles. There are thus four distinct larval stages, besides the pupa and beetle. Now these stages correspond to the habits and food of the young beetle, and these supernumerary stages and marked changes of form are evidently due to changes of environment, of habits and of food, resulting in the atrophy of limbs in certain stages. This throws light on the causes of metamorphism in general.

No Distinct Metamorphosis in the Primitive Insects.— The wingless insects (*Synaptera*) do not pass through a metamorphosis. And it appears, as first suggested by Fritz Müller, that the habit of metamorphosing is an acquired one. Thus in the more primitive winged insects, such as the cockroach, grasshopper, bugs, etc., metamorphosis is incomplete, the young differing mainly from the adult in not having wings. Also the most primitive arthropod animals, such as the horse-foot crab (q.v.), the spiders and myriapods, pass through no metamorphosis.

Metamorphosis in the Lower Animals.— The more specialized cœlenterates (*Medusæ*), the echinoderms, mollusks and crustaceans, as well as many worms, undergo remarkable changes of form. (See LARVA). The larva of the marine annelids is a top-shaped ciliated creature (*trochosphere*) entirely different from its parent. The marine mollusks pass through a larval condition (*religes*). The young of the sea-urchin, star-fish and holothurians differ remarkably from their parents in being bilaterally symmetrical, transparent and free-swimming; they serve as scaffoldings from which the body of the adult is developed. The shrimps, etc., are hatched in a nauplius or six-legged form, and crabs in a zoëa form.

METAPHOR, a figure of speech expressed in a single leading word; a similitude — for example, "The man is a lion," is a metaphor; "The man is as bold as a lion," is a simile. Metaphor is an ideal characterization or illustration which may be affirmed by one mind and denied by another, or affirmed and denied by the same mind at different times; it is a kind of comparison in which the speaker or writer rejects the circumlocution of the simile and attains his end immediately by establishing the identity of his illustration with the thing spoken of. It is thus of necessity, when well conceived and expressed, graphic and striking in the highest degree, and has been a favorite figure with poets and orators and makers of proverbs in all ages. Even in ordinary language the meanings of words are in great part metaphors; as when we speak of an *acute* intellect or a *bold* promontory: all such words are *in metaphor,* and the *language* may be called *metaphorical.*

METAPHOSPHORIC ACID. See PHOSPHORIC ACID.

METAPHYSICAL DETERMINISM. See DETERMINISM.

METAPHYSICS (from Gr. *Meta ta phusika,* "after physics," alluding to the position of Aristotle's treatise on metaphysics in his works). Metaphysics and epistemology (q.v.) are the twin sciences of the nature of reality and of our knowledge thereof. Metaphysics seeks for the criteria of being, epistemology for those of truth. As the truth is generally conceded to possess some peculiarly intimate relation to reality which is not found in the case of error, and as our sole avenues of access to reality are those of experience, be it sensory, rational, emotional or volitional, the boundary line between epistemological and metaphysical opinions is of the most obscure and wavering nature, so that a separate study of the two disciplines is exceedingly unprofitable. We shall accordingly shift our standpoint continually from that of one science to that of the other.

Metaphysics is not a subject which one can study or refuse to study at will; whether it is explicit or not, there is always some criterion of truth, of reality, that permeates our barest common sense. This may be metaphysically inadequate, but must be metaphysical. When I draw a distinction between a dream and an experience of waking life, between a truth and a lie, between a fact and an error, I am drawing a metaphysical distinction. When a physicist reduces the table before him to a vast aggregate of electric charges, or asserts the basic identity of time and space, or interprets light a transverse electromagnetic vibration, he is nothing if not metaphysical, for he is drawing a distinction between the appearance of things and their underlying reality. Even those who claim to be agnostics or sceptics in the professor's chair are tainted with metaphysics in their daily life, for the only agnosticism, the only scepticism which can free itself from all blemish of metaphysics is an agnosticism, a scepticism so complete that it does not even tentatively maintain any criterion of reality or unreality, of truth or falsity.

We have accordingly three stages of metaphysics to discuss: (1) the metaphysics of common sense; (2) the metaphysics of the natural scientist; (3) the metaphysics of the technically trained philosopher.

(1) The Metaphysics of Common Sense. — The average philosophical layman, be he educated or not, believes that the wall he sees in front of him, the cane that he holds, the song that he hears are real, with an immediate and underived reality. He is confident that the wall, the cane, even the song would be the same with nobody to experience them. He is also confident that he exists, and that his existence is utterly independent of any experience he may have. Now, this view that the object is out there and I am in here, and that seeing is something which needs no analysis (for so the layman believes), works remarkably well providing I only see things that are so. It is, however, clear that in my dreams and other illusions I frequently see things that in some

manner are not so. If seeing is an immediate relation between me and my object, what is my object when I dream of something which, in every common-sense interpretation of the words, does not exist?

This is obviously the highest common factor of metaphysics and epistemology, for it unites the fundamental questions of the two sciences, the question of truth and that of reality. What is more, it is in essence the one cardinal problem of both sciences, the great problem of error. The problem of error may be approached from two different angles, according as there are supposed to be real entities which form the objects of erroneous experience, or no such entities at all. In the latter case, experience must be interpreted as not essentially a subject-object relation. As we shall see, practically all the earlier modern philosophers hold that erroneous experiences have objects. The second alternative is indicated in Spinoza and appears in the philosophies of Kant and Hegel.

(2) The Metaphysics of Natural Science. — Of course, science as such can have no peculiar metaphysics, for the truth is essentially one — unless we adopt the pragmatist attitude — and cannot be changed into a falsehood merely by looking at it through the spectacles of a particular discipline. Nevertheless, there is a certain conventional metaphysics which may be read between the lines of the majority of scientific textbooks, the habitat of which is the laboratory and the specimen-box. Though this may be traced to the Greeks, it owes its incarnation in its present avatar to Descartes and Locke. Both these writers, who are conventionally called dualists, since they believe in the essential distinctness of mind and matter, are really rather what one might name ternarists, inasmuch as they posit between the self and its objects a third class of entities, the ideas, by the mediation of which the mind or self is aware of the outer world. Dreams differ from true waking experiences in that the ideas they contain have no realities corresponding to them. Modern science has turned the real universe into a world of movements of material particles, or of electric charges, without any intrinsic color or sound, and has relegated these latter qualities to the realm of ideas. The physical correlates of these ideas are, of course, particles or charges in motion. By the mediation of the nervous system these particles or charges and their movements are supposed to produce certain alterations in the brain — Descartes considered that they were in the pineal body, while the advance of modern science has placed them in the cerebral cortex — which have as invariable concomitants certain ideas or ideational processes. It is these that form the sole direct object of human inspection.

This theory is perfectly successful in explaining error, but remarkably inadequate in accounting for anything else — any knowledge, that is, which is not a mere accidental blundering belief. The situation is quite analogous to that of a man gazing at the cover of a book and trying to know what is inside. This knot or rib in the cloth *may* cover an exposition of this or that theory, but if the book is permanently locked up, and is opaque, we can never know this. We consequently find that at the very beginning additions and modifications were made in the theory. These, however, belong to

(3) The Metaphysics of the Technical Philosopher. — Modern philosophical tradition may be said to commence with Descartes. Accordingly, he is the first man with whom the metaphysical issues of the present day receive the division and treatment with which we are familiar. We have seen that he divided the world into separate realms, apparently of mind and matter, but really of soul, matter and ideas. Nevertheless, he saw the difficulties of the problem of error and tried to give it a more adequate solution than that pertaining to the conventional philosophy of natural science. As the founder of modern mathematics he tried to introduce mathematical criteria of truth into metaphysics, and so he starts with the proposition, "I think, therefore, I am," the denial of which he regards as self-contradictory in the same sense in which "2 has a rational square root" is self-contradictory. Having thus obtained the existence of the self, he goes on to demonstrate that God exists: "I have an idea of a most perfect Being, and this idea can only come from the Being with the one perfection my idea lacks, that of existence." Once he has got this Being, Descartes asserts that our knowledge of matter receives its guarantee in the honesty of God. This relieves the difficulty we encountered in the metaphysics of the scientist, the difficulty of bringing ideas and their objects into relation, but it is not by any means completely satisfactory. If God is honest, how can we make blunders? By failing to have our ideas clear and distinct, says Descartes. But how can an honest God permit vague ideas? This involves us in the interminable and fruitless controversies concerning the relative power and goodness of God which were so characteristic of the mediæval schoolmen at their worst.

Descartes' philosophy thus involves a *Deus ex machina*. His followers, without exception, laid far more emphasis on this phase of his philosophy than he himself. In the systems of Geulincx and Malebranche, God becomes the agent causing every change in mind and matter, who for each change in the one wills that there shall be a corresponding change in the other. From this Occasionalism it is but a step to the monism of Spinoza, for whom mind and matter are but two among an infinite number of aspects of the one reality, God. From another standpoint, the entire world is the content of intellection, without the mediation of the Cartesian and Lockean "ideas." Spinoza retains the logical, mathematical, intellectualistic standards of truth and knowledge which were set up by Descartes, but he has also a mystical, emotionalistic view of the nature of reality, in that he believes that this is most truly perceived through the Intellectual Love of God.

The *Deus ex machina* survives in the views of the next great continental philosopher, Leibnitz. Instead of the two substances, mind and matter, of the Cartesian tradition, he supposes an infinity of substances, the monads, all partaking to some extent of a mental nature. In place of calling upon God's continual intervention to keep these experiences in accord with the facts, Leibnitz supposes that at the Creation the Lord foreordained that all these many experiences should keep time, just as two perfect clocks, wound up and set together, will agree

on all subsequent occasions until they run down. It will be seen that the problem of error appears in the philosophy of Leibnitz almost in its Cartesian form.

Leibnitz regarded the monads as possessing ideas of various grades of clearness and distinctness, and believed that matter was made up of those with the vaguest ideas. Because he considered matter to be of the nature of mind, Leibnitz is called an idealist, and is classed together with Berkeley, whom we shall next consider. By observing the vast distance that separates the philosophies of these two men, it will be possible to see how little content inheres in this term, which, with its contradictory realism, has been singled out by a certain American philosophical school as the index of a grand dichotomy of all philosophical systems.

Berkeley belongs to the British empiricistic tradition. His immediate philosophical ancestor is Locke. Unlike Locke, however, Berkeley saw that no object not directly given can furnish a test of empirical reality, nor an aid in its explanation. Accordingly, his world consists of selves and their ideas or sense-data. This does not mean that he rejected natural science, but that he insisted that all its propositions were capable of expression in terms of ideas. Such ideas as are not immediately given to any person he considered to reside in the mind of God, one of whose functions it becomes, to put it crudely, to watch things when nobody is looking and to see that they do not vanish away. However, it will be noticed that an idea in the mind of God which is not experienced by us is as inert, remote and useless from an explanatory point of view as a bit of matter. Furthermore, the self apart from its ideas does not appear to play any great part in knowledge. Given an experience, nothing more seems to be added by the adjunction of the self. For these reasons, the next successor to the British tradition, David Hume, rejected both the Berkeleyan matter — thinking God and the soul as a specific entity, and interpreted the world purely and simply as an aggregate of sense-data.

We thus see the contrast between the natural-scientific and the Humian view of the universe; for the naïve scientist, a bit of experience is really an aggregate of atoms in motion, whereas for Hume an atom in motion would have to be interpreted in terms of bits of experience. Unfortunately, Hume possessed neither the scientific knowledge nor the logical mechanism to carry out this process in any but the crudest and most schematic way, and his philosophy of space, time and causality is in detail as bare and inadequate and unsatisfactory as any yet devised. Recently, however, Bertrand Russell, who is essentially a Humian in spirit, though he adopts the independent nature of the soul as at any rate a plausible hypothesis, has developed a treatment of these subjects, and of many other allied ones, which is at once scientific and at bottom after the manner of Hume. Matter, for instance, is treated as the system (Hume would have erred by saying "the sum") of its appearances; an atom or electron becomes a class of sense-data or a relation between them, or something of this general nature. The scientific analysis in terms of atoms and electrons is recognized as valid, but as based on a deeper analysis into the experiences out of which atoms and electrons are artefacts.

This recrudescence of British empiricism, however valid its opinions and valuable its results may be, is off the main stream of philosophical development during the latter part of the 18th century and the entire 19th. This main stream has its source in Kant, who, to continue the metaphor, marks the junction of the currents of British and of Continental thought. What is most distinctive in the thought of Kant is his definite and final occupation of the standpoint of epistemology, as the true ground for the determination of the problems of metaphysics. Now in so doing, Kant is making thought the measure of reality, and this seems to be only repeating the judgment of Spinoza. But there is a great difference. Kant declines to accept Spinoza's doctrine of thought and reality. The real is more than the content of thought. In fact Kant returns to the ancient intuition of thought as formal, and the real as in some sense its correspondent. This was also the tradition of Locke and his school, from which Hume departed, as we have seen, with a result that is often called scepticism. Now the history of Kant's thought shows that, while he clung to the belief in the mere formal character of thought, his tendency was also strongly in the direction of scepticism. Moreover it was on account of his failure to completely achieve what he calls his Copernican revolution, and which was in fact a reaction toward a constitutive doctrine of thought, that he was never able, during the whole of his critical period, to reach a satisfactory conception of the relation of thought to reality. Had Kant completely achieved the mental revolution he proposed, the result would have been, that in epistemology he would have asserted the doctrine of Spinoza, the identity of the real with the content of thought. The knowable world would thus have been identical with the real world and Kant would have escaped the dualism between knowledge and reality into which he actually fell. Kant also denies the universality of thought; at least in the ontological sense. The thought that functions epistemologically is my human relative thought which can only pronounce judgments that are subjectively valid for me, but have no ontological value for reality. The Kantian metaphysics is a corollary from his epistemology. What Kant calls critical idealism is first an epistemology, secondly a metaphysic. As an epistemology it teaches that my thought is constitutive for me; that is, that its content is valid for my subjective connation. It gives me a world, in other words, in which I can work out the practical issues of my life, but it does not give me the world of real things in themselves with respect to which my attitude must be one of renunciation. As a metaphysic critical idealism simply carries its program out in the field of ontology. The presumption of the identity of what is thought with the real cannot be carried out objectively. Kant's metaphysics is therefore necessarily negative. Thought is able to complete itself ontologically, it is true, but the ideals it reaches have no other than subjective value. Their hypothetical content can never be identified with the real, and the Kantian is per force obliged to represent the whole ontological region as an indeterminate X and to look for

the satisfaction of his wants to extra-metaphysical forces. These he finds in the domain of ethics.

In Hegel we have also an example of a thinker who approaches metaphysics along the epistemological way. But Hegel is a much more thoroughgoing thinker than Kant. He starts no doubt with the Kantian traditions in mind and his first great task, the development of his logic, is formal. But Hegel is not a formal thinker, in the sense that he divorces content and form. Thought is formal. This Hegel is not afraid to confess, but it is also ontological. At the same time there are no outlying realities, like the Kantian things in themselves. How is this? Are we to have the spectacle of a lapse into Spinoza? Our apprehensions are ungrounded, for Hegel asserts calmly that the form creates the content. Hegel asserts the identity of thought and reality in the sense that the real is, and is only, what the thought thinks it to be. It is the real by virtue of the thought thinking it to be. This sounds like a dangerous kind of subjectivity, till we learn that by thought Hegel means, not my thought or yours, as simply my or your intellectual function, but the thought that is universal and that thinks the universal. So much for Hegel's epistemology. In Hegel's system epistemology and metaphysics are simply two aspects of the same thing. In epistemology we have the system logically conceived; that is in view of the process which the finite thought of the individual must pass through in order to apprehend it; whereas in the metaphysics we have the system presented in its unity as a self-completing whole. Epistemologically the dialectic is the movement by which results are achieved; metaphysically it is the Divine Spirit of the system as a whole. Error is accounted for precisely by the disparity between individual and universal thought.

One of the most remarkable aspects of the metaphysics of the past century is the strong voluntaristic or emotionalistic trend which is to be observed among writers of the most different philosophical ancestry. Schopenhauer, though in many ways a follower of the Kantian tradition, interpreted the course of events as the manifestation of a world-will, which performs the functions of the Kantian thing-in-itself. This will manifests itself in man as will in the ordinary sense, while in matter it is seen as force. A view which displays an analogous voluntaristic or rather activistic trend, though in every other respect most unlike that of Schopenhauer, is pragmatism, the chief exponent of which was the American philosopher, William James. This view states that the truth of a theory or the reality of a system is not merely determined but constituted by what is in some sense the ease with which it can be applied and the value of the results of this application. A similar position is that of Henri Bergson, who maintains that the analysis of science yields us only half-truths, while the real nature of the world is shown to us by intuition, which exhibits it to us as the working of a certain vital impulse.

There is no metaphysics at the present time which can lay claim to a general acceptance. The 19th century domination of all philosophy by the memories of Hegel and Kant is passing away, and the tendency of worshiping these great men as philosophical demigods is wellnigh extinct. Their followers, numerous though they are, must dispute their realm with the modern critical adherents of the British tradition, armed with modern logic, mathematics and science, and with the pragmatisto-Bergsonian tendency.

Before closing this article, let there be a word of caution to the reader against that facile metaphysical criticism which depends on labels. We have already seen that the line of cleavage between idealism, or the view that all things are either thoughts or their thinker, and realism, which asserts the existence of other entities, does not of itself mark one of the great philosophical dichotomies; Berkeley, the first typical British idealist, and Leibnitz, the idealist of the Continent, both, fall into the epistemological difficulties which are generally accepted as characteristic of realism, in that the problem of the relation between the knower and the known remains in what is essentially the Lockean or Cartesian stage. The distinction between spiritualism, which is almost a synonym of idealism, is that it regards matter as constituted of psychical material, and materialism, which analyzes mind in terms of matter, is similarly not a touchstone to the real nature of the views which it denies. The only really satisfactory method of metaphysical criticism is by the careful individual analysis of each philosophical system according to its own concepts. See EPISTEMOLOGY; PHILOSOPHY; PHILOSOPHY, HISTORY OF; and the articles on the individual philosophers mentioned.

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NORBERT WIENER.

METASOMATISM. According to the United States Geological Survey, "Metasomatism may be defined as the process by which, through chemical interchange, a mineral or aggregate of minerals undergoes partial or

complete change in chemical constitution." More simply stated, metasomatic ore bodies are formed when the ore substance replaces the rock particle by particle, instead of filling already existing cavities. Replacement is frequently used as a synonym for metasomatism, and ore bodies so formed are usually called replacement bodies. Replacement, unfortunately, is used loosely by some writers, to indicate cavity filling, and these authors use the term metasomatic replacement in the same sense in which others use the term metasomatism. According to the most careful usage metasomatism and replacement are synonyms, and apply to ore bodies replacing the wall rock particle by particle. "Metasomatic replacement" is then pleonastic.

METASTASIO, Pietro, pē-ā'trō mā-tās-tā'zē-ō (properly PIETRO TRAPASSI), Italian poet: b. Rome, 13 Jan. 1698; d. Vienna, 12 April 1782. His poetical talents were early displayed in improvisations, and often he drew about him a crowd to listen to some versified narrative. The jurist Gravina, who thus accidentally became acquainted with his talents, took him under his protection, called him (by an Italianized translation of his name into Greek) *Metastasio,* paid great attention to his education, and on dying in 1717 left him an estate of $20,000. On 15 April 1718 he was received into the Arcadian Academy with the name of Artino Corasio, and in 1720 entered at Naples the office of the attorney Castagnola, who discountenanced literary work, and kept him severely to the law. He wrote anonymously 'Gli Orti Esperidi' (1722), but the authorship was soon revealed, and Metastasio left the lawyer's office, studied further, and wrote a series of musical dramas, or melodramas in the true sense, which were set by leading composers and given with great success. In 1730 he settled in Vienna as court poet, and there in 1730–40 wrote his best works, 'Demetrio,' 'Issipile,' 'Demofoonte,' 'La Clemenza di Tito,' 'Attilio Regolo.' In the consideration of Metastasio's rank as a poet, his work must be viewed not absolutely, but with regard to its original environment, as done in collaboration with a composer, and rendered by great artists. He wrote, too, for the predominantly vocal system of Italian musical drama; and with this his poetry fell into comparative neglect. His writings have been praised by so good a critic as Symonds for excellent versification, ease of diction, effective simplicity of construction and frequent imagery of the highest rank. His lyrical verse and criticisms are also of value. The best collected edition of his works is that of 1780–82 (Paris). Consult Massafia, 'Pietro Metastasio' (1882); also Lee, 'Studies of the 18th Century in Italy' (new ed., 1908).

METASTASIS (1) *in medicine,* a change in the seat of a disease, attributed to the translation of morbific matter to a part different from that which it had previously occupied, or to the displacement of the irritation. Mumps is a disease peculiarly liable to induce metastasis. In adult males the inflammation often goes to the testicles, producing orchitis, and in adult females to the breasts or ovaries, in the latter case ovaritis. Mastoiditis often results in similar shifting of the inflammation by the travel of blood clots, and the inflammation may reappear in any of a dozen places. (2) *In botany,* a change produced upon a substance designed for the nutriment of a plant, to make its assimilation more easy. Thus, when the starch formed in the leaf of a potato has to be transferred to the tubers as a depot of nutritial material, it is first changed into a soluble substance — glucose. See METABOLISM.

METATE, the stone implement on which grain and other substances, more especially corn, were ground before the discovery of America and are still ground throughout the territory of the United States occupied by the Pueblo Indians, and in Mexico, Central America and much of South America, more especially the west coast. See MORTAR.

METAURUS, mę-tâ'rŭs, or **METAURO,** mā-tow'rō, Italy, a river in the Marches, which flows northeast past Saint Angelo in Vado, and falls into the Adriatic, southeast of Fano; total course, about 50 miles. It is noted for the victory gained by the Romans under the consuls Claudius Nero and Livius Salimator near its banks over the Carthaginians under Hasdrubal 207 B.C.

METAVOLTINE. A sulphur-yellow mineral occurring in aggregates of hexagonal scales at Madeni Zakh, Persia. Dichroic. Hardness, 2.5; specific gravity, 2.53; composition: Sulphuric acid, 46.90; sesquioxide of iron, 21.20; protoxide of iron, 2.92; potash, 9.87; soda, 4.65; water, 14.58. Much of the mineral called misy belongs to this species.

METAYER, mĕ-tā'yĕr, Fr. mā'tĕ'yā' (L. Latin, *medietarius*), a name given in France to the cultivator of a *métairie* or farm who reserves for himself one portion of the produce as the price of his labor and gives the proprietor the other, which represents the rent of the land after deducting what is necessary to keep up the stock. The greater part of the center and south of France, and almost the whole of Italy, is cultivated by métayers, who are in general upright, economical and industrious. This system of farming on shares, usually half and half, is extensively practiced in the southern United States where both white and negro share croppers cultivate tobacco and cotton acreage. The introduction of modern farm machinery and the population trend to urban life will no doubt reduce the number of tenant farmers. See AGRICULTURE IN THE UNITED STATES; COTTON CULTIVATION IN THE UNITED STATES—*Share System.*

METAZOA, one of the two great sections into which Huxley divides the animal kingdom, the other being the Protozoa. The Metazoa embrace all animals composed of more than a single cell, that is all that develop through eggs or ovum. The *Porifera* or sponges are the lowest of the Metazoa. See ANATOMY, COMPARATIVE; PROTOZOA.

METCALF, William, American steel manufacturer: b. Pittsburgh, Pa., 1838; d. 1909. In 1858 he was graduated at the Rensselaer Polytechnic Institute, Troy, N. Y., and from 1860 to 1865 supervised the manufacture of Rodman and Dahlgren guns at Fort Pitt, Pittsburgh. In 1868 he entered the steel manufacturing field and in 1898 organized the Bræburn Steel Company, of which he was president for 11 years. It is said that Metcalf made the first crucible steel in America. He was president of the

American Institute of Mining Engineers in 1881 and of the American Society of Civil Engineers in 1893. He published *Steel—A Manual for Steel-Users* (1896).

METCALFE, Sir Charles Theophilus, 1st Baron, English Indian and colonial administrator: b. Calcutta, Jan. 30, 1785; d. Malshanger, near Basingstoke, Hampshire, England, Sept. 5, 1846. The son of a major in the Bengal Army and educated at Eton, the 15-year old boy sailed back to India in 1800, a writer in the East India Company's service. Four years later, he became political assistant to General Lake during the Mahratta war. Several increasingly important appointments followed. In 1822 he succeeded his brother in the baronetcy, and five years later obtained a seat on the supreme council. First governor of the new presidency of Agra, in 1835 he succeeded Lord Bentinck as provisional governor general of India. Resigning in 1838, he was appointed governor of Jamaica. Illness compelled his return to England in 1842, but the following year he went to Canada as governor general. A malignant disease compelled his retirement in 1845 when he was awarded a barony for distinguished service.

METCALFE, Samuel L., American physician and scientist: b. near Winchester, Va., 1798; d. 1856. In 1823 he was graduated in the medical department of Transylvania University; established a medical practice at New Albany, Ind., and visited England in 1831. Upon his return to his native country, he made a geological tour in Tennessee, North Carolina and Virginia. Later he settled in New York where he took up scientific work. He published *Narratives of Indian Warfare in the West* (1821); *A New Theory of Terrestrial Magnetism* (1833); *Caloric: Its Mechanical, Chemical and Vital Agencies in the Phenomena of Nature,* 2 vols., 1843 (2d ed., 1859).

METCHNIKOFF, Élie, Russian bacteriologist: b. Kharkov, Russia, May 15, 1845; d. Paris, France, July 15, 1916. Following his education at Kharkov, Metchnikoff studied at Giessen and Munich, and in 1870 he was appointed professor of zoology at Odessa. He held this post until 1882, when he resigned to devote himself to private researches into the anatomy of invertebrates. It was while working at lowly organized forms of life such as sponges that he first made the observations which constituted the basis of all his subsequent work. In 1888 he had attracted the notice of Louis Pasteur, the founder of the famous Pasteur Institute for the treatment of rabies, in Paris, and he was invited to become one of Pasteur's associates. In 1895 he succeeded as the director of the institute, a post which he held to the time of his death. In his study of longevity, Metchnikoff came to the belief that it should not be uncommon for persons to live to the age of 150 years. He found every indication that the human mechanism was calculated to last far longer than it actually does. His researches showed among other things that animals which had no large intestines lived to an advanced age, particularly birds, which preserve their youthful agility and spryness to the end of their long span. In the case of human beings, he found that even among those whose sufferings were terrible, there were few who wanted to be put out of their agony by death. They all wanted to live. If the normal specific longevity were attained by human beings, he believed that old and not degenerate individuals would lose the instinct for life and acquire an instinct for death and that as they had fulfilled the normal cycle of life, they would accept death with the same relieved acquiescence as they now accept sleep. On his seventieth birthday, in 1915, Professor Metchnikoff received a present of a golden book, forming a unique record of the latest scientific researches, signed by men of science of the day. Although there was much controversy in the scientific world regarding his original ideas, he was fully recognized as one of the most eminent bacteriologists. In 1908 the Nobel Prize for medical research was divided between the late Dr. Paul Ehrlich, of Berlin, and Professor Metchnikoff. The $20,000 which he thus received he devoted entirely to the furtherance of his scientific researches. Personally he was not well off, and throughout his long life sacrificed all but the plainest living necessities to the cause of science. He was the author of a number of books including *Lectures on the Comparative Pathology of Inflammation* (London 1893); *Immunity in Infective Diseases* (New York 1905); *Etude sur la nature humaine; essai de philosophie optimiste* (1903). English translations of his lectures are *The New Hygiene* (Chicago 1907); *The Nature of Man* (New York 1910). He edited, with Sacquépée and others, *Médicaments microbiens* (1909). Consult *Annales de l'Institut Pasteur* (Paris), and Slosson, E. E., *Major Prophets of Today* (Boston 1914).

METELLA, Caecilia, daughter of Metellus Creticus and wife of Crassus the Younger. Her tomb on the Appian Way about 2 kilometers from Rome is one of the best-known surviving monuments of the Augustan age. It is a circular structure of 65-foot diameter on a square base. A frieze of garlands and bucranes circles the upper part. During the 13th century the tomb was incorporated in a fortress which three centuries later Pope Sixtus V (1521–1590) tore down to bring it again into full view.

METELLI, mĕ-tĕl'ī, a Roman family of the *gens Caecilia.* Quintus Caecilius Metellus Macedonicus defeated the Achaeans, took Thebes and invaded Macedonia, and received a triumph 146 B.C. Quintus Caecilius Metellus Numidicus rendered himself illustrious by his successes against Jugurtha, the Numidian king. He took, in this expedition, the celebrated Marius (q.v.) as his lieutenant; was soon recalled to Rome, and accused of extortion and ill-management, but was acquitted of these charges. He celebrated a triumph at Rome 107 B.C. His son, Quintus Caecilius Metellus received the surname of Pius on account of the love which he displayed for his father when he besought the people to recall him from banishment in 99 B.C. In 83 B.C. he joined Sulla, with whom, three years later, he was united in the consulship. Quintus Caecilius Metellus Creticus conquered Crete, and reduced it to a Roman province in 67 B.C. Quintus Caecilius Metellus Pius Scipio, the adopted son of Metellus Pius, in 52 B.C. was colleague in the consulship with Pompey, who had married his daughter Cornelia. Hence he exerted himself to the utmost to destroy the power of Caesar and strengthen that of his son-in-law. He commanded the center of Pompey's army at the Battle of Pharsalia, and thereafter fleeing to Africa

was defeated by Caesar at Thapsus 46 B.C. He died by his own hand.

METEMPSYCHOSIS. This ancient theory has at times been confounded with reincarnation. While both imply that man lives again, the propositions present radical differences. See also TRANSMIGRATION OF THE SOUL.

METENIER, Oscar, French novelist and playwright: b. Sancoins, Cher, France, 1859; d. Saint Mandé, 1913. At the age of 24, Méténier became secretary to the police commissioner of Paris, a post he held for six years. In his novels and plays he made considerable use of the first-hand experience of underworld life gained during this period. Among his novels, which in general are quite daring, may be mentioned *La Chair* (1885); *Bohême bourgeoise* (1887); *Madame la Boule* (1889); *Barbe-Bleue* (1894). His plays include *En Famille* (1887); *La Casserole* (1889); and *Mademoiselle Fifi* (1896) adapted from de Maupassant's novel. In 1897, Méténier founded the noted Montmartre theater, Grand-Guignol, where he alternated short pieces that were either madly mirthful or gruesome. The Grand-Guignol soon became a theater specializing in sheer horror.

METEOR. The term is now restricted to cosmical bodies which enter the Earth's atmosphere from without, but until a century or two ago it included other phenomena such as halos, auroras and rainbows. In some cases this makes it uncertain whether older writers were describing true meteoric bodies or their trains, or something purely atmospheric. The science of meteorology, which covers the phenomena of the Earth's atmosphere, does not include the study of meteors, this latter being a branch of astronomy sometimes called meteoritics. As now used the term *meteor* denotes any type of body, coming from space, which makes its presence known by rapidly moving across the sky, its head generally starlike but sometimes with an apparent disk, and often leaving a luminous streak or train of light along its path. This latter usually disappears in less than a second, but in rare cases may last many minutes. For descriptive purposes we have the terms *shooting star, fireball, bolide,* and *meteorite.* The first is a popular term denoting the average meteor; a fireball is a meteor at least as brilliant as the larger planets; a bolide is an exploding fireball; a meteorite is a fireball large enough to survive its fiery atmospheric journey and fall to the ground. All the other types are destroyed at considerable heights. The word *meteor* is used both in the general sense to cover all classes, and in the restricted sense to denote what used to be called a shooting star, that is, the fainter and far more numerous members of the family, such as may be seen on any night.

It is difficult to separate the history of meteors and meteorites, so, while these latter are described in another article (see METEORITES), it is best to consider the development of ideas concerning their cosmical significance here. The fall of stones from the heavens is such an unexpected event, especially as it is usually accompanied by thunderous noises and often by smoke trains, that it must always have terrified primitive peoples, and later such events were doubtless recorded in official documents. Yet the oldest known record is that in the Book of Joshua, 10:11, where men fleeing from a battle are said to have been killed by "stones from heaven." We find that the Chinese, as early as 687 B.C., record the fall of meteorites and also describe fireballs and meteoric showers. Greek and Roman writers were less careful, some accounts being ambiguous. The oldest authentic one is of the large meteorite that fell in 467 B.C. at Aegospotami in Thrace. The oldest existing meteorite, the exact date and place of fall of which are known, is the one that fell on Nov. 16, 1492, near Ensisheim, Alsace.

In the next three centuries, a good many meteorites fell in Europe, but the reaction against superstitions of the Middle Ages led the scientists of the day to such great skepticism that they refused to face facts, in some cases. Perhaps the most notorious instance refers to meteorites: in the 18th century the learned men of the day did not *believe* stones could fall from the skies, hence they affirmed they did not. Even the great French Académie des Sciences went on record denying that meteorites had an origin outside the atmosphere, despite accounts of falls by reliable witnesses, which were ridiculed, and the splendid pioneer work of Ernst F. F. Chladni about 1794. However, on April 26, 1803, a fall at L'Aigle in France, investigated by Jean B. Biot, finally convinced even the "philosophers," and the study of meteorites, as such, began. As for the more ordinary shooting star, two German students, H. W. Brandes and J. F. Benzenberg, in 1798 carried out simultaneous observations from two stations some distance apart. Thus by the ordinary methods of triangulation, they were able to determine the approximate height at which meteors appeared and disappeared. Their average value for the points of disappearance was 98 kilometers. This proved they were far higher than clouds, but not at lunar or planetary distances. It should be mentioned that Sir Edmund Halley had calculated a fireball path in 1719, so the methods were well understood, but still scientists neglected meteors almost entirely, and we may truly say that meteoric astronomy was born on Nov. 13, 1833, when the great Leonid shower appeared over America.

The Leonids.—This shower is estimated to have furnished 200,000 meteors for a given station between midnight and dawn, numbers of them brilliant, and many leaving trains. The terror excited among the masses of the population was great, the superstitious fully expecting the end of the world was about to come. However, there were enough trained men who saw the phenomenon for several to detect that the meteors really had a radiant in the constellation Leo, that is, a point in the sky from which they seemed to shoot away as spokes from the hub of a wheel. It was quickly seen that this radiation was merely a perspective effect and that the meteors, before meeting the Earth, were really moving in parallel paths. The position of the radiant fixes the direction in space from which the meteors come. As the radiant eventually was shown to be in the same position among the stars as seen from distant stations, this proved that the meteors came from space and did not originate in the atmosphere. From then on meteors have formed a definite branch of astronomy.

Professor Denison Olmsted of Yale was the man who, at the time, made excellent observations on the Leonids and then concluded that what had occurred was due to the Earth's encounter with a swarm of particles moving around the Sun. John Locke, in America, in

1834 proved that the August meteors had a radiant in Perseus; and Lambert A. J. Quételet, of Belgium, in 1836 discovered from a study of older records that they appeared every August on about the same date. George Adolf Erman in 1839 developed a method for calculating the orbit of a meteor swarm; Sears C. Walker developed another in 1841; and it is stated that Palm H. L. Boguslawski had done so even earlier. Alexander C. Twining's work in 1862 pushed the knowledge of the Perseid orbit much further. But the truly great advances were made by Hubert A. Newton of Yale and Giovanni V. Schiaparelli of Italy. The former in 1863 proved from a search of ancient annals that we had been meeting Leonid meteors in great showers at least back to 902 A.D., though the date then was October 12. He showed that this change of date was to be expected, as our calendar is based on the tropical year, whereas the meteors would follow the sidereal year. He gave a table showing there were great showers in the following years: 902, 931, 934, 1002, 1101, 1202, 1366, 1533, 1602, 1698, 1799, 1832, and 1833. From this he deduced a period for the stream of 33.25 years, and a shower was predicted for 1866 or 1867. (Since Newton's day, examination of Arabian, Chinese, Japanese, and Korean records have added showers in: 935, 967, 1035, 1037, 1237, 1238, 1465, 1466, 1532, and 1566.) This prediction was fulfilled by an excellent shower in 1866, another good one in 1867, and a fair one in 1868. None of these, however, was anything like as wonderful as that in 1833.

Before following the Leonids further, it must be stated that Schiaparelli was able to prove to his satisfaction that most meteors met the Earth with nearly parabolic velocity, which is 42 kilometers per second. He further was the first to show that a meteor stream and a comet followed approximately the same orbit, this being done for the August Perseid meteors and Tuttle's comet, 1862 III. He embodied his researches into the first reference book on meteors (see *Bibliography*), which remained the standard work for over half a century and still should be read by all students of the subject.

Returning to the Leonids, there was general expectation of another grand shower in 1899, but, shortly before, two English astronomers, G. Johnstone Stoney and A. M. W. Downing, undertook the calculations of the perturbations which the meteors had undergone since 1866. We should pause to say that the Leonid orbit is an elongated ellipse, its aphelion point being near the orbit of Uranus. Meteors are scattered all around this orbit, which is really a cylinder several million miles in diameter, so that every November, when the Earth passes through, we meet at least a few Leonids per hour. For a certain space, however, meteors are very much more concentrated, and this is roughly a tenth of the whole circumference. Hence it takes about three years for this denser part to pass, and we go through it either three or four times in succession. During these, greater showers occur. If we go, as in 1833, through the very densest part, wonderful showers are seen; if we miss the central mass and go through outlying regions of the stream, lesser displays are afforded. The calculations of Downing and Stoney showed that Jupiter and Saturn had so perturbed the densest part of the stream, as it passed near them, that it was probable it would wholly miss the Earth in 1899. In 1898 the preliminary increase was indeed seen, and a good, if not spectacular, shower appeared, but the wretchedly poor display of both 1899 and 1900 more than vindicated the gloomy prediction. The 1901 Leonids, which had not been in position to be much influenced by the planets, furnished a good display, but nothing comparable even to that of 1868. The main stream being thus "lost," it was impossible to compute exactly what should happen for the next return. Actually, on the night of Nov. 16-17, 1931 an excellent display occurred, comparable to that of 1901, but in no other year of the period did really great numbers of Leonids appear; hence again the Earth had totally missed the densest part of the stream. As to the future, it is not possible to assert what will happen: it may be that perturbations will shift the dense part of the stream back into such a position that we will again pass through it. The next return should be somewhere between 1961 and 1967; one cannot safely be more specific. The Leonids follow the same orbit as the faint Tempel's comet, 1866 I. This should have returned in 1899 and 1932 but careful search failed to detect it.

Other Showers.—The Lyrid meteors of April were proved by Johann G. Galle in 1867 to follow the same orbit as Comet 1861 I, and the Andromedes (also called Andromedids or Bielids) and Biela's comet were proved to have the same orbit almost simultaneously by Edmund Weiss and Heinrich L. d'Arrest in 1867. Many other possible connections of meteor streams and comets were then explored, one—that of the Aquarid meteors of May and Halley's comet—being made probable though the observational data were very poor. In 1910 the final proof of this connection was given by Charles P. Olivier, based on new and adequate data. In 1916, meteors appearing in May and June, coming to a maximum on June 28, were proved independently by William F. Denning and Olivier to be connected with Pons-Winnecke's comet. In 1933 the splendid shower of Draconids, seen in Europe on October 9, was proved to follow the orbit of Giacobini-Zinner's comet. The possibility that this comet might furnish a meteor shower had been foretold some years before by Reverend Martin Davidson and by Denning. Lastly, the Taurid meteors of October, which do not give any "shower" in the popular sense, were proved to follow the orbit of Encke's comet by Fred L. Whipple. The other three annual showers, which furnish enough meteors to be worth noting here, the Quadrantids, Delta Aquarids, and Geminids, do not appear to have companion comets; the Orionids probably also are connected with Halley's comet. Some thousands of radiants of so-called minor streams have been published. At present, it is impossible to say what per cent represent real streams, though of course many do.

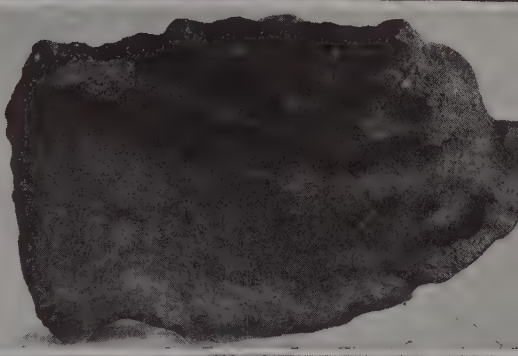
The Bielids furnished a grand shower on Nov. 27, 1872, a fine one in 1885, a good one in 1892, and an expiring effort in 1899. From then on few Bielids have been seen, either because the whole group has been so shifted that our Earth misses them, or because the meteors have been dispersed so that the cross section of the stream is far larger and hence the meteors more sparsely scattered. As to Biela's comet itself, it divided into two in 1845, the twins were seen in 1852 at the next return, but never since (see COMET). Both the meteors and the comet were doubtless fragments of a much larger comet, and between them represent the last stages of its dispersal

METEOR

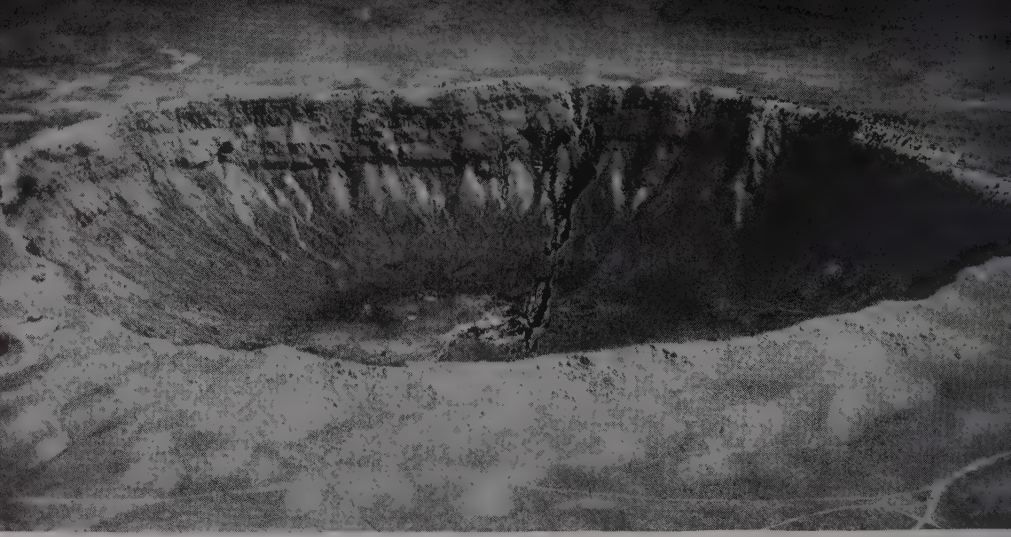
Above: A bolide—as a meteor of exceptional brightness is often called—crosses the camera field while the great spiral in Andromeda is being photographed.

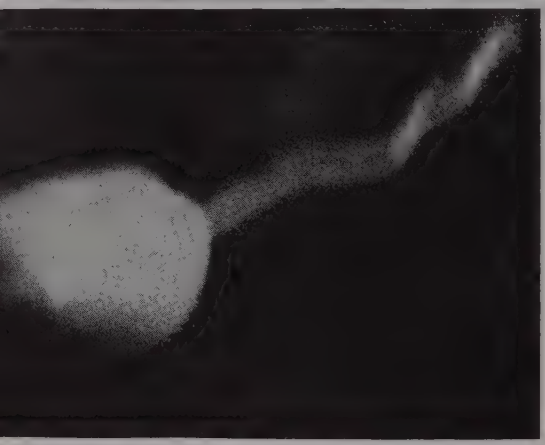
Right: Meteorite found at Cape York, Greenland, weighing 36½ tons.

Below: Chubb Crater, Quebec, from the air. The round crater is more than two miles across at the rim, and is of meteoritic origin. It was discovered in 1949.



Courtesy (1) and (2) American Museum of Natural History; (3) National Geographic Society





METEOR

Above: Aerial view of the great Meteor Crater in Arizona, considered the largest known meteoritic crater until the discovery of Chubb Crater in Canada.

Left: The great fireball of March 24, 1933.

Below: The Willamette meteorite, found in the Willamette Valley near Oregon City, Oregon.

Courtesy (1) and (2) American Museum of Natural History; (3) Hayden Planetarium of the American Museum of Natural History

or destruction. The cases of the two meteor streams connected respectively with Pons-Winnecke's comet and with Giacobini-Zinner's comet illustrate very vividly how our Earth may penetrate such streams on one or more occasions and then planetary perturbations shift the meteor orbits so they no longer intersect ours. For example, the perihelion distance of the first comet in 1819 was 0.77 astronomical units, in 1915 was 0.97, and in 1939 was 1.10. Meantime the orbital inclination changed from 10°.7 to 20°.1. The result was that by 1916 the comet's orbit was literally pulled far enough from the Sun to intersect ours and a fairly good display took place June 28. But the effects continued so that by the comet's next return in 1921, its orbit was wholly outside ours and a meeting with meteors moving therein impossible. As a consequence, since 1916 only outlying members of the stream have ever been seen—nothing which could be properly dignified as a "shower."

For the second comet, the period of which is 6.59 years, Denning on Oct. 10, 1926, identified a fair number of meteors as from a radiant which could be connected with the comet. Then on Oct. 9, 1933, a gorgeous shower appeared, observed in Europe, but it was over before darkness had come in America; in other words, it lasted only a few hours. Evidently in 1926 the Earth penetrated the edge of the stream, in 1933 went through what was probably its center, but not again has the shower appeared. This shower may, however, reappear brilliantly about Oct. 9, 1946. The stream must be narrow. Both of the comets move with direct motion and belong to Jupiter's family. This means they are subject to great orbital changes. These latter have given us the chance to have meteor showers. In time to come we may hope that other streams may be switched into our path.

Frequencies.—The accompanying tables will indicate the average hourly and monthly number of meteors, and the average duration, date of maximum, and richness of the principal meteor streams. They are compiled from data secured through the American Meteor Society and other sources. They refer therefore mostly to middle northern latitudes, to clear nights without moonlight, and are for persons of good eyesight.

It will be noted that the second half of the year is much richer in meteors than the first, and that the same is true for the second half of the night. The first fact is due simply to the number and richness of the meteor streams intersected by the Earth in the respective periods. The hourly duration comes as a result of the Earth revolving in 24 hours, so the zone where it is 6 A.M. is on the exact front side with respect to its orbital motion; while the zone where it is 6 P.M. is exactly in the rear. The meteoric apex is the direction in which the Earth is going at a given moment, defined by the tangent to the orbit. Our average orbital speed is 30 km/sec. (kilometers per second); that of meteors about 42 km/sec. It is easy to see then that we, in a unit of time, meet many more than overtake us. Also the relative velocities of the two groups will be $42+30:42-30$ or 72:17. When the Earth's attraction is added to the heliocentric velocities of the meteors, this ratio becomes 73:16. There is an important consequence when it is remembered that kinetic energy varies as the square of the velocity. Hence the ratio of the energy developed by a meteor coming from the apex at 6 A.M. to that of one of the same mass from the antiapex overtaking us at 6 P.M. is $73^2:16^2$ or about 20:1. Therefore we might expect more meteors to survive their passage through our atmosphere in the evening than in the morning hours, which is found to be statistically true. Also only larger bodies could survive during the morning hours.

TABLE 1

HOURLY NUMBER OF METEORS FOR WHOLE YEAR

Hour	Number of meteors per hour	Hour	Number of meteors per hour
6 P.M.	3.8	12	11.5
7	4.6	13*	13.1
8	5.6	14	14.4
9	6.8	15	15.0
10	8.2	16	14.8
11	9.8		

* 13 hours equals 1 A.M.

TABLE 2

HOURLY NUMBER OF METEORS FOR EACH MONTH

Month	Number of meteors per hour	Month	Number of meteors per hour
Jan.	7	July	10
Feb.	6	August	16
Mar.	6	September	10
Apr.	7	October	13
May	8	November	11
June	7	December	12

TABLE 3

Name	Duration in days	Date of maximum	Hourly number of all meteors on this date
Quadrantids	4	Jan. 2	28
Lyrids	4	April 21	7
Eta Aquarids	8	May 4	7
Pons-Winnecke	?	June 28	?
Delta Aquarids	3	July 28	27
Perseids	25	Aug. 11	69
Draconids	1	Oct. 9	*
Orionids	14	Oct. 19	21
Leonids	7	Nov. 16	21
Andromedes	2	Nov. 20	?
Geminids	14	Dec. 12	23

* Brilliant shower in 1933; return probable in 1946.

Orbits.—The heliocentric orbits of all meteors are conic sections with the Sun at the focus, but once the small body comes very near our Earth, the attraction of the latter becomes dominant, and so, in our atmosphere, the meteor moves in a hyperbola with the Earth's center as focus. The visible path being described usually in a second or less, and its length being only a few score miles, for the average meteor it is practically a straight line. By using observations from two or more stations, made simultaneously on the same meteor, it is possible to compute the height at which it appeared and that at which it disappeared and the path length. If an accurate estimate of its duration is made, the velocity, and, by well-known methods, its orbit in space can be computed. Even when, as is usual, the velocity is poorly determined, by assuming parabolic heliocentric velocity we derive an orbit which is nearly correct in several of the elements, especially the inclination and the perihelion distance.

The necessary observations for determining a

meteor's path have, so far, mostly been made visually. During the past half century photography has begun to play a part, but even yet only the brighter meteors can be photographed. Visual observations consist in plotting the apparent path, as seen from each station, upon a star map. Knowing how far the stations are apart and their latitudes and longitudes, the base line can be established. The ends of the apparent path being measured with respect to the stars give the right ascensions and declinations of these points. Knowing the time, the altitudes and azimuths can then be computed. We now have, in principle, the case in trigonometry for solving a triangle when the base and adjacent angles are known. It is impossible to state how many meteors to date have had their height computed, but one would be safe in estimating the number to be several thousand—quite enough to give good average heights both for certain magnitude classes and special showers. Results based upon photographs are very much more accurate than visual, but as yet are few in number. This is because faint meteors do not impress themselves upon the plates and also the faster their angular velocity, the more difficult it becomes to photograph them. Short-focus lenses of large field of view and considerable aperture are best. With small fields of view, the chances for catching meteors decrease rapidly. At observatories where there are great collections of plates, notably Harvard and Sonneberg, Germany, statistical studies have been made. At Harvard, Willard D. Fisher, in 1927, examined 71,454 plates and found 213 trails. A later search at Harvard, covering 8,077 plates taken with two instruments in 1930–1935 inclusive, netted 59 meteors; 159 more meteor trails were found on other series there for these same six years. Cuno Hoffmeister reports that at Sonneberg (about 1937) on 10,729 plates 51 trails were detected.

By rotating a sector at high speed in front of a given lens, if a meteor is photographed, the path comes out as a line with a series of breaks thereon. If a photograph at another station is available, then the heights and length of path can be computed and, knowing the timing of the breaks, not only the meteor's average velocity can be found, but the velocity in each part of its path. Pioneer work along this line was done by William L. Elkin at Yale from 1891 to 1910, and more recent work at Harvard by F. L. Whipple. Interesting and important results, including proof of the slowing up of a meteor as it penetrates lower, have come from these programs, but observational and technical difficulties have not yet permitted results on any large scale.

Spectra.—When it comes to meteor spectra, attempts made in the latter part of the 19th century with small visual spectroscopes need scarcely be mentioned in view of the relatively greater accuracy of photographs taken with objective prisms. The work of one man, Peter M. Millman, is so outstanding that it alone need be mentioned. He has, however, enlisted the aid of many observers, so that the actual plates come from various sources. In 44 spectra discussed before 1941, he finds two groups which he calls Y and Z. In the Y group of 33 spectra the two strong H and K lines of ionized calcium appear; these are absent in the 11 in Z group. Also 25 of Y are meteors belonging to the four most prolific annual showers, while 10 of Z are certainly sporadic. Iron is found in 37 spectra. Besides Fe, in order of number of cases are: Ca^+, Ca, Mn, Mg, Cr, Mg^+, Si^+, Si, Ni, Al, and Na. This list of elements so far identified may be compared with those found in meteorites. It should be noted that all objective prism spectra are of very low dispersion and only prominent lines can be detected. As sporadic meteors form all of class Z, with one doubtful exception, it might well lead to belief in a considerable difference in structure between sporadic and the shower meteors, which latter seem to be debris of comets' nuclei. The term "sporadic meteor," as used here and elsewhere in this article, simply signifies that the meteor does not belong to one of the dozen or so best-known annual streams, or those known to be connected with some comet.

Mass.—The average meteor seems to be an extremely small body. To determine its size or mass, we remember that the equation for kinetic energy is $E = \frac{1}{2} m v^2$, where m is the mass and v the velocity of the moving body. Further it can be shown that no body can strike the Earth with a smaller v than 11 km/sec., and it is nothing unusual for this figure to be as large as 70, 80, or even greater. It is then clear that v^2, expressed in the usual units, is a great quantity, and E may still be large, even when m is very small. By knowing how bright a meteor is, its path length, its duration, and how far it is from the observer, then a good estimate of the amount of light-energy it emits can be made. If all its E went into light, then our problem would be easier, but much goes into heat and probably also into other forms of energy. So assumptions are necessary. Accepting what seem the more probable, it is surprising to find that a meteor as bright as Jupiter may weigh only 4 grams, one as bright as Polaris 40 milligrams, and one just visible to the eye 1 milligram only. Fletcher G. Watson computes that daily the mass of meteors which strike us amounts to 1,000 kilograms, the meteors ranging from −10 to +30 magnitude. The latter are the smallest bodies which could move under gravitation and not be seriously affected by radiation pressure. He computes the true number of meteors, including those of +6 magnitude, or all visible to the eye, to be about 185,000,000 daily, while from +7 to +10 magnitude inclusive, or those visible in a small telescope, there would be 7 billion. These estimates are larger than most earlier ones, but are based upon more modern data.

Heights.—Meteors are mostly visible in that stratum of our atmosphere extending from 130 to 70 km. from the ground. Exceptional ones may begin higher and penetrate lower. It is obvious then that the average meteor one observes will be 70 to 200 kilometers distant. How can such minute bodies be seen so far? The answer is that they *are not*: it is the results of the energy they develop which we see. The small, solid body rushing through even the tenuous upper atmosphere continually strikes air molecules, heating them, and they in turn heat the surface. Those in front of the solid nucleus are greatly compressed so it is surrounded by an envelope of incandescent gas, much larger than the body itself. It must indeed be remembered that a lot of heating takes place and perhaps even some loss of mass occurs, before the body becomes visible. As it rushes into denser air, the surface is continually sloughed off, and the average meteor will be wholly consumed above the 70-km. level. However, the resulting debris,

gas and dust, add to the Earth's mass. The first stays in the atmosphere, the latter eventually settles. Traces can be found in polar snows and even deep-sea dredgings.

The geocentric velocity of a meteor seems to determine the height at which it first appears, the greater the velocity, the greater the beginning height. The Leonids, 70 km/sec., Perseids 56 km/sec., are cases in point. Results for 1932–1934 from work by the American Meteor Society (A.M.S.) give for Leonids $H_1 = 124$ km. (220 meteors) and $H_2 = 92$ km. (232 meteors). Results by Weiss on 49 Perseids give $H_1 = 115$ km. and $H_2 = 88$ km., respectively. A.M.S. results for sporadic meteors, observed on the same nights the Leonids appeared in 1932–34, are $H_1 = 106$ km. (177 meteors), and $H_2 = 83$ km. (183 meteors). V. V. Fedynski for the period 1930–1933, using a new method, derived for 62 Leonids $H_1 = 128$ km., $H_2 = 92$ km. These agree excellently with the A.M.S. values as do those derived from the Yale photographic campaign by Elkin. Ernst Öpik, in his results of the Harvard-Cornell Meteor Expedition of 1931–1932, derives for what he calls "shower meteors" $H_1 = 103$ km., $H_2 = 85$ km., while for all meteors $H_1 = 95$ km., $H_2 = 82$ km. He preferred to use harmonic means which appear in all cases to make H_1 and H_2 smaller than arithmetic means. Large meteors or fireballs penetrate often to 30 km.

Trains.—Most meteors leave an evanescent streak along their path which quickly disappears. The brighter ones often develop trains which last from one to many seconds. But exceptional meteors and fireballs occasionally leave trains which remain from a few minutes to even a couple of hours. Charles C. Trowbridge was the first to undertake serious researches upon long-enduring trains. His work appeared from 1906 to 1911. In this he proved that the stratum in which night trains appeared was that from 72 to 105 km., mean value 87 km. As for the cause of luminosity, he assigned phosphorescense of the atmospheric gases following preceding ionization, and showed that duration and brightness of the trains agreed well with laboratory experiments. He showed that trains were cylindrical and that they rapidly expanded; also that their drift furnished the means of finding the direction of winds in the stratum where they occur. Velocities for drift up to 300 km/hr. were found, and it was further proved that thin layers, even when adjacent, had winds blowing in different directions and with different velocities. This means that the original train not only expands its diameter, but takes many forms, often fantastic in shape. In 1921, S. Kahlke, bringing the researches upon drifts partly up to date, showed that, for night trains over 80 km., a west wind was predominant over both America and Europe, but with a strong southern component for the former, a weak northern component for the latter. This he explains on the basis of the European observations being made in higher latitudes, on an average. For day trains, between 25 and 80 km. height, for Europe he found an east wind, but there were too few cases for much certainty.

In 1941, Olivier published a much more extensive research on trains, having not only two more decades of results to handle, but finding in older literature numerous cases overlooked by the two investigators mentioned. Among his results are that for night trains the averages are: $H_1 = 102$ km., $H_2 = 74$ km., for day trains: $H_1 = 57$ km., $H_2 = 30$ km., while the average velocities are respectively 175 km/hr. and 133 km/hr. This clearly indicates higher wind velocities at greater heights, on the average. It was also proved, in a few cases, that the winds were not merely horizontal but had strong vertical components. As sounding balloons have not yet been able to explore our atmosphere above some 37 km., it is obvious that train drifts furnish our best method for getting wind velocities in the stratum where they occur, and hence are of great value to meteorology. Excellent systematic work has been done since 1920 in this, as well as all other branches of meteoric research, by Russian astronomers.

The trains left by bodies visible in daylight average, as said, much lower. These indeed must largely consist of dust and smoke, which show up by reflected sunlight. The night trains, on the contrary, cannot be so illuminated, and hence their light must be inherent. Twilight trains may be composite. The great fireball of March 24, 1933, over Oklahoma and New Mexico left a long-enduring train from 100 km. at the beginning to 25 km. height at its end. It also dropped stone meteorites. Explanation of how such a train, particularly the lower part, remained visible is more difficult. The upper part was in sunlight but at an altitude at which day trains do not usually extend. The Sun had not risen for the lower, western end. Excellent photographs were secured of this train, as well as of a few others before or since.

Under the head of telescopic meteors may be included all which are fainter than +6 magnitude. Every observer at intervals must see a meteor shoot across the field of his telescope, but the number of serious studies of the little bodies have been few. With regard to shower meteors, observations have been made at the maxima of the Perseids and Bielids particularly. One interesting result by Adelbert Safarik in 1885 for the great shower of that year was that, in his telescope, he did not see many meteors fainter than +9 magnitude, and inferred that few smaller particles existed in the Bielid stream. Fletcher G. Watson in 1936 concluded that "from a preliminary study of strong meteor showers we are led to expect relatively few telescopic shower members." Öpik concluded that most sporadic telescopic meteors had hyperbolic velocities and hence come from space beyond the solar system. J. Hoppe in 1935 considered that he was able to prove that the daily variation extended to telescopic meteors. Some observers have been disposed to think such meteors are very much higher than the average naked-eye object, but this cannot be considered as proved, or indeed very likely.

Meteoric observations are particularly suited to amateurs, not indeed that they are easy to make, if plotting is part of the program, but because professional astronomers can spend but little time away from their telescopes. Hence much of the best work has been done by amateurs who were able to devote enough time to secure results over long periods. Outstanding among such men was William F. Denning (1848–1931) whose work, over many decades, brought him deserved reputation. From about 1867 to 1872 there was an efficient association in Italy. The Meteor Section of the British Astronomical Association has been active for many decades

doing most excellent work. The American Meteor Society, founded in 1911, had up to 1946 made about 400,000 observations, perhaps one third of the meteors plotted and fully recorded, the rest mostly planned comets. In the USSR since 1920 there has been the greatest activity among both professionals and amateurs, and excellent work of every type was done on meteors. In this connection I. S. Astapowitsch and V. V. Fedynski have been leaders. There was a flourishing society in Czechoslovakia prior to World War II. There is also a society in Japan doing good work. Individuals and, at intervals, groups in many European and a few other countries have functioned effectively.

Despite all that has been done, there is a vast field for future endeavor. This can be along two lines: devising new methods or instruments, or the attempt to use those we have in a more effective manner. Nearly all previous work has been done in Europe and North America; the Southern Hemisphere has been relatively neglected. Statistical studies on such bodies as meteors should be made from many places on the Earth, widely distributed, if we would have full information. Then there are problems which can best be attacked at fixed observatories. Primarily here would be wider application of photography to meteors, both to secure more accurate paths and heights, but most of all to settle the vexing question of their velocities. So far, due to obvious selection, the velocities secured must have been for slower moving bodies, and for the brighter ones. We need accurate velocities for the more average meteors. Not until these can be derived instrumentally can the question of where they originated be settled. If their heliocentric velocity is over 42 km/sec., then they are from outer space; if less, then in general they originated in the solar system. There has been great controversy on this point, since, unfortunately, visual observations as to durations are perforce inaccurate and hence the derived velocities must be also. Cuno Hoffmeister's important work, which appeared in 1924 and later, indicated that most meteors, omitting those belonging to the principal annual showers, had a strongly hyperbolic velocity. This was based on his interpretation of the daily variation. Also the majority of the 611 fireballs contained in the Von Niessl-Hoffmeister *Catalogue* (1925) give hyperbolic velocities. This latter result was strongly criticized by W. D. Fisher, and later by Charles C. Wylie, who believed that errors in the data are responsible for the high velocities found. Yet the results of the Harvard-Cornell Expedition, both by the rocking-mirror method, which is a partly instrumental one, and by another approach to the problem, according to Öpik confirm the high velocities of sporadic meteors. But Watson (see *Bibliography*) indicates clearly that, as to the fireballs, he believes the large velocities erroneous. Whipple's work on the Taurid meteors, which Hoffmeister had worked out as an interstellar stream with high velocity, showed them to be connected with Encke's comet and really of low velocity. With all this disagreement among the best authorities, it is clear that no more important problem awaits solution than that of meteor velocities. On the answer will depend how meteors must fit into the general evolutionary picture, and, as meteorites are the only extraterrestrial bodies we can analyze, they must furnish an important key to evolution

The importance of meteor trains for studies of the upper atmosphere has already been explained. But determination of accurate heights and path lengths also give information as to the temperature, pressure, and possible composition of the stratosphere. Nearly all of this work has been and will have to remain visual. We need more and better data. Studies of meteor rates help to determine the quantity of matter in space, and the density of meteor streams. In turn we are led to a better understanding of the composition and course of dissolution of comets. Up to 1946 no one had succeeded in getting the spectrum, by photography, of a meteor train. When this is accomplished we will have direct information on the composition of our atmosphere at the heights in question. We need convincing parallax determinations of telescopic meteors to see whether they are faint because small though at average heights or are of average size at great heights. This last, like many other important problems, could be undertaken by amateurs with the proper training and instruments. All the societies mentioned welcome persons interested in the subject, and generally furnish them with full instructions and aid in starting their work.

Origin.—At present, all theories of evolution in the astronomical sense are in a state of flux, or, it would be better to state that no one has general acceptance among scientists. Such being the case, it is impossible to be certain as to where or how meteors originated. We may say that shower meteors are debris of comet nuclei, but no one has any clear idea of how a comet came into being. If, as the writer believes with many others, most sporadic meteors come from space, cometary origin is scarcely credible. Are these tiny bodies indeed the building block of evolution or its debris? If anyone could explain how such small bodies could form out in space from molecules or atoms of gas, the former would be a very comfortable hypothesis. But no one ever has, so far as the writer knows, given an even partially adequate explanation of such formation. We are then driven back to the debris hypothesis, and at present it seems the more logical of the two. In this, meteors are debris of evolutionary processes by which large bodies are born into the embryonic stage. From here on some attain full growth, others are destroyed before, or perhaps after, reaching it. For every large fragment, say of asteroid size, there would be innumerable small ones, down to the dimensions of dust. These tiny particles, scattered in vast numbers through space, give us our meteors; those a little larger, and hence far less numerous, our meteorites. In historic times we have not met a body of the next order of size, that of a small asteroid, but our Earth is itself of moderate area, space is vast, and human history short. There is not the least reason to doubt such bodies do exist, and given time enough we shall find it out in a most unpleasant manner when one finally collides with us. We should hasten to add that some meteorites, the orbits of which have been calculated, originated in the solar system: we know of asteroids of short period which come inside our orbit. It being the writer's opinion that the same processes, which formed them here, formed similar bodies in distant systems, the only question we need ask further is how the sporadic debris escaped into space. The answer would be rather

technical but should follow the type of explanation as to how a comet can attain hyperbolic velocity, which we occasionally find has occurred. Studies of space absorption and the masses of spiral nebulae also lead independently to belief that innumerable particles of meteoric size and larger exist beyond the confines of the solar system. So while a complete account of *why* they are there cannot as yet be given with any certainty, we have many good reasons for believing they *are* there.

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METEORITE, a solid mass which enters the Earth's atmosphere from without and survives its fiery passage to fall upon the Earth's surface. Previous to this encounter, a meteorite travels in an orbit which is a conic section, our Sun being at one focus. Closely approaching the Earth, the latter's attraction adds to its heliocentric velocity, hence it can be proved that the minimum velocity with which an outside body can strike us is 11 km/sec. (kilometers per second), while the maximum has reached perhaps as high as eight times this value. Just before collision, the temperature of the meteoric body would be that of a small airless planet at one astronomical unit from the Sun, or about 4°C., not near absolute zero, as is sometimes erroneously stated. Entering our atmosphere, even in the tenuous upper regions, the body would be heated by collision with air molecules, the friction or heating becoming greater as it penetrated lower. And meantime a large gas cap would be formed in front, the gases therein being tremendously compressed, and carried along with it. The surface becomes greatly heated, and in fact melts and sloughs off, and eventually the resistance, due to increased air density, not only slows but virtually stops the body at a height of some 20 to 30 km. Having lost much or all of its cosmical velocity, from this height it drops down under the Earth's attraction. This explains why any meteorite, actually seen to fall, never penetrates deeply into the ground. The greatest penetrations known are only a few meters, while small meteorites are found lying on the surface; one fell upon lake ice a few inches thick without breaking it.

As the time of passage through the air is measured in seconds, heat has no chance to penetrate from the surface into the interior by conduction. The heating and melting are therefore superficial. While meteorites are doubtless warm when they first fall, accounts of their being extremely hot, or setting fire to vegetation, seem certainly exaggerated. If they come at night, they are usually visible from a height of 120 km. or more, to 20 or 30 km.; below this, it is doubtful if many are seen. Some attain at their brightest the brilliancy of the full Moon, or even more when they burst or flare up. Such bursting is doubtless due to tremendous air pressure on their front surfaces, plus sudden surface expansions. A meteorite acts like a typical fireball while visible in its atmospheric path. The rapid passage through the air, which is violently disturbed, often produces sounds like rolling thunder, artillery fire, or even explosions. These are sometimes violent enough to shake houses. If the body comes during daylight, it is usually detected at lower heights and, by contrast, against the sunlit sky will not be so brilliant. It is accompanied often by clouds of smoke and dust, which debris at times remains visible for long intervals after the body itself has fallen. Some meteorites "explode" into many fragments; others fall in a single mass or at least only one is found. In the first case, fragments may be dispersed over an area of several square miles. When a meteorite is found, its surface to the depth of about a millimeter has a black, fused crust. This is, of course, due to the last melted material which was not brushed off by the air during its passage. Irons usually have pitted surfaces, the smaller depressions looking not unlike deep thumbmarks. When a meteorite has lain on or in the ground for a long time, larger cavities are formed by the removal of the less refractory materials through weathering. Stone meteorites, unless promptly found, are likely to be permanently lost. This is because they look not unlike ordinary rocks and they disintegrate rather rapidly. Irons, on the contrary, may survive for centuries and still be recognizable. Curiously, however, only one meteorite has been found embedded in ancient strata. This was in the Pliocene gravels of the Klondike. The history of meteorites is briefly touched on in the article METEOR, as the subjects overlap. As additional information, there is reason to believe that the (original) image of Diana at Ephesus, which "fell down from Jupiter," must have been a meteorite (see STONE WORSHIP). Several Greek or Roman writers describe the fall of other stones from heaven, which were thereafter held in veneration. The Chinese record a fall in 644 B.C. The sacred black stone built into the Kaaba (q.v.) at Mecca, which may still be seen, is believed to be a meteorite. Despite the skepticism of 18th century scientists, a few meteorites which fell before 1800 were preserved.

The German philosopher Ernst F. F. Chladni in 1794 seems to have been the first eminent man to give scientific reasons for believing certain metallic masses could not have formed on the Earth. The researches of Jean B. Biot in 1803 first convinced his colleagues that witnesses' accounts of the L'Aigle, France, fall were true and that the stones came from space.

In 1953, we have specimens of over 1,400 falls, about one fifth of which were actually seen to occur. (The one fifth is based upon data from the United States only.) Most of these objects fortunately are in large museums: the National Museum in Washington, D.C., the Field Museum in Chicago, Ill., and the British Museum have outstanding collections; and before World War II the Natural History Museum of Vienna had a noteworthy collection. There is a fine exhibit at the Vatican Museum, and also in other places, though not so large as those mentioned. Small collections by private citizens should be discouraged, since too often, on the death of the owner, they are dispersed or lost.

Meteorites are roughly called either irons or stones, but the more accurate classification is as follows: (1) irons or siderites, consisting mostly of nickeliferous iron; (2) stony-irons or siderolites, in which iron and stony matter are both mixed in large amounts; (3) stones or aerolites, consisting mostly of stony matter. There are two subdivisions of this last: (a) stones poor in

iron, generally without round chondrules, (b) chondrites, with some bronzite, olivine, and nickel-iron, and many rounded chondrules. It is obvious that while most meteorites fall clearly into one of the three main groups, there must be some borderline cases. Up to August 1943, the Society for Research on Meteorites listed 1,366 falls or finds classified as follows: in Class 1, 491 cases; Class 2, 61 cases; and in Class 3, 814 cases.

Among the elements which have been detected in meteorites by either chemical or spectroscopic analysis, no new one has been found. This indicates that the same elements exist everywhere in space. Yet combinations of minerals are found which do not occur on our Earth. This latter is one of the proofs that these bodies were formed elsewhere and came to us fully developed. In 1945, consulting five different authorities, it was found that 55 of the 96 chemical elements have been detected in meteorites. It is interesting to note that of the elements with atomic numbers 1 to 33 inclusive, 30 have been detected; from numbers 34 to 56 inclusive, 14 elements have been found; but from numbers 57 to 96 only 11 are known.

Meteorites, even of the same class, differ considerably in their composition; hence individual analyses deviate much from the average. In general, however, speaking of stone meteorites in comparison to the Earth's crust, we find over five times the percentage of iron but only about three fourths that of oxygen and silicon. The other well-known elements common to both are in quite different percentages. We would, therefore, not expect to find in meteorites the same minerals or compounds which are familiar to us here on the Earth. The stones, in general, belong to a very basic class of rocks, low in silicic acid but high in iron and magnesium. Undoubtedly they have the characteristics of igneous, not sedimentary, rocks. The stones are very complex in structure and much fragmented. Many show intrusions of other minerals which must have occurred after their original consolidation. The irons consist essentially of alloys of iron, nickel and cobalt, with which are commonly associated the phosphide schreibersite and the sulphide troilite. It is this type in which have been found small quantities of the rarer elements, including gold, iridium, and platinum. In iron meteorites, which usually have from 7 to 15 per cent of nickel, a surface, polished and then treated with acid, shows characteristic patterns of intersecting bands, known as Widmanstätten figures. They are due to the inequality of the acid's action upon thick or thin plates of the various constituents, which are largely kamacite and taenite. The latter is richer in nickel than the former, and the bands narrower. The bands are indeed edges of plates arranged parallel to the faces of an octahedron, the form crystallization had taken. Such meteorites must have formed under conditions of high temperature and great pressure. Indeed they must once have been in a liquid state and cooled slowly. Meteorites did not form in the presence of free oxygen. Reports of the finding of bacteria in meteorites are not thought to be correct.

Important Meteorites.—The largest meteorite discovered, if we omit the highly controversial Adrar or Chinguetti mass, is that still lying near Grootfontein, Southwest Africa, called the Hoba West meteorite, the present weight of which is estimated at 60 metric tons.[1] Allowing for the iron-shale around the meteorite would add 20 tons to the present weight. It is uncertain just when this was discovered (1920?), but in any case it had been lying there certainly for centuries. The next largest meteorite is the Ahnighito, or The Tent, brought from Greenland by Admiral Robert E. Peary in 1897, weight 33.1 tons. This, with two others from the same region but much smaller, and the Willamette from Oregon, weight 14.2 tons, are all irons and are in the Hayden Planetarium, New York City. Mexico possesses four very large irons: Bacubirito, 24½ tons; Chupaderos I, 14.1 tons; Morito, 10.1 tons; and Chupaderos II, 6.8 tons. The other very large iron is Mbosi, 12 tons, in Tanganyika Territory, Africa. Incidentally, the largest specimen found at Meteor Crater, Arizona, is about half a ton. No record survives as to the fall of any mentioned above.

Turning to stone meteorites, we find a different result. This is in part because irons will last for thousands of years, if large, and still be recognizable, while stones will decay. The largest single stony mass fell Feb. 17, 1930, at Paragould, Ark. Its weight is 338 kilograms (745 pounds). Three other pieces from this fall weighed 73 kilograms more. The next, Knyahinya, Czechoslovakia, weighed 293 kilograms. Two very large ones—Long Island, Kans., total weight of fragments 564 kilograms, and Bjurböle, Finland, 330 kilograms, were broken into fragments either in the atmosphere or on impact. All these were seen to fall. The fall at Pultusk, Poland, Jan. 30, 1868, seems to break all records. About 100,000 fragments were picked up, the largest 9 kilograms; the smallest perhaps 1 gram. Of these, about 200-kilogram weight has been preserved. The Estherville, Iowa, fall of May 10, 1879, also furnished thousands of fragments, total 338 kilograms. At Holbrook, Ariz., July 19, 1912, some 15,000 stones fell, total 219 kilograms. At present, many more falls are composed of stony than of iron meteorites, the proportion being about 9 to 1. Also most of those irons *seen* to fall have consisted of a single mass: the stony falls may be from one to many thousand. That we have so many irons in our collection is because, as pointed out in the case of large masses, irons survive weathering longer and attract more attention.

In modern times, meteorites have struck houses and fallen very close to people, but we have no authentic accounts—except that in Joshua—of people being killed. Taking the United States, for example, the distribution of meteorites is most surprising. For instance, up to 1941, 28 had been found in North Carolina, and only 2 in Illinois—a more populous state of about the same area and with no mountains. The southern Appalachian region seems much favored, as are Texas, New Mexico, and Arizona; but the three very populous states, Massachusetts, New York, and Pennsylvania, had only 0, 7, and 6 respectively. Colorado had 39 and Kansas 50, but this is due largely to the work of Harvey H. Nininger, who has explored that territory. Were thorough surveys made in other states, considerable numbers might be discovered, but no good explanation has been given for the curious distribution so far shown. Obviously, regions of small rainfall are those most favorable for me-

[1] The metric ton will be used in this article. It equals 2,205 pounds or 1,000 kilograms.

teorite survival and eventual discovery. It is clear that but few of the fallen masses are in any case recovered. The Earth is about three fourths covered by water; all meteorites that fall on the water areas are lost. Besides, there are vast regions near the poles where no one lives; great areas of jungle and much other uninhabited country. Even when small masses fall in thickly settled areas, unless the exact place of fall is known and at once examined, the chances for finding the meteorite are poor. It would be a very liberal estimate to say that one out of every hundred is recovered.

Meteor Craters.—By far the most important effects produced upon the Earth's surface by the fall of outside bodies are the so-called meteor craters. Several have been discovered and doubtless there are many others. They were probably caused by the impact of not one mass but of a rather compact group of meteorites, perhaps we could say the nucleus of a small comet, at least in some cases. The first to attract attention is Meteor Crater in Arizona. Around this, thousands of meteorites, weighing in the aggregate 10 to 20 tons, have been picked up. At first believed to be a peculiar effect of vulcanism, its true character was definitely proved by Daniel M. Barringer in 1909 to be due to impact. This crater is 4,000 feet in diameter and 570 feet deep, with a rim that is from 130 to 160 feet above the surrounding plain. Its bottom is filled to an extra depth of 600 feet by pulverized rock. The otherwise horizontal strata which form its walls are arched in the southwest quadrant. Geophysical surveys also indicate there is magnetic material buried there. Despite this, scientists are now divided into two schools of opinion. One, trusting to the surveys and borings, believes that large metallic masses survive, buried under the southwest quadrant; the other, basing its conclusions on computations of what would happen when a mass great enough to make the crater struck, believes it was vaporized on contact. The writer is in the first group, being more inclined to trust to actual observations than theory, especially as men have never witnessed such a catastrophe at close range, or, if so, lived to report what really took place.

There is a group of craters, 13 in number, at Henbury, Australia, the largest being 660 by 360 feet; the smallest, only 30 feet. Iron meteorites have actually been excavated from some of the smaller craters of this group.

The Odessa Crater in Texas is 530 feet in diameter and has a depth of 18 feet with a very low rim. Numerous small meteorite fragments have been found around that.

Besides these we know of other craters. The most famous of the seven are the Siberian Craters, formed on June 30, 1908. The former were caused by a group of meteorites which crossed Siberia from south to north, falling at a spot in position longitude 101° 57′ E., latitude 60° 55′ N. It was not until 1927 that an expedition under L. A. Kulik found the place, and therefore it was long after the event before observers were interviewed and data collected. There were numerous small craters, and around the area the forests had been seared and flattened, the trees lying with their tops away from the center, over an area of from 30- to 50-kilometer radius. No meteorites are known to have been recovered. The principal damage had been done by the blast of superheated air, coming from that carried along by the solid fragments, where air and fragments struck the ground. The fall occurred in an uninhabited area. Had it struck a great city, the latter would have been destroyed. More recently, several large craters, all believed to be meteoric in origin, have been located. Wolf Crater lies in northwestern Australia. It is about one half mile in diameter and 100 feet deep. Chubb Crater in northern Quebec is the largest known. It is 2½ miles in diameter and part of its rim, composed of fragmented granite, is 550 feet high. The interior is filled by a lake whose level exceeds considerably that of others nearby. In the East Pamir highlands of the U.S.S.R. two smaller companion craters exist. The larger is 260 feet in diameter and 50 feet deep; the smaller 52 feet in diameter. In this case there is a legend about a "fiery star" falling there two or three centuries ago. Lastly, on Feb. 12, 1947, a swarm of iron meteorites fell in southeastern Siberia. At least 106 craters, the largest 90 feet in diameter, were formed. A considerable weight of iron meteorites was recovered and it is estimated that perhaps 1,000 tons formed the original mass. Several other "craters" have been suspected as being impact in origin but are not considered as certain by scientists.

Origin.—There seem but two possible types of hypotheses as to the formation of meteorites: they come from small masses of gas and dust which somehow condense out in space, or they are debris of larger bodies which have disintegrated. While certain eminent men have leaned to the former theory no one has been able to show how the extremely complex meteoric structure could evolve under such conditions. For it is obvious that the structure of meteorites, shown when they are examined under the microscope, must be the result of very complicated actions. Unless this point can be explained, it would seem that we are driven to the second method of formation. Here we are at liberty to think of an exploded planet, asteroid, or possibly a star, and disintegrated nuclei of comets. There seem no grounds for believing that meteorites could have been fragments of our Earth.

To determine the age of meteorites would aid in settling their origin. Helium and lead are products of radioactive elements. As the rate of radioactive decay is known, for instance the total amount of helium accumulated in any period, divided by the actual rate of production of helium in the meteorite, gives the age of the latter. The method is more applicable to irons than stones, it being assumed gases can escape more readily from the latter and not at all from the former, once solidification of the minerals has taken place. Work by Fritz Paneth, William D. Urry and W. Koeck on 23 irons indicated their age as being from 10^8 years for the "youngest" to 2.8×10^9 years for the "oldest." If these ages are correct, none seems older than the Earth. Measurements on the Pultusk stones gave 5×10^8 years, but this estimate is without doubt much too low, as the stones are at least semiporous. In comment, the results depend upon the *assumption* there has been no leakage. In millions of years, meteorites moving in what is a practically perfect vacuum, and heated on each approach to our Sun (or any other star), *may* lose some of their gas. If so, their ages would be greater than indicated above.

Some at least have such low velocities that

we know they belong to the solar system and originated therein. Some of their orbits resemble those of short period comets. For others, observations (which are always very uncertain as to duration) give hyperbolic orbits. If these orbits are *truly* hyperbolic, then these meteorites came from other parts of space. They could not have evolved in the solar system. Even so, this only tells *where* not *how* they came into being. The two hypotheses on their origin that now are available have been mentioned. As with meteors, accurate velocities will settle whether they were permanent members of our solar system or not.

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METEOROLOGY, the branch of physics dealing with the atmosphere and its phenomena. The term *weather* refers to the state of the atmosphere with respect to temperature, pressure, humidity, wind, cloudiness, and precipitation at any instant or over a period of time. A distinction is drawn between weather and climate (see also CLIMATE) in that the latter is the integral or totality of weather at a place over a long period of years.

History.—Man's interest in the atmosphere has existed since primitive times because his life has always been greatly affected by the weather. Of necessity, he began to observe the weather so that he might be able to protect himself from its vagaries. He soon learned that certain atmospheric phenomena were connected with certain kinds of ensuing weather. Thus, the solar halo was early recognized as a precursor of rain, and twilight colors were given a significance.

The early Greeks applied their philosophy to weather phenomena. Aristotle's *Meteorologica*, which today seems so naïve, nevertheless remained a standard treatise on meteorology for 2,000 years (c.350 B.C.–1650 A.D.). It was not until the 16th and 17th centuries following the stagnation of the Middle Ages, that meteorology along with other sciences began to progress. The invention of the thermometer (c.1593) by Galileo and the barometer in 1643 by Evangelista Torricelli brought the beginning of the period of exact weather observations. Observations were then begun in Italy and spread slowly through Europe and to America in the next century. From observations at only a few points Benjamin Franklin recognized that individual storms move from place to place over the Earth's surface. About 1820 the German physicist and astronomer Heinrich Wilhelm Brandes (1777–1834) collected observations in Europe, all of which had been made at the same time some 37 years earlier at various places, and plotted them on a map. This was the first synoptic weather map. About a year later, William C. Redfield (1789–1857) prepared synoptic maps in the United States based on more recent data. Shortly after the establishment of the first commercial telegraph line in 1848, Joseph Henry and James Pollard Espy organized a regular telegraphic weather service in the United States. With observations collected from many places by telegraph, synoptic maps showing the weather existing only a few hours earlier could be constructed. Soon thereafter, weather services were organized in France, Holland, and England. In 1870 the United States Weather Bureau was established (see WEATHER BUREAU). In more recent years, teletype, radio, and facsimile have made possible the rapid collection and exchange of meteorological reports from vast ocean regions and remote land areas over most of the Earth. In addition, the speedy dissemination of weather maps and forecasts has been facilitated.

The nature of systems observed on weather maps has been the subject of much study since the middle of the 19th century. In 1841 Espy was among the first to point out the importance of expansion and cooling of rising air in producing clouds and thunderstorms. Heinrich Wilhelm Dove in 1857 published *Das Gesetz der Stürme* (*The Law of Storms*), in which he attributed the development of large-scale storms (cyclones or low pressure areas of temperate latitudes) to the interaction between tropical and polar air currents. In 1860 the Dutch meteorologist, Christoph H. D. Buys Ballot formulated his famous law (Buys Ballot's law) on the relation between pressure and wind. During the period of World War I (1914–1918), Vilhelm Bjerknes and several collaborators in Norway developed the principles of air masses and fronts. They theorized that large-scale storms developed from large waves along a boundary or front between air masses of differing characteristics. During the 1920's and 1930's these new air mass and frontal concepts revolutionized the whole theory and practice of temperate zone weather analysis and forecasting. As observations of the upper air became fairly numerous in the 1930's and 1940's, hydrodynamic wave theory was applied to the wavelike upper-level circulations. Much of this work has been done in the United States by many workers, among whom the most notable have been Jakob Bjerknes and Carl-Gustaf Rossby.

Definitions of the Meteorological Elements.—*Pressure.*—Pressure refers to the weight of a column of the atmosphere above a given place of observation. It is hard to realize in the quiet of a room that air has weight or can exert any pressure. But actually the air in a room 10 by 10 by 10 feet weighs about 75 pounds. Since air has weight, the whole atmosphere presses down upon the Earth's surface beneath it. The average force is about 14.7 pounds per square inch at sea level. Pressure has been expressed most frequently as the height of a column of mercury of equivalent weight (as read from the mercurial barometer). It is now customary to express pressure in millibars, which are units of the metric system. Thus, the average sea level pressure is 1,013 millibars which is equal to 29.91 inches of mercury and 14.7 pounds per square inch. Obviously the pressure must decrease with increased elevation, for as one goes up in the atmosphere a greater part of the total column of air is left below. A consequence of this idea is that if the air is more dense in one place than in another, the pressure will decrease more rapidly with height where the denser layer of air is more concentrated near the ground. Thus pressures at equal levels aloft are usually higher where the air is warmer (or less dense) below that level, and lower where the air is cooler (or more dense).

Temperature.—Air temperature is a measure of

the thermal state of the atmosphere. Two temperature scales, the Fahrenheit and the Centigrade,* are in use in recording meteorological data. On the former scale, 32° is the freezing point of water and 212° the boiling point (at standard atmospheric pressure—1,013 millibars). On the Centigrade scale, 0° is the freezing point and 100° the boiling point.

Wind.—Wind is air in motion. Both speed and direction of the wind are observed. The direction always refers to the point of the compass from which the wind is blowing. Speeds are expressed in miles per hour, knots, or meters per second. Winds at the surface are usually gusty and changeable while winds aloft generally blow more steadily. Wind also includes a vertical component at all levels above the ground, which is generally much smaller than the horizontal component considered here. The vertical wind velocity is difficult to measure.

Humidity.—This refers to the amount of water vapor, exclusive of condensed water, in the atmosphere. Air has a greater capacity for water in vapor form at higher temperatures. As air is cooled and/or lifted this capacity is reduced, and if allowed to continue long enough, the air will reach a point beyond which it will no longer be able to hold its original amount of water in vapor form. This is known as saturation and if the temperature is lowered below this point, the excess vapor condenses into liquid water or ice. For most purposes of daily life, the *relative humidity* is the quantity used to express the condition of the air with respect to water vapor. It is defined as the percentage of saturation. Other measures of humidity in use are the dew point, which is the temperature to which air must be cooled at constant pressure in order to become saturated, and mixing ratio, which is the amount of water vapor present per unit mass of dry air.

Condensation Forms.—Water vapor condenses at saturation, forming dew or frost on the ground or on objects in the air, and fog or cloud in the air. (Fog is merely a cloud whose base rests on the ground.) Clouds and fogs usually consist of water droplets, even at temperatures below freezing in a supercooled state. At very low temperatures, however, the fog and cloud particles more frequently consist of small ice needles. Condensation forms which fall out of the air to the ground constitute *precipitation.* Precipitation falls when the water or ice particles become too large to float freely in the air. Precipitation occurs in many forms, the most frequent of which are rain, drizzle, snow, sleet, and hail. (See also Clouds, Dew, Fog, Frost, Rain, Rain-making, Snow.)

Visibility.—This is the horizontal distance at which prominent objects are visible. The observed visibility defines the degree of fog, smoke, dust, or haze which is present in the atmosphere. Visibility is also reduced by snow, rain, and drizzle.

Ceiling.—This refers to the vertical visibility as determined by the height of the cloud base. Ceiling is defined strictly as the lowest height at which the sky is more than one half obscured, including all clouds at or below that level. However, if the sky is one half or less overcast, the ceiling is defined as unlimited. Ceiling and visibility are of greatest importance in aircraft operations, especially in takeoffs and landings.

Meteorological Instrumentation.—To provide an adequate three-dimensional picture of the atmosphere the meteorological elements just mentioned must be observed at many points on the Earth's surface, at many levels above the surface, and at regular intervals each day. The human observer plays an important part in making these observations, but improved instrumental techniques have made man's observations more exact and have tremendously broadened the scope of the probing of the atmosphere. The standard meteorological instruments used for measuring temperature, pressure, humidity, rainfall, and wind at the Earth's surface are well known, and are discussed in detail in other volumes of The Encyclopedia Americana (see Anemometer, Barometer, Hygrometer, Rain-Gauge, and Thermometer). A brief discussion of a few notable advances in instrumentation will be given here with emphasis on instruments for upper-air observations.

Temperature, pressure, and humidity of the upper air are now generally measured by the radiosonde, a small lightweight instrument carried aloft by a large balloon filled with helium or hydrogen. The radiosonde contains an aneroid barometer, a resistance thermometer, and a hygrometer. These are connected to a very small radio transmitter so that signals giving pressure, temperature, and humidity values at various levels are broadcast by the instrument as it ascends. These signals are received and recorded at the station from which the balloon was released. In earlier years upper air soundings were made by kites (until about 1930) and then airplanes. By 1939 the airplane ascents were in turn almost completely replaced by the radiosonde in the United States. However, airplane observations have been used extensively during and since World War II in probing the atmosphere over vast ocean regions and remote land areas where meteorological stations are scarce. Aircraft reconnaissance has done some of its most notable work in polar regions, and over the tropical oceans where tropical storms have been located and closely tracked. Since the close of World War II rockets have been used to provide direct observations of the higher atmosphere (up to 135 miles). These have been experimental in nature and very infrequent.

Measurement of upper winds in clear skies or below clouds has been accomplished by observing the movements of an ascending small pilot balloon (pibal) with the aid of a theodolite. The development and application of radar and radio direction-finding since the late 1920's have made possible the tracking of balloons through and above clouds and fog and up to as high as 10 to 15 miles. These radio wind observations which are called "rawins," are made on a routine basis at many stations, but pibal observations still (1951) remain the predominant means of upper-wind measurement.

Radar, in addition to its use in winds-aloft determination, has since World War II become a powerful meteorological tool in several other ways. It is important in aircraft reconnaissance where absolute altitude can now be determined in conjunction with pressure measurements. It is also interesting that the very phenomenon (the blanketing of the echoes of man-made targets by precipitation and clouds) which at first hampered

* The term "Celsius" was officially adopted in place of Centigrade by the Ninth General Conference of Weights and Measures in 1950.

the operation of radar for its original purpose now provides the basis for many meteorological uses. Water drops in the atmosphere reflect radar pulses so that echoes can be obtained from clouds and precipitation. Thus, radar can reveal the position, direction of motion, structure, and intensity of clouds and rainfall associated with showers, thunderstorms, squall lines, fronts, hurricanes, and tornadoes at horizontal distances up to a few hundred miles. It also appears that it will soon be a means of obtaining a far better space integration of rainfall intensity and amount than can be given by widely scattered rain gauge measurements. (See RADAR for a full discussion of its development and operation.)

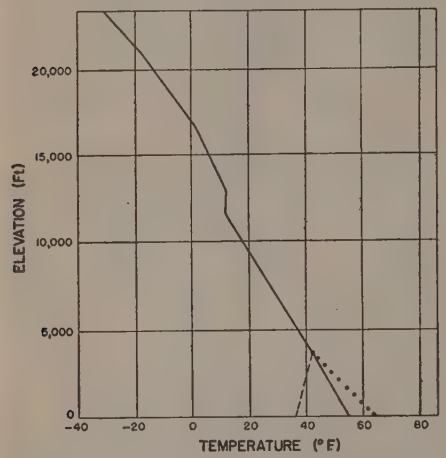

FIG. 1.—Typical vertical sounding of the atmosphere taken at 10 A.M. early in May at a station in the northeastern United States. Appearance of lower portion of sounding at 7 A.M. is indicated by dashed line and at 3 P.M. by dotted line.

Composition of the Atmosphere.—Air is a mixture of ten different gases. Aside from water vapor, this mixture is nearly the same throughout most of the atmosphere, with nitrogen (78 per cent) and oxygen (21 per cent) predominating. Between 12 and 25 miles above the Earth's surface much of the oxygen appears as ozone which absorbs part of the ultraviolet radiation from the Sun. Argon and carbon dioxide are also of significance but make up less than 1 per cent of the mixture. Water vapor is the one gas which is quite variable, ranging from a trace to as much as 4 per cent at some places on hot, humid days. According to William J. Humphreys, if all the water vapor were condensed out of the atmosphere, it would cover the entire earth with water about one inch deep. The atmosphere also holds in suspension minute particles of many solid substances such as dust, smoke, salt, and pollen. These are picked up from the underlying surface of the Earth and thus are most significant in the lower levels of the atmosphere.

Extent of the Atmosphere.—As any layer of air is compressed by overlying layers, it follows that the layer at the surface is densest. Accordingly, air becomes lighter and lighter with increasing elevation. There can be no definite upper limit to the atmosphere, but probably above an elevation of more than about 600 miles the atmosphere gradually becomes as highly rarefied as the gases in outer space. It has been calculated that at an elevation of about 21,000 miles the force of gravity can no longer hold the air particles and that they fly freely out into space. In spite of its great depth, half of the atmosphere is contained within only the first 3.5 miles above the surface since pressure drops off so rapidly with elevation. If the atmosphere had the same density throughout as at the surface, it would form a layer only 5 miles high. (See also ATMOSPHERE.)

Heat Balance of the Atmosphere.—Heat for the atmosphere originates on the Sun, the amount received being enormous. It has been calculated that the solar energy received by the Earth per minute is equal to the burning of 100 million tons of soft coal.

The air is practically transparent to the incoming solar radiation (unless there is a cloud cover) so that most of the energy is received directly at the Earth's surface without much heating of air. A considerable part of this solar energy is directly reflected to space from the Earth, the amount depending upon the reflective character of the Earth's surface (water, forest, desert, etc.). The remainder is absorbed by the surface. The Earth then contributes heat to the air in several ways. First the Earth reradiates some of its heat energy, but at longer wavelengths than those received from the Sun. Many of these longer waves are more readily absorbed by the water vapor of the atmosphere, although a substantial part of this terrestrial radiation passes directly out to space again. The Earth also heats the air by conduction combined with convection. When air is cooler than the Earth, the layer immediately in contact with the ground is heated by conduction. Since air is a very poor heat conductor, other layers somewhat removed from the surface would not be affected solely by conduction. However, it is the heated layer of air adjoining the ground which transports the heat to higher levels and distant portions of the atmosphere. This occurs as the heated air, becoming lighter than adjacent bodies of air, is forced to rise by virtue of its buoyancy, and then flows off horizontally aloft. This convection process transfers heat both horizontally and vertically at a much more rapid rate than radiation. Water vapor also plays an important role in transferring heat from the Earth's surface to the atmosphere. Evaporation of water from the Earth's surface into the air takes place at the expense of a certain amount of the surface's heat content. The water vapor carrying this latent heat is diffused through the atmosphere by the winds. Eventually the water vapor condenses again mostly in the form of clouds and precipitation, thus releasing the latent heat of condensation to the atmosphere aloft.

Since the Earth and its atmosphere, as an entity, do not become progressively colder or warmer, it is apparent that there must be a balance of the heat received by radiation from the Sun and that lost by the Earth and air. Most of the incoming solar radiation is absorbed in tropical regions, while much smaller amounts are received in polar regions. But since much of the heat received in equatorial regions is transferred by the air and the oceans to higher latitudes, the outgoing radiation from the Earth and the air does not vary appreciably with latitude.

Distribution of Temperature.—*Surface Air*

Temperatures.—It follows from the considerations of the heat balance just mentioned that temperatures at the Earth's surface are warmest in equatorial regions and coldest at the poles. However, the distribution of land and water and the presence of ocean currents and winds make the temperature distribution over the Earth much more complex. Land and water at the same latitude, exposed to the same amount of solar radiation at a given time, may have markedly different temperatures because of their differing absorption properties. Land very readily absorbs nearly all of the radiant energy received, but it is all concentrated within a few centimeters of the ground surface. Thus, temperatures of land rise rapidly as heat is received, and likewise drop rapidly as heat is lost. On the other hand, the heat received by water is distributed through a rather deep layer so that the surface temperature rises slowly. When the water surface cools, warmer water is constantly transported upward, as the cooler water sinks to greater depths. Therefore, the surface temperature of water decreases rather slowly as the surface cools. As a consequence of the difference between land and water, it is found that surface air temperatures over continents are considerably colder than those over the oceans in winter, and considerably warmer in summer.

Vertical Distribution of Temperature.—The temperature in the atmosphere generally decreases with height above the Earth's surface until it reaches on the average about —50°F. at 6 miles above the Earth in polar regions and about —100°F. at 11 miles in equatorial regions. Above these levels the temperature remains nearly constant in polar regions while it rises with height in equatorial regions. The level at which the temperature decline ends is called the *tropopause.* Below the tropopause is the *troposphere,* where the temperature drops with height, and above is the *stratosphere,* where the temperature remains the same or increases with height.

Direct observations of the upper air by sounding balloons have become frequent only since the 1930's. Soundings of the atmosphere regularly reach heights of 10 to 15 miles. Some comparatively rare observations by rockets have been made since the 1940's up to 135 miles. Thus, temperatures above 15 miles are known largely from indirect evidence such as meteor observations, abnormal sound wave propagation, noctiluscent clouds, aurorae, and radio beams. From all available evidence it is believed that temperatures increase from the lower stratosphere upward to about 100°F. at 35 miles, decrease again to about —100°F. at 45 to 50 miles, and then increase again to about 1,300°F. at 190 miles.

Temperature Lapse Rate.—The rate at which temperatures decrease with elevation is called the vertical temperature gradient, or temperature lapse rate. In the troposphere the lapse rate is about 3°F. per 1,000 feet. An example of an atmospheric sounding is given in Fig. 1. This shows how the lapse rate varies in different atmospheric layers at the given time and place of this sounding. The sounding was taken at 10 A.M. The estimated appearances of the curve at 7 A.M. and at 3 P.M. are shown by the dashed and dotted lines to illustrate the difference in the sounding between the warmest and coolest parts of the day at the surface.

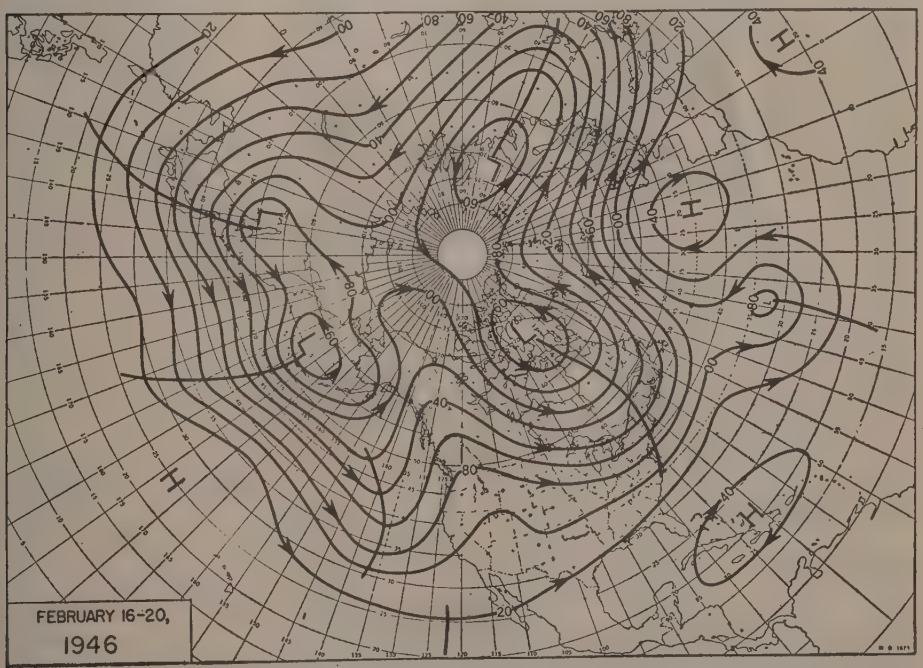

FIG. 2.—Average 700-mb constant pressure chart for a five day period. This is an example of the winter circulation around the Northern Hemisphere between about 8,500 and 10,500 feet above sea level. Air flows in the directions indicated along the contour lines at a speed inversely proportional to the spacing of the lines. H indicates high center, L is low center.

Adiabatic Process.—If a parcel of air is heated at the surface it is usually forced to rise because it has expanded and is therefore lighter than the surrounding air. In rising it further expands and we have the process known as *adiabatic cooling*. This refers to the cooling of a parcel of ascending air without the gain or loss of heat from or to air outside the rising parcel. In the case of unsaturated air, the rate of cooling of this parcel through the surrounding atmosphere is 5.5°F. per 1,000 feet. (The lapse rate prevailing in the surrounding air which was discussed in the previous section may or may not be the same as the cooling rate of this rising parcel, which is called the dry adiabatic lapse rate.) Conversely, if unsaturated air descends it warms at the same dry adiabatic rate.

If an air parcel is lifted and cooled beyond its saturation point, water begins to condense out of the air. As condensation takes place, latent heat is released as a result of the change of state from gas to liquid or ice. So, as a parcel ascends above the condensation level, it cools more slowly than when it was unsaturated. This moist or pseudo-adiabatic lapse rate has no constant value since it varies with the amount of moisture being condensed. When precipitation drops out of the rising air it is obvious that its total moisture content (vapor, liquid, and solid) decreases during the lifting. In this case, if the air descended again, it would drop for a much shorter distance at the moist adiabatic rate than on its way up. It would then continue its descent at the dry adiabatic rate and return to its original level at a higher temperature than it had at the beginning. This effect is often observed when moist air

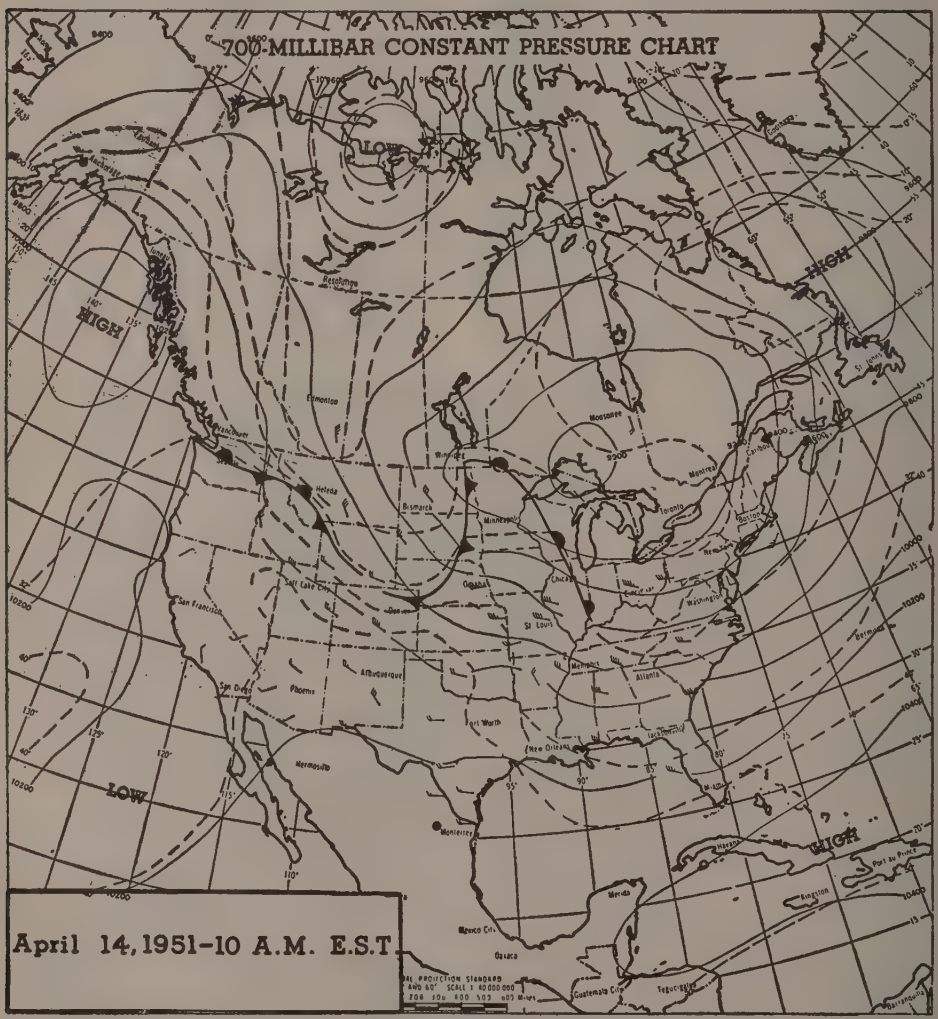

FIG. 4.—Upper level chart based on observations made 3½ hours earlier than those used for the sea level chart in Fig. 3. Thin continuous curved lines are height contours along which the air generally flows. Arrows show observed wind direction with the number of barbs indicating strength of flow (each full barb represents about 10 miles per hour). Dashed lines show temperatures in °F. at 10° intervals. These charts are usually prepared twice daily from radiosonde observations.

flows over a mountain. As it is lifted on the windward side the air cools, and rain or snow falls out up to the top of the mountain. Then, as the air descends on the leeward side, it warms at the dry adiabatic rate, returning to its original level at higher temperatures than it had before it ascended the mountain. This is in part the explanation of the warm dry chinook or foehn winds observed on the leeward slopes of the Rocky Mountains and the Alps.

Vertical Stability of Air.—The lapse rate of the air existing at a given time and place determines the degree of stability of the air in the vertical. If the lapse rate is such that a parcel or layer of air resists upward or downward displacement, the air is stable. But if the lapse rate is such that an air parcel or layer will rise or sink of its own accord, once given an impulse, the air is unstable.

Stable air is characterized by a vertical temperature gradient or lapse rate which is less than the dry or moist adiabatic lapse rate, depending upon whether saturated or unsaturated conditions exist. Under stable conditions a lifted air parcel would soon find itself at a lower temperature than its surroundings since it cools at the adiabatic rate. Since this parcel would now be denser than the surrounding air, it would have to sink back to its original level. Thus, vertical motion is resisted and the air is stable.

Unstable air is characterized by a vertical temperature gradient or lapse rate which is greater than the dry or moist adiabatic lapse rate, once again depending on whether saturated or unsaturated conditions exist. In this case a lifted air parcel would cool at the adiabatic rate, which is not as much as the prevailing rate in the surroundings, and would soon find itself at a higher temperature than its surroundings. Since the parcel would now be less dense than the surrounding air, it would continue to rise, becoming at an ever increasing rate warmer than the adjacent air, as long as the prevailing lapse rate remains steeper than the adiabatic. Thus, vertical motion is accelerated and the air is unstable.

When a substantial amount of unstable air rises all at once in a convective updraft, such as exists in the familiar thundercloud, the air parcels do not simply rise without disturbing the adjacent layers of air. Rather a considerable amount of the cooler, drier air surrounding the updraft is pulled along or "entrained" with it. As this happens, the moister and warmer air coming up from lower levels mixes with this entrained air, and the result is that the air at higher levels in an updraft is cooler and less moist than would be expected from the simple adiabatic cooling of a parcel or layer discussed above.

The degree of stability or instability of the air has several consequences since it reflects the susceptibility of the air to vertical motions. For one thing unstable air with its inclination toward vertical motion generally results in rather bumpy or turbulent flying conditions while stable air is ideal for rather smooth flying conditions. Also, clouds associated with unstable air are of the cumuliform (vertically developed) type while stratiform (flat layer type) clouds are favored where stability prevails. Air must be markedly unstable, of course, for the development of cumulus-type clouds into the large swelling cumulus or cumulo-nimbus which produce showers, thunderstorms, and tornadoes. Of ever increasing importance is one other consequence of stability. This is its role in facilitating or obstructing the removal of the combustion products of industrial plants and other sources from the layers of air near the Earth's surface. When instability prevails in the air within about a thousand feet of the ground the turbulent vertical motions rapidly diffuse the smoke emitted from stacks through a large volume of air. When the air is stable, however, and turbulent vertical motions are suppressed, these combustion products are concentrated near the ground and have little chance to escape. Pollution becomes most acute when a large temperature inversion exists in the surface layers for several days. This is likely to occur in connection with a stagnant high pressure cell (anticyclone). The very severe effects of such a condition were felt on October 30-31, 1948, when 20 persons died and hundreds of others were stricken in and near Donora, Pa.

Wind and Pressure.—The speed of the wind is largely a function of the horizontal difference in pressure between two places. The greater the difference in pressure, the stronger the wind. It would seem logical for air to flow directly from high pressure toward low pressure, but this is not the case on the rotating Earth. The rotation of the Earth produces an apparent deflecting force, which in the Northern Hemisphere turns air currents toward the right. Thus, air flowing from high to low pressure is turned to the right until the deflecting force balances the force of the pressure difference, or the pressure gradient force. Air flows nearly parallel to the lines of constant pressure, or isobars, with high pressure to the right and low pressure to the left. (These directions are all reversed in the Southern Hemisphere since the deflective force acts toward the left.) At the surface, the friction of the ground retards the air and allows the pressure gradient force to overbalance the deflective force so that the air blows at a small angle (20° to 30°) across the isobars toward lower pressure.

General Circulation.—Measurements have shown that the heat received by solar radiation in equatorial and tropical regions is greater than that radiated to space in those regions, while the heat received from solar radiation in polar regions is less than that radiated. This means that there must be a transfer of heat from the tropical to polar latitudes. To effect this transfer there must be a primary or general circulation of the air over the Earth. This circulation is rather complex due to the Earth's rotation, the unequal distribution of land and water, and the effect of mountain barriers over which the air must travel. Many features of the general circulation are known through observations, and some of these will be discussed here.

The observed general circulation of the atmosphere may be portrayed by long period average, or normal, pressure maps for various months of the year at both sea level and aloft. Since the winds generally blow along the isobars and at a speed inversely proportional to the spacing of isobars the circulation is readily portrayed by the pressure field. For example, a chart of the normal pressure distribution over the Northern Hemisphere at sea level for a winter month reveals certain large cellular high and low pressure areas, generally known as centers of action. These are the Icelandic and Aleutian lows, the

Atlantic and Pacific, subtropical high cells, and the North American and Siberian highs. The circulation around the Icelandic low, for instance, comes from the north out of eastern Canada, turns eastward across temperate latitudes of the Atlantic, flows across northern Europe towards the northeast, turns poleward in the Siberian Arctic, and then flows westward across the Arctic Ocean and northern Greenland back to northeast Canada. From such a chart one may obtain the average airflow around the hemisphere in a west-to-east or east-to-west direction. When this is done, it is found that in January this flow is prevailingly from the west (westerly) in temperate latitudes and from the east (easterly) in polar and subtropical latitudes. Average pressure maps at higher levels (from 10,000 to 50,000 feet) become somewhat simpler since higher pressure appears over the warmer regions and lower pressure is found over colder areas. Thus, in winter at higher levels the easterly winds largely vanish and there exists a vast whirl of westerly winds surrounding the pole. In summer the individual features at sea level and aloft mentioned here change somewhat, so that circulation is less intense and the upper level westerlies shift farther north.

The large-scale general circulation around the hemispheres also exists on shorter period average maps or on a daily map. At most times, at levels between 10,000 and 50,000 feet, there are narrow zones of strong winds (sometimes reaching a maximum of about 250 miles per hour near the tropopause level) in the "westerly whirl." These are known as *jet streams.* The jet stream and its accompanying westerly current are by no means straight westerly, but actually the flow has the appearance (from a perspective of the entire hemisphere) of a meandering river moving to higher latitudes in some areas and to lower latitudes in others. A picture of such a flow pattern at the 700-millibar pressure level (about 10,000 feet) is shown in Fig. 2. This is an average map for five days. Lines connecting northernmost points of the curving contours of the westerlies are called *ridges,* and lines connecting southernmost points are *troughs.* (The latter are drawn as heavy lines in Fig. 2.) Together these troughs and ridges constitute "waves in the westerlies." The wavelengths (measured in terms of distance from trough to trough) usually vary from about 2,000 to 4,000 miles. The individual waves in this circumpolar belt are strongly interdependent. Cold air masses from polar latitudes are brought into the troughs by the northwesterly flow behind them, while warm air from the subtropics travels northward in the southwesterly flow ahead of the troughs and into the ridges. Each trough is generally associated with one or more of a family of cyclones at sea level, and each ridge with a sea level anticyclone. This association can be seen by comparing the sea-level and upper-level maps in Figs. 3 and 4. The upper-level current generally exercises a steering effect on the surface air masses, fronts, and storms, which will be discussed below.

Air Masses.—An air mass is defined as a large portion of the atmosphere which is homogeneous as to temperature and humidity in its horizontal layers over an extensive area of the Earth's surface. If a body of air lies or travels over a particular region of uniform surface and great extent, such as a large land area or a broad ocean, it will acquire properties of temperature and humidity peculiar to that area. Thus a mass of air over a northern continent will be cold and dry in distinct contrast to air over a tropical ocean which will be warm and moist. As an air mass moves from its source region, it begins to modify in response to the surface it traverses at a rate which is relatively slow. An exception to this is when cold, dry air in winter moves out over a warmer ocean surface. In this case the air mass absorbs heat and moisture rather rapidly, developing into a different type in less than a day.

Air masses are classified according to their primary source region, either polar or tropical. They are further classified as to whether they are maritime or continental in character. Consequently, there are essentially four different air masses, continental polar (cold and dry), maritime polar (cold and moist), continental tropical (warm and dry), and maritime tropical (warm and moist). Continental polar air in the Northern Hemisphere originates over the northern continents and the ice- and snow-covered Arctic Ocean. Maritime polar air has its source in northern portions of the Atlantic and Pacific oceans. Maritime tropical air comes from the tropical and subtropical latitudes of the Atlantic, Pacific, and Indian oceans, the Mediterranean and Caribbean seas and the Gulf of Mexico. The subtropical continental areas produce continental tropical air. These areas include the southwest United States and Mexico, the Sahara, and large portions of the Near and Middle East. The properties of the air masses change with the changing properties of source regions from season to season. In temperate latitudes the air masses often alternate (with warm air masses extending their influence farther and farther north as summer approaches) so that the weather may be warm and balmy one day while maritime tropical air is present, and cold and blustery the next day, as continental polar air invades the area.

Fronts.—When two dissimilar air masses are brought together by the general atmospheric circulation they do not immediately mix, but a definite boundary or *front* (perhaps 5 or more miles wide) occurs between them. Along and near this front colder (denser) air generally underlies warmer (rarer) air in the form of a wedge so that the front is usually inclined at a small angle to the Earth's surface. A *cold front* is the boundary between the forward edge of an advancing cold air mass which is displacing warmer air in its path by underrunning the latter. A *warm front* is the boundary at the forward edge of an advancing current of relatively warm air which is displacing a retreating mass of cold air, in which case the warm air overruns the cold mass. These fronts are often characterized by rather definite air-mass interactions, such as variable winds, clouds, rain, rather abrupt temperature changes, and other weather phenomena. The form and intensity of these interactions depend on the differences in characteristics of the air masses involved, their extent, and the amount of converging motion forcing them together. The major cloudiness and precipitation associated with fronts are produced by the cooling and saturation of the warm air mass as it is forced upward over the colder air mass.

Cyclones and Anticyclones.—*Extratropical Cyclones.*—These are the general storms of temperate latitudes. The great majority of these

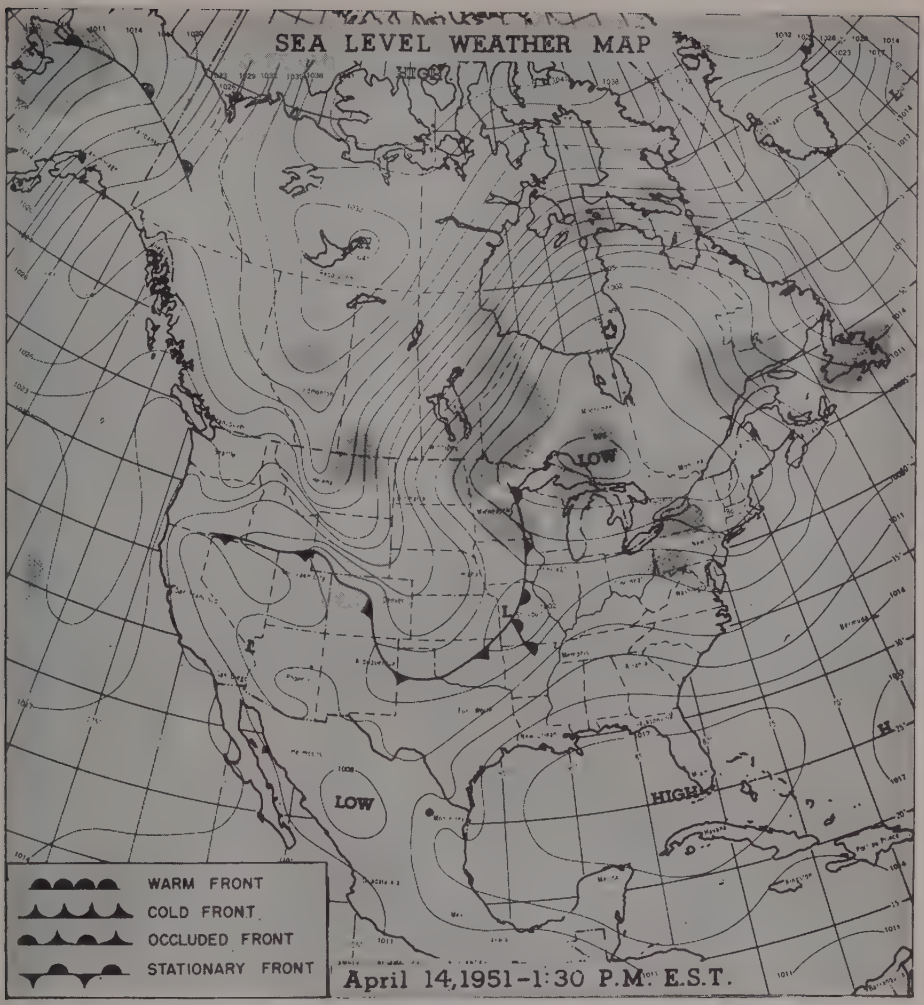

Fig. 3.—A sea level weather map, one of four prepared daily, showing (shaded areas) where precipitation is occurring. The thin curved lines are isobars.

Courtesy United States Weather Bureau

The white areas on this radarscope are the reflected signals from regions where heavy rains are falling; the quasi-circular bands denote a hurricane, the smallest circle showing the storm center or eye.

Courtesy Weatherwise, Franklin Institute, Philadelphia

The fury of a hurricane lashes the southern coast of Florida near Miami.

Courtesy United States Weather Bureau—Robideau Studios, Malone, N. Y.

Sagging telephone wires and broken tree branches tell the story of layer upon layer of ice accumulated during a severe ice storm in upper New York State.

storms develop as small waves along slow moving or nearly stationary fronts between two differing air masses. This initial wave disturbance causes a thrust of warm air toward the cold air at one place (warm front) followed by a thrust of cold air toward the warm air (cold front) at another place. If certain conditions of air mass contrast, wind discontinuity, wavelength, and upper flow pattern are met, this wave begins to develop into a full-scale extratropical cyclone. The warm front pushes far to the north and the cold front pushes far to the south as the wave moves (generally eastward), steered by the westerly flow aloft. The average speed of these waves is about 35-40 miles per hour in winter and about 20-30 miles per hour in summer. The storm development is accompanied by lowering pressure at the crest of the wave, or cyclone center, and by increasing winds circling the storm in a counterclockwise direction (in the Northern Hemisphere). Generally the cold front moves more rapidly than the warm front so that the former begins to overtake the latter while the storm is still in its intensifying stage. This *occlusion* process lifts the warm air completely off the ground and the cyclone soon becomes a whirling mass of cold air. As this occurs the storm gradually begins to decay. At its greatest intensity the storm may have a diameter of as much as 1,000 miles.

The huge cloud and precipitation systems of these great extratropical cyclones are representative of frontal weather in its most pronounced form. Ahead of the warm front there is usually a large area of steady precipitation caused by the gentle upglide of the warm air. Along the cold front there is a long, narrow band of heavy, showery precipitation caused by the forced lifting of the warm air.

Tropical Cyclones.—These storms occur within the tropical air masses, and are most frequent in western portions of the tropical Atlantic and Pacific oceans from August to October. Other common names for the tropical cyclone are *hurricane* and *typhoon.* In the Northern Hemisphere hurricanes form over the oceans at about 10° to 20° N. latitude where there is a plentiful supply of heat and moisture. They generally travel westward in the trade wind belt. Very often they curve northward at the western edge of the subtropical high cell and reach into temperate latitudes. Here they either dissipate or become extratropical cyclones. These storms are usually only about 100 to 200 miles in diameter, but they are characterized by destructively strong winds (often 150 miles per hour at the surface), torrential rainfall, incessant lightning, and very low central pressure. In addition the strong winds generate large waves and high tides which inundate low-lying coastal areas exposed to the onshore flow of the storm.

Anticyclones.—These are high pressure systems which are generally characterized by clear skies and gentle winds. They usually mark the centers of air masses, and may be cold polar air highs or warm tropical air highs. They are in contrast to the extratropical cyclones which mark the meeting ground of two or more dissimilar air masses. Cold anticyclones in middle latitudes are generally transported eastward under the westerly upper-level flow. Warm highs in the subtropics and cold highs in the arctic are slow-moving or stagnant.

Local Storms.—*Thunderstorms.*—These are the familiar local storms which are accompanied by lightning, thunder, strong and gusty surface winds, heavy rain, and sometimes hail. They are usually of short duration (less than 2 hours) and are only of limited horizontal extent (8-12 miles in diameter). Vertically these storms often extend from a few thousand feet above the ground up to 30,000 feet or more. The typical towering cumulo-nimbus or thundercloud is produced by vigorous upward motion resulting from well-marked vertical instability of the air. After the cloud is well-developed, extensive downdrafts, which are associated with large falling raindrops or hail, set in. These cool downdrafts spread out from the storm's center as they approach the ground. Thunderstorms are most frequent in regions where warm moist unstable air masses predominate. Frequently thunderstorms are found in long lines several hundred miles in length. These are known as *squall lines* and often occur along or preceding a cold front.

Tornadoes.—These are the most violent storms known. They develop in connection with severe thundersqualls where extreme instability of the air is present. The tornado consists of a whirling mass of air of small diameter (between about 300 and 3,000 feet) with an intense rotation. The most spectacular visual characteristic is the funnel-shaped cloud which frequently descends to the ground. The wind speeds in the tornado have never been accurately measured (wind instruments do not survive the blast), but it is estimated from their destructive effects on solid structures that they exceed 300 miles per hour. Fortunately it is usually a short-lived storm lasting from a few minutes to an hour.

Forecasting.—The ultimate goal of most meteorological knowledge and research is the improvement of weather forecasting. Although innumerable advances in the science of meteorology have been made in the first half of the twentieth century, weather forecasting is still much dependent upon empirical methods. However, even though rigid scientific methods are largely lacking, increasing application of theoretical principles to weather prediction is taking place.

The general problem of forecasting weather conditions may be broken down into two major phases. One is the prognosis of the expected state of motion of the atmosphere at some time in the future. The other is the problem of interpreting this state of motion in terms of weather it will produce at various points.

The first phase of the problem involves primarily a thorough diagnosis of the existing state of the atmospheric circulation and associated meteorological elements over a considerable portion of the Earth, both near the surface and aloft. For the short-range forecast (up to 48 hours) the area involved may be a continent and large sections of adjacent oceans as in Figs. 3 and 4. For the long-range forecast (more than two days) in the Northern Hemisphere, for example, the area should cover practically the whole hemisphere as in Fig. 2. This means that the forecaster is dependent upon a great deal of international cooperation to provide him with weather data, and to help him obtain more adequate data in the future. Once the current state is known the problem is to secure an estimate of how the atmospheric motion will change from the present to a specified future time. To do this the laws of fluid mechanics and thermodynamics, which are

generally known, should be applied. But since the Earth-atmosphere system is so complex, the problem of solving the necessary equations is very difficult even when many simplifying assumptions are made. The development and use of high-speed electronic computing machines in the 1940's and early 1950's promises to provide the forecaster with some practical solutions to this problem in the near future. However, even if this proves feasible, the complete solution of this phase of the problem without simplifying assumptions seems a long way off since so many of the physical factors involved are so poorly known or understood. Meanwhile the forecaster makes use of many hydrodynamic principles in prognosticating the motion and development of waves in the upper-level westerly flow and the associated cyclones, anticyclones, air masses, and fronts of the surface map. To the indications of these principles he adds the results of application of purely kinematic and empirical methods, and arrives at a circulation forecast.

The second phase of the problem is to forecast the weather from the expected circulation. Here again certain theoretical principles are applied. For example, from the cyclone theory of Vilhelm Bjerknes and others, a certain distribution of precipitation, cloudiness, and temperature around a cyclone in relation to cold and warm fronts is expected. In the 1940's the development of statistical forecasting techniques, which summarize the relation of the circulation to the weather elements for past data, has begun to provide a substitute for long forecasting experience.

It is expected that forecasting will continue to become more of a purely scientific procedure in the future as meteorological research makes further discoveries about the complex workings of the atmosphere.

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METEOROLOGY, Marine, differs from that of land areas chiefly from the fact that the rays of the Sun penetrate more deeply into the ocean substance than into the land and that the diffusion of this heat through the water body is practically uniform. The ocean thus becomes a vast storage reservoir of heat which is but slowly returned to the atmosphere. The effect upon the ocean climate is to render it more equable. See also CLIMATE; METEOROLOGY; OCEANOGRAPHY; WEATHER BUREAU.

METER, a mechanical device or instrument for automatically measuring, indicating, and recording the quantity measured.

Gas Meter.—This is an automatic instrument which measures the volume of gas flowing through a pipeline. There are two types: (1) the *wet meter,* in which a drum submerged in liquid is rotated by the entering gas; indicators geared to the axis of the drum indicate the amount of gas flowing through the instrument; (2) the *dry* meter, in which the gas entering the instrument displaces a piston, the extent of the displacement being shown on a dial.

Water Meter.—This mechanical device measures and automatically records the quantity of water flowing through a pipe. There are three types: (1) *positive,* which measures the actual volume of water; (2) *inferential,* which measures the velocity of the flowing water; and (3) *proportional,* which measures a fractional part of the full flow. See also CURRENT METER; WATER METER.

Electric Meters.—These instruments are designed to measure either electrical current or energy, or its potential, resistance, inductance, or capacitance. There are three general types of electric meters: (1) the *electrolytic* meter; (2) the *clock* meter; and (3) the *motor* meter. The latter is most generally used. For other types of meters see under AMPEREMETER; ELECTRICAL MEASURING INSTRUMENTS; ELECTRICAL TERMS; ELECTROMETER; GALVANOMETER.

METH. See MEAD.

METHANE, CH_4, is the first member of the aliphatic or paraffin series of hydrocarbons of the type formula C_nH_{2n+2}. It is a very stable and abundant substance, being the principal component of natural gas. The methane content of natural gas varies between 50 and 98 per cent, but is commonly nearer the higher value. A typical gas will contain around 85 per cent methane, up to 9 per cent ethane, 3 per cent propane, the remainder being higher hydrocarbons and nitrogen. This sample before distribution contained some low-boiling liquids which were removed and blended with petroleum distillates. Since methane is a product of the decomposition of vegetable matter, it is often called marsh gas. Pockets of methane are often found in coal deposits, and as firedamp, are a source of danger and the cause of numerous mine disasters. Methane is also evolved in certain sewage disposal processes and may be used as a source of heat and power.

In the carbonization of coal for the production of industrial and metallurgical coke a gas is formed which contains methane to the extent of 30 to 40 per cent. Carburetted water gas, made up mainly of carbon monoxide and hydrogen, owes its added heat value to 10 to 15 per cent methane, which results from the thermal decomposition of enriching oil. Since methane is practically always a product of the pyrolysis of hydrocarbons, petroleum refinery gases are rich in methane.

Pure methane may be prepared in the laboratory by heating dry sodium acetate with a mixture of caustic soda and quicklime, and by decomposing either methyl magnesium iodide or aluminum carbide with water. Both carbon monoxide and carbon may be reduced by hydrogen at high temperature to methane. Compressed methane is available in commercial cylinders, but the bulk of this gas is utilized as it is produced without separation from accompanying substances.

Methane is comparatively unreactive towards such reagents as nitric acid and sulphuric acid, but can be converted into a series of substitution

products ranging from methyl chloride, to carbon tetrachloride. However these substances are more commonly prepared by other methods so that mixtures of the four possible compounds are avoided. Methane is a common source of hydrogen, being acted on by steam in the presence of a catalyst, the accompanying carbon dioxide being scrubbed out from the hydrogen. A method of making so-called "synthesis gas" for the production of liquid hydrocarbons from natural gas involves the partial combustion of methane with commercial oxygen to carbon monoxide and hydrogen. Subsequent reactions carried out at high temperature in the presence of a catalyst result in higher molecular weight hydrocarbons and oxygenated derivatives. Methane and ammonia may be made to react to form hydrogen cyanide, a starting substance in the plastics industry. Acetylene may be made from methane either by thermal methods or by a low voltage electrical discharge, but neither method is in commercial operation. Methane and other hydrocarbons in natural gas are the source of various types of industrial carbon, the most important being "gas black" for the rubber industry.

The boiling point of methane is —161.7°C., hence it is rarely liquefied except when necessary to remove helium from the natural gas of the Southwestern states. Methane has no color nor odor and its density is approximately 0.56 that of air. Its heat of combustion is 1113 British thermal units (gross), the gas being measured at 60°F. and 30 inches barometric pressure. Methane forms explosive mixtures with air in proportions which range from 5.8 to 13.3 per cent.

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METHOD OF LEAST SQUARES. See Least Squares, Method of.

METHODISM is a general name describing the practical religious movement of personal experience and social responsibility set in motion in the 18th century by the experience, preaching, hymn writing, and organizing genius of two British Anglican priests, John Wesley (1703–1791) and Charles Wesley his brother (1707–1788) (qq.v.).

The thirteen and one-quarter million Methodists in the world, two thirds of whom are in the United States, are loosely bound together in the Ecumenical Methodist Council, conferences of which met in London (1881), Washington (1891), London (1901), Toronto (1911), London (1921), Atlanta (1931), and Springfield (1947).

HISTORY

Oxford Beginnings.—At first strictly Anglican and rubrical, the movement began at Oxford University in November 1729 when John Wesley, returning from service under his father, Samuel Wesley (1662–1735), as a curate in Lincolnshire, joined a group of Christ Church students who were taking weekly communion with his brother Charles. At the time John was 26, Charles 22. The group, never exceeding 30, was bound together by personal influence and mutually agreed upon habits and usages including the common study of the Greek Testament, regular fasting, the observance of stated hours for private devotion, the visitation of the sick, the poor, and prisoners, and instruction of neglected children.

The name *Methodists* was one of a number of derisive epithets used to describe the group. Because it continued to be an accurate description, Methodism was finally accepted as the official name of the movement. A doggerel current at the time expresses the significance of the name like this:

> By rule they eat, by rule they drink,
> Do all things else by rule but think,
> Method alone must guide them all,
> Whence Methodists themselves they call.

The Aldersgate Experience.—While between 1733 and 1735 the first Oxford Methodism was becoming more patristic, John Wesley fell under the influence of William Law's devotional ideas most clearly expressed in his *Serious Call to a Devout and Holy Life* (1728). Wesley's spiritual experience was further advanced during his unsuccessful service as a missionary of the Society for the Propagation of the Gospel to the Indians in Georgia (Feb. 6, 1736, to Dec. 2, 1737) by his industrious translation of 33 hymns from the German into English and by daily contact with the Moravians in their joyful faith, their earnest prayer, and in their conviction of the merits of the religious method of justification through faith. In Georgia the young priest sang in his own translation Dessler's words: "Into Thy gracious hands I fall and with the arms of faith embrace: O King of Glory, hear my call! O raise me, heal me by Thy grace!" Returning to London, Wesley suffered from disappointment over his spiritual ineffectiveness in the new world, disaffection resulting from a love affair, and spiritual unrest kindled by his contact with the Moravians. Influenced especially by the Moravian Peter Böhler to alter his belief that religion was only an intellectual and moral habit, that is, a methodical union of intellectual belief, voluntary self-submission, and punctilious performance of the routines of the Church and the general duties of life without concern for the intervention of the supernatural and divine in life, Wesley wrote on March 5, 1738: "By Peter Böhler in the hands of a great God I was fully convinced of the want of that faith whereby we are saved." The text "if any man be in Christ, he is a new creature" increasingly expressed the object of Wesley's quest to be born again.

On May 24, 1738, at the end of a day of earnest spiritual seeking, Wesley, dressed in the habit of an Anglican priest, sat down in a prayer meeting being held in a secluded room on Aldersgate Street, London. He listened to a layman reading aloud Luther's *Preface to the Epistles to the Romans*. Of the ensuing experience, Wesley says: "While he (Luther) was describing the change which God works in the heart through faith in Christ, I felt my heart strangely warmed. I felt I did trust in Christ, Christ alone, for salvation; and an assurance was given me that He had taken away my sins, even mine, and saved me from the law of sin and death." This experience of the "heart strangely warmed" became a motivating religious experience characteristic of Methodism. Among Methodists this *day* of the *Aldersgate Experience*, May 24, 1738, and the *hour* of "quarter to nine" identify a vivid, dated conversion. William E. H. Lecky in his *History of England in the Eighteenth Century* (1882)

calls the experience on Aldersgate Street an *"epoch in English history."*

The Evangelical Mission.—Following the Aldersgate Experience and after a visit to the Moravian center at Herrnhut on the continent, Wesley, feeling now the assurance of salvation through Christ, began his life mission. During the 53 strenuous years which followed he preached some 40,000 sermons and traveled a quarter of a million miles, mostly on horseback, keeping a detailed journal which literally is a guidebook of the British Isles.

The Wesley who emerged from Aldersgate and Herrnhut preached a gospel of a "new birth" by which men became "new creatures." This new birth depended neither on churchly form, creed, priestly prerogative, sacramental grace, or influence; it was the free gift of God's grace to repentant men. Wesley came to have one dominating objective: by preaching and personal influence to raise up a body of converted men who themselves would become witnesses to truth by which he had been saved. Under this inspiration he preached a persuasive gospel; as a consumate organizer he formed living witnesses into classes and societies. *Preaching power in the pulpit and private and personal influence in the class room became the two characteristic forms of Methodist activity. The power-link between the pulpit and the class meeting was the doctrine and experience of conversion.*

A word needs to be said about John Wesley's effective method of preaching. He spoke in short, economical phrases, using his eyes in such a way that each person in the congregation felt himself alone pierced and knew that the words were meant especially for him. Three of Wesley's simple observations about Christian method may help to explain his practical and direct program for Christian living.

1. "Read and meditate upon the 13th chapter of the 1st *Epistle to the Corinthians.*"

2. "If we see God in all things, and do all for Him, then all things are easy.

3. *"Do all the good you can, by all the means you can, in all the ways you can, in all the places you can, at all the times you can, to all the people you can, as long as ever you can."*

Evolution of a Church.—The unsectarian evangelical efforts of John and Charles Wesley and their associates were in reality the activity of another sect in process of formation as a church. When established churches closed their doors to him and clergy took offense at his doctrines, Wesley in 1739 took recourse, as his Oxford friend, George Whitefield (1714–1770), was already doing, to preaching in the open fields to immense crowds and in an old arsenal in Moorfields called "The Foundery" which he transformed into a "meeting house." From this point the history of the evolution of Methodism as a church may be summarized in 10 steps:

The *first step* in the evolution of the church was the formation of religious societies through which the Wesleys exercised their spiritual influence. These societies were in part imitated from the Moravians and in part were the continuation of societies related to the Church of England, being successors of those groups which sprang up in the last years of the Stuarts to compensate for the decay of Puritanism within the Anglican Church.

The *second step* was taken in 1739 when Wesley, to avoid an antinomian quietism growing among the Moravians in England, formally separated from the Moravians to establish a society of his own at the Foundery as mentioned above. This became the first society under the direct control of Wesley and the beginning of the Wesleyan Methodist Society.

The *third step* was taken in 1740 because the clergy excluded the Wesleys from their pulpits and repelled them and their converts from the Lord's Supper. The brothers therefore took the decisive step of administering the sacrament to their societies themselves in their own meeting rooms, both at Bristol and at Kingswood. The only link which now connected the administration of the sacrament to these societies with the Church of England was that the preachers who served the Lord's Supper were among its priests.

The *fourth step* was taken in 1741 when Wesley called out lay preachers to itinerate under his direction. To the societies founded and sustained with the aid of these preachers, who were absolutely under Wesley's personal control, the two brothers in their extensive journeys administered the sacraments as they were able. Despite Wesley's injunctions that his societies should generally keep to their parish churches, the societies wanted to have their own full Sunday services and to have the sacraments administered by their own preachers. The development of these preachers into ministers and of the societies into fully organized churches was the natural result of Wesley's designation of spiritual agents to carry on the work that was continually opening up before him.

The *fifth step* was taken in 1742 with the division of the societies into classes with leaders appointed as lay spiritual helpers and subpastors, and as stewards to take and give account of moneys received and expended.

The *sixth step* was by the Wesley Brothers in 1743, who published the *Rules of the United Societies* which have continued unaltered as the rules of Wesleyan Methodism. The Society was described as a "company of men having the form, and seeking the power of godliness, united in order to pray together, to receive the word of exhortation, and to watch over one another in love, that they may help each other to work out their salvation." The condition of membership in the societies was stated as a "desire to flee from the wrath to come and to be saved from their sins." The minimum customary contribution was a penny a week to "help the poor"; later the contributions were paid more generally toward "the support of the gospel."

The *seventh step* was taken in 1744 when Wesley held his first annual conference composed of preachers whom he personally selected. These early conferences were chiefly useful for the settlement of points of doctrine and discipline and for the examination and accreditation of fellow laborers. The aging of the brothers and the authority of the evolving church so far existing only as a personal authority of the two brothers exercised either directly or by their official delegates, moreover, led Wesley in 1784 to provide for the perpetuation of his work by a deed poll enacted by Parliament which vested in trustees for the use of "the people called Methodists" under the jurisdiction of the conference as to the appointment of ministers and preachers all the preaching places and trust property of the con-

nection. The legal conference was defined as 100 itinerant preachers named by Wesley with power given to this "legal hundred" to fill vacancies in their own numbers, to admit and expel preachers, and to station them from year to year. Indeed, no preacher was allowed to remain more than three years in one station. By the constitution of this conference Wesley consolidated his movement into a distinct religious organization with legally corporate character and large property holdings.

The *eighth step* was taken when Wesley began to ordain ministers. This step gave the societies a yet more definite character as a separate church, yet Wesley protested that his societies were not a church. They were only a "society," the "United Society," the society of the "People Called Methodists," the "Methodist Society." In fact Wesley held the members of his society to be members of the Church of England, except for professed Dissenters whom he defined in a letter to Charles as those "who for conscience sake refused to join in the services of the church or partake of the sacraments administered therein." He interpreted the "Church of England" to mean "all the believers in England, except Papists and Dissenters, who have the word of God and the sacraments administered among them."

By 1746 Wesley abandoned his ecclesiastical high-churchmanship and revolutionized his views on ecclesiastical organization by reading Lord Chancellor King's account of the primitive church. From this time on he consistently maintained that the "uninterrupted succession was a fable which no man ever did or could prove." Indeed he was convinced by Lord King's book that the office of bishop was originally one and the same with that of presbyter. From this position he drew the practical inference that he himself was a "Scriptural Episcopos" and that he had as much right as any primitive or missionary bishop to ordain ministers as his representatives and helpers to administer the sacraments. Despite this belief he held this right in abeyance for three fifths of a century until at length he was constrained to exercise it. In doing so he in effect led the way toward making his society a distinct and independent church.

The *ninth step* was taken in 1784 when the independence of the American colonies made necessary the organization of a separate Methodism for America. Wesley declared that the colonial Methodists should be "totally disintangled from both the state and the English hierarchy." By giving formal ordination and letters to Thomas Coke, former curate of South Petherton and presbyter of the Church of England, Wesley commissioned Coke to preside over the "Flock in America" as presbyter and superintendent. Coke in turn associated himself with Francis Asbury (1745–1816), a preacher in the Wesleyan Conference in London. Asbury had come to America in 1771 as a volunteer missionary to the 400 Methodists in America. Against Wesley's order issued immediately before the outbreak of the Revolutionary War, Asbury alone refused to return to England.

The *tenth step* was taken at the Christmas Conference convened in Balitmore, Maryland, on Dec. 24, 1784. Sixty preachers met with Coke, approved an organizational plan submitted by Wesley, accepted his liturgy and hymnal, adopted the Articles of Religion with the addition of a clause recognizing the civil government and with the inclusion of a prayer for the rulers of the United States. The conference elected Coke and Asbury to the episcopal office. Asbury, with the approval of the Conference, was ordained by Coke. Thus Episcopal Methodism began in America with bishops considered only as chief administrative officers among the presbyters whom they superintended.

At the time of John Wesley's death in 1791 Methodism in Great Britain, the Isle of Man, and the Channel Islands numbered 19 circuits, 227 preachers, and 57,562 members; in Ireland 29 circuits, 67 preachers, and 14,006 members; in the West Indies and British America 19 preachers and 5,300 members; and in the United States 43,265 members.

DIVISION AND REUNION

In America.—Methodism as a church became divided as a result of two wars and the philosophy of political independence which affected church organization. The American Revolution precipitated the first major cleavage along nationalistic lines. In the year that the battles at Lexington and Concord were fought, all the Methodist preachers except Asbury and Thomas Rankin left America. Indeed during the war a Methodist was classified as a Tory until he proved himself otherwise. Wesley, to make the position of the Methodists more difficult, declared: "We Methodists are no republicans and never intend to be." Following the Treaty of 1783, however, Wesley released the Methodists from their British connections and urged them "to stand fast in that liberty wherewith God has so strangely made them free." Methodism in the new union separated from British Methodism on nationalistic lines.

The first important division within the new Church in the United States led to the organization of the *Methodist Protestant Church.* The Methodist Protestant group insisted on the right of a layman to vote on any question in any church meeting and the administration of the church without bishops. "Having no traditional prejudices in favor of a divine right monarchy or a divine right hierarchy," they said, they took for their model "the church without a bishop and the state without a king." By insistence upon these two principles the Methodist Protestants sought to bring church government, as they said, into harmony with the Republic and to make it conform to the principles of the "Kingdom of God." The Methodist Protestants, being unable to work out their reform within the Methodist Episcopal Church, assembled 114 delegates at Baltimore on Nov. 2, 1830, to separate and found the Methodist Protestant Church.

The second important division in America occurred in 1844 when the *Methodist Episcopal Church, South,* separated from the Methodist Episcopal Church. On the northern side the division was considered to have resulted from the slavery issue; on the southern side it was considered merely to be a constitutional issue over the powers of the episcopacy. After years of discussion, negotiation, and litigation, the Cape May Commission, established in 1876 by joint membership and action of the Methodist Episcopal Church and the Methodist Episcopal Church, South, reached terms of amity according to which each body recognized the other as a legitimate branch of Methodism and laid the basis for a peace which moved steadily toward reunion. The Methodist Episcopal Church, the Methodist Epis-

copal Church, South, and the Methodist Protestant Church, by a Declaration of Union issued at Kansas City, Missouri, on May 10, 1939, came together again as a united church with more than eight million members under the name of *The Methodist Church,* retaining however permanently the names of the three constituent churches and authorizing these names forever to be carried in the Discipline.

The Methodist Church in America also took morphology along color lines. The *African Methodist Episcopal Zion Church* (489,244 members) was organized in 1796 out of the old John Street Methodist Episcopal Church in New York. The *African Methodist Episcopal Church* (868,735 members) was organized in Philadelphia in 1816 and extended throughout the South after the Civil War. The *Colored Methodist Episcopal Church* (381,000 members) was organized with the approval of the General Conference of the Methodist Episcopal Church, South, in 1870 to bring its colored membership, at the request of the colored members, into a separate ecclesiastical body. By provision of the constitution of The Methodist Church after its unification in 1939 the Negro membership is organized in what is known as the Central Jurisdiction, an administrative unit which includes all the Negro annual conferences, Negro mission conferences, and missions in the United States. The Central Jurisdiction is based on color rather than geography as is the case in the other administrative jurisdictions.

The *Yearbook of American Churches* (1947) records nineteen independent varieties of Methodism in the United States. Among these groups, totaling 1,871,718, of which number three major Negro bodies comprise 1,739,979 members, are the Reformed Methodists (1814), Primitive Methodist Church (1830), Wesleyan Methodist Connection in America (1843), Congregational Methodist Church (1852), Free Methodist Church of North America (1860), New Congregational Methodist Church (1881), Holiness Methodist Church (1900), Independent A.M.E. Zion Denomination (1907), and the Apostolic Methodist Church (1932).

In Great Britain.—Division in Great Britain began in 1797 when Alexander Kilham, expelled from the Wesleyan Conference for his violent zeal directed toward abolishing the distinction between ministers and laymen, founded the *New Connection.* Other divisions resulted in the organization of *Primitive Methodist, Bible Christians, Protestant Methodists,* the *Wesleyan Methodist Association,* and the *Wesleyan Reformers.* In 1857 the Protestant Methodists, the Wesleyan Methodist Association, and the Wesleyan Reformers formed a union as the *United Methodist Free Churches.* In 1907 these were incorporated with the Methodist New Connection and the Bible Christians as the *United Methodist Church.* In 1932 the Wesleyan Methodists, the Primitive Methodists, and the United Methodists merged into one church as the *United Conference of Methodist Churches.* One special separation deserves mention. In the 1860's William Booth withdrew from the ministry of the New Connection to organize the *Salvation Army* as an international quasi-military religious organization to bring religion and social service to the masses, finding opposition to his specialized ministry not to his liking in the Church in which he had been ordained.

In Canada.—The history of Methodist expansion in Canada parallels the opening and settlement of the Dominion itself. Spread oftener by laymen than by preachers, Methodism was introduced into Newfoundland by Laurence Coughlan in 1765. Yorkshire Methodists settling in Nova Scotia in response to a call for British colonists, United Empire Loyalists in New Brunswick, soldiers of General Wolfe's army in Quebec, the Heck family migration to Ontario, missionaries to upper Canada and the Indians, encouragement from the Hudson's Bay Company, and saddle bag itinerants pressing westward to the Pacific all contributed to the spread of Methodism across the new continent.

On June 10, 1925, *The Methodist Church,* formed in 1884 by the merger of four Methodist branches (The Methodist Church in Canada, the Methodist Episcopal Church in Canada, the Primitive Methodist Church in Canada, and the Bible Christian Church) united with the Congregational Churches of Canada, the Presbyterian Church in Canada, and the Local Union Churches in Western Canada to form *The United Church of Canada.* The Methodist Church was the only one of the three denominations entering the union to bring into the United Church all its local churches. Negotiations looking toward this union, begun in 1899, were completed by the enactment of necessary legislation by the Parliament of Canada in 1924 and by the legislatures of the various provinces from 1924 to 1926. In 1930 the Wesleyan Methodist Church of Bermuda joined with the United Church of Canada as a Presbytery of the Maritime Conference. The United Church is carrying on negotiations looking toward organic union with the British and African Methodist Episcopal Churches (colored) whereby the two bodies may merge with the United Church of Canada.

Congregational in polity, the basic organization of the United Church is much like that of The Methodist Church in the United States except that it has no bishops and no elected or appointed ecclesiastical hierarchy.

In 1948 The United Church of Canada had eleven conferences, 115 presbyteries, 3,215 ministers, 6,580 preaching places, 528,955 families, 780,234 members, 5,068 church schools with 491,925 members, 21 hospitals, and church property valued at $103,955,432. Overseas missions are carried on in six fields, namely West Africa, North, South, and West China, Central India, Japan, Korea, and Trinidad.

The basic literature of the United Church consists of the *Hymnary* (1930) containing the great hymns of the ecumenical church drawn largely from the Presbyterian, Congregational, Methodist, Anglican, and Moravian churches; the *Book of Common Prayer;* the *Statement of Faith;* the *Catechism;* and the *Manual* which contains the doctrinal standards, constitution, and laws for the government of the church. The official church paper is *The United Church Observer* (1939) the product of a merger of several smaller publications. The general officers of the United Church of Canada are located 299 Queen Street, West, Toronto 2 B.

Among the Germans.—The practical nature of Methodism was nowhere more obvious than in the mission of the Methodist Episcopal Church to the Germans. Concerned with effective ministry to the German immigrants swarming into the United States in the 19th century, Bishop

Joshua Soule on Aug. 19, 1835, in concluding the Ohio Annual Conference appointed Wilhelm Nast as "German Missionary." A seminary classmate of David Friedrich Strauss, Nast came to the United States to settle at West Point as librarian of the United States Military Academy. Hearing a sermon of Wilbur Fisk in the West Point Chapel, Nast came under the influence of the Methodists, finding "grace abundant to his needs." Nast began his preaching as a German missionary in Cincinnati, holding class meetings in the home of James Gamble, an Irish soap maker. Itinerating in areas settled by German immigrants, Nast established Methodist societies and organized his advances into German-language speaking conferences. By 1915 the German work in the United States was organized into ten annual conferences extending from ocean to ocean and from Canada to Mexico. The German work was carried on in 761 churches with 644 preachers caring for 60,270 members. Including the Methodists in Germany and German-speaking sections of Europe, the German Methodist movement grew to about 120,000 members and 1,200 preachers.

Episcopal Methodism was carried from the United States to Germany by Ludwig Sigmund Jacoby, a Jew converted in Cincinnati under the preaching of Nast. Jacoby married Amalie Therese Nuelsen, a devout Catholic converted in Cincinnati under the preaching of Peter Schmucker. Pastor and Frau Jacoby arrived in Bremen on Nov. 10, 1849. Working against prejudice and the legal status of the established church, the Methodists gained a permanent footing and developed on the continent in organic relationship with the Methodist Episcopal Church in the United States. In 1874 the Bethany Society with motherhouse in Frankfurt am Main began a deaconess work which was to become a major contribution to the Methodist Church.

The strains of World War I together with the assimilation of the Germans in language and custom led to the integration of the German Methodism into the English-speaking church. Liquidation of German Methodism was begun by an enabling act passed by the 1924 General Conference and completed with the disbanding of the East German Conference in 1943.

The principal journal of German Methodism was *Der Christliche Apologete,* established by Nast as editor in 1839, edited by him until 1892, until 1918 by his son Albert, and until 1936 by a Swiss scholar, August J. Bucher. *Der Christliche Apologete* celebrated its centennial in 1939 and then discontinued publication.

The statesman of German Methodism was Bishop John L. Nuelsen, elected to the episcopacy in 1908 and assigned to administer continental Methodism in 1912. "Our battle," said Bishop Nuelsen, "is against sin, the flesh, the devil, and his works."

The work in Germany continues under the Germany Central Conference with episcopal headquarters at Frankfurt am Main where the German Methodist Theological Seminary is located and under the Provisional Central Conference of Central and Southern Europe with episcopal headquarters in Geneva, Switzerland.

The traditions of German Methodists were bound together into the history of the Methodist Church by the heroic efforts of John A. Diekmann, who became president of Bethesda Institutions in Cincinnati in 1922.

The Methodists also developed strength among the Scandinavians, Chinese, Japanese, Italians, and Latin Americans in the United States. The Northern European Central Conference, administered from Stockholm, continues as a substantial overseas area of Methodist work.

PROTESTANT COOPERATION

The Methodists in the United States constitute the largest constituent body of the Federal Council of the Churches of Christ in America, a general Protestant federation organized at Philadelphia in 1908. The Methodists have also played a leading role in the organization of the World Council of Churches, established by constitution promulgated at Amsterdam, Holland, in 1948. The Methodist layman, John R. Mott, became the first honorary president of the Assembly and Bishop G. Bromley Oxnam, of the New York Area of the Methodist Church, president of the Federal Council of the Churches of Christ in America from 1944 to 1946, became one of the six World Council presidents.

DOCTRINE

Methodist theology expresses an eclectic evangelical Arminianism. Wesley explained his conception of doctrine in 53 sermons known as the four volume edition of 1787–1788 and in his *Explanatory Notes Upon the New Testament* (1755). To a generation which believed in heaven and hell as objective entities in the other world, to Englishmen advised by Calvinists that God had predestined every man, some to hell and some to heaven for eternity, Wesley offered the comforting assurance that any man seeking to be saved from his sins and desiring to live the Christian life could by an act of faith find God's grace abundant to his needs and could be born again. The sovereignty of God, according to the Methodist preaching, was so exercised as to be compatible with the freedom of man, divine grace originating, maintaining, and perfecting man as God's free gift. The sequence of Methodist spiritual psychology runs from original sin through repentance, justification by faith, the witness of the spirit defined as the consciousness of the divine favor through the atonement of Jesus Christ, and Christian perfection.

Methodists recognize the two sacraments as ordained by Christ to be baptism and the Supper of the Lord. To Methodists a sacrament is a certain sign of grace and of God's good will toward man by which God works invisibly in man to quicken, strengthen, and confirm man's faith in God. Baptism is both the mark of difference which distinguishes a Christian from others and a sign of regeneration and new birth. The Supper of the Lord is a sign of love that Christians ought to have among themselves one to another and a symbol of man's redemption by Christ's death. The visible Church of Christ to the Methodists is a congregation of faithful men in which the "pure word of God" is preached and the sacraments duly administered according to "Christ's ordinance." The local church is a society of persons who have professed the faith and have joined together in the fellowship of a Christian congregation in order to pray together, to receive the word of exhortation, and to watch over one another in love, that they may help each other to work out their salvation. Any confusion in the theological position of Methodism is explained by its pragmatic concern for practical rather than ecclesiastical detail.

POLITY

The organization of Methodism is divided into two general forms by British and American Methodism.

British Methodism.—During his life Wesley acted between conferences as patriarch and visitor with summary and supreme jurisdiction. By a letter produced after his death he begged the members of the Legal Hundred to assume no advantage over other preachers in any respect. Instead of appointing bishops, therefore, the preachers divided the country into districts with operating committees within these districts. Presently chairmen were elected for the whole conference each year.

American Methodism.—In the United States the organization of The Methodist Church is episcopal, with bishops serving as superintending presbyters rather than as prelatical or diocesan officers. The bishops, elected by jurisdictional conferences oversee the spiritual and temporal affairs of the church, preside in the General Jurisdictional, Central, and Annual conferences, annually appoint preachers, district superintendents, deaconesses, and connectional officers, and execute the policies and programs established by the General, Jurisdictional, and Annual conferences. The bishops are organized in three groups: a College of Bishops composed of all the bishops assigned to or elected by a Jurisdictional or Central conference; a Council of Bishops composed of all the bishops of all the jurisdictions and central conferences; and a Conference of Methodist Bishops composed of all the bishops elected by the General, Jurisdictional, and Central conferences, and bishops of affiliated autonomous Methodist Churches meeting each quadrennium immediately prior to the General Conference or on call of the Council of Bishops.

Bishops for purposes of residential and presidential supervision are assigned to convenient geographical areas by a jurisdictional conference upon the recommendation of a Committee on Episcopacy composed of ministerial and lay delegates.

Jurisdictions.—The United States is divided into six jurisdictions, namely the Northeastern, Southeastern, Central (Negro), North Central, South Central, and Western.

Conferences.—For effective action, the work of the Methodist Church is organized in a pattern of conferences. The quadrennial "General Conference" exercises supreme legislative and policy-making power for the entire church over all active connectional matters. The "Quadrennial Jurisdictional Conference" meets after the adjournment of the General Conference, elects bishops, and plans details for carrying out the program of the General Conference within the jurisdiction. Delegates to both the General and the Jurisdictional conferences, are elected by the Annual Conference. The *Annual Conference* is the *basic body in the church.* It is composed of all traveling preachers and lay members elected by each pastoral charge. District Conferences are informal administrative units of the Annual Conference corresponding to the geographical districts presided over by an administrative officer known as a district superintendent appointed by the bishop presiding over the Annual Conference. The "Quarterly Conference," presided over by the district superintendent, is the governing body of the pastoral charge. Central Conferences are administrative units for the work of the church outside the United States to promote evangelistic, educational, missionary, and benevolent interests and institutions. These bodies elect their own bishops.

Recognizing the need for national leadership, the Methodist Church provides for Affiliated Autonomous Churches defined as self-governing churches in whose establishment The Methodist Church has assisted and with which it is cooperating through its Board of Missions and Church Extension.

Administrative Agencies.—The Administrative Agencies of the Methodist Church are the Methodist Publishing House; the Board of Missions and Church Extension, composed of a Division of Foreign Missions, Division of Home Missions and Church Extension, Woman's Division of Christian Service, and Division of Education and Cultivation; Board of Education composed of a Division of Educational Institutions, University Senate, Commission on Ministerial Training, Division of the Local Church, and Editorial Division; Board of Temperance; Board of Lay Activities; Board of Hospitals and Homes; Board of Evangelism; Commission on World Peace; Commission on Public Information; and Commission on Chaplains.

The Methodists, never divorcing personal religion from its social application, have continually agitated for total abstinence and legal prohibition of the liquor industry, a just and durable peace, and have given some concern to the ethics of the programs created by industrial society.

STATISTICS

The official 1948 discipline gives the estimated membership of world Methodism as 13,281,000. Statistics for the United States, Territories, and Cuba, are: 40,321 preaching places, 21,603 pastoral charges, 5,343,446 persons enrolled in church schools; annual church school offerings $12,630,005; 1,442,421 members of Woman's Societies of Christian Service raising $16,024,061; annual expenditures of local churches, $164,138,457; local church property, less indebtedness, $1,475,530,795; 9 universities; 10 schools of theology; 69 colleges; 26 junior colleges; 10 secondary schools; 71 hospitals; 55 homes for the aged; 41 homes for children; and mission work carried on in 49 foreign countries in 125 different languages. Per capita giving for all purposes is reported in the 1947 *Yearbook of American Churches* as $18.33.

LITERATURE

The basic literature of the Methodist Church includes the *Discipline of the Methodist Church,* published quadrennially; *The Methodist Hymnal; The Christian Advocate,* weekly journal; and extensive periodical and instructional literature published by the administrative agencies of the church. The publishing interests of the church are organized in the Methodist Publishing House (founded in 1789 as the Methodist Book Concern), the profits of which are annually distributed through the annual conferences as pensions to retired preachers.

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METHODIST PUBLISHING HOUSE, The, a company established in 1789 in Philadelphia as The Methodist Book Concern. It has branches in 14 cities and publishes thousands of books and pamphlets each year.

METHODIST YOUTH FELLOWSHIP, The. When the three Methodist bodies united in 1939, it was necessary to unify the youth work in the three churches. This union was completed in 1941 when the Methodist Youth Fellowship was launched. The name was chosen by a vote of the young people throughout the church. The details of organization were largely planned by youth groups, although the responsibilities for promoting the program lie with the Youth Department of the Board of Education of the Methodist Church. The Methodist Youth Fellowship includes all of the young people connected with the church school between the ages of 12 and 23 years, inclusive. This includes those attending the Sunday morning sessions of the church school, Sunday evening meetings such as Epworth League (q.v.), Christian Endeavor, and University of Life, or other youth groups within the church.

The national organization is known as the National Conference of the Methodist Youth Fellowship. Its membership is composed of presidents of annual conference youth organizations, the presidents of state or regional student organizations, representatives from the staff of the agencies working with youth in church, and selected young people designated by the conference.

The Methodist Youth Fellowship is organized in each annual conference of the Methodist Church and provision is made for district and subdistrict organization where desired. In the local church, the Methodist Youth Fellowship is divided into three departments: (1) intermediate (ages 12, 13, and 14); (2) senior (ages 15, 16, and 17); and (3) young people (ages 18 to 23). Intermediates do not participate in the program beyond the local church. Provision is made for two types of youth organization. Plan I provides for a unified plan with one set of officers serving for all functions within a given age range. Plan II provides for separate organization for morning and evening sessions or as many divisions as seem advisable for the local church.

The activities of the organization on each age level (conference, district, subdistrict, and local church) are carried on through four commissions: Commission on Worship and Evangelism; Commission on World Friendship; Commission on Community Service; and Commission on Recreation and Leisure. The National Conference of the Methodist Youth Fellowship is responsible for specific projects in the youth field and has its own secretary who is a co-operating member of the Youth Department and the Department of Student Work in the Board of Education of the Methodist Church.

METHODIUS, mĕ-thō′dĭ-ŭs, **Saint.** See CYRILLUS AND METHODIUS.

METHOW, mĕt′hou, river, in the north central part of the State of Washington. Rising in the Chelan National Forest, it flows southeasterly and merges with the Columbia River just east of the town of Pateros. The Methow drains the larger part of the western half of Okanogan County. The narrow valley to which the river gives its name has no large towns, and is given over principally to farms, orchards, and pasture lands. It is especially well known for its apple orchards which produce four excellent varieties of apple—Delicious, Winesap, Jonathan, and Rome Beauty. Owen Wister drew upon this locality for several of the characters and episodes in his novel, *The Virginian.*

METHUEN, mĕth′ū-ĭn, 3D BARON (PAUL SANFORD METHUEN), English general: b. Corsham Court, Wiltshire, England, Sept. 1, 1845; d. there, Oct. 30, 1932. He is descended from John Methuen who effected the treaty, named after him, between England and Portugal in 1703. He studied at Eton; entered the Scots Fusilier Guards in 1864; saw special service on the Gold Coast in 1873; received a medal for bravery in the Ashanti War in 1874; became attaché in Berlin (1878), assistant quartermaster general Home District (1881), and quartermaster general in the Egyptian War (1882). He was in command of the Home District from 1892 to 1897; and commanded a division in the unsuccessful attempt at the beginning of the South African War to relieve Kimberley. At Magersfontein (1899) he was defeated. With Lord Roberts he marched on Pretoria in May 1901. In March 1902 he was captured between Vryburg and Lichtenburg, but immediately released. His ill success in South Africa was attributed to the difficult circumstances, and he was placed over the Eastern Command after the Boer War. In 1907 he was commander in chief in South Africa, in 1909 governor of Natal, was created fieldmarshal in 1911; in 1915–1919 governor of Malta; and after 1920 governor of the Tower.

METHUEN, town, Massachusetts, in Essex County; altitude 105 feet; on the Spicket River; 28 miles northwest of Boston, on the Boston and Maine Railroad. Its industrial products are yarn, shoddy, worsted cloth, shoes, wooden heels, brooms and weaving equipment. The Nevins Memorial Hall and Library, and Methuen Memorial Music Hall are notable buildings.

First settlement of the site was made about 1642; it was included within the limits of Haverhill until 1725, when it was incorporated as a separate municipality. In 1917 it was chartered as a city, but in 1921 it returned to town government. It was named for Sir Paul Methuen, pre-Revolutionary official. Pop. (1940) 21,880; (1950) 24,477.

METHUEN TREATY, a commercial treaty between Great Britain and Portugal, signed in 1703 and annulled in 1835, dealing with the tariff on wines and wool, negotiated by John Methuen, the British ambassador.

METHUSELAH, mĕ-thū′zĕ-lä ("a man with a dart"?), Hebrew patriarch. The name appears in old manuscripts also as Mathusala

and Mathusale. It has been variously translated as "Man of God," "Man of the Javelin," "Man of Sin," "Man of Selah." Because Selah was a title of the god Sin, these other derivations are possible. He is remarkable as the oldest man mentioned in the Bible, his age being stated in Genesis 5:27 as 969 years. According to Hebrew chronology and to that of the Samaritan version (which, however, reduces his age to 720 years), he died in the year of the Flood; but the Septuagint calculation makes him die six years earlier. Few will be found who believe that a man ever attained such an age. The most rational conclusion is that the original writer had in mind a period different from the year of 365 days.

METHYL, měth'ĭl. The simplest and most common organic radical is known as methyl and has the formula CH_3. It will be readily seen that this corresponds to one molecule of methane, CH_4, from which one atom of hydrogen has been removed, and it would not be expected to be a stable substance. As will be pointed out later in the discussion of free radicals, it has only momentary and fugitive existence in organic reactions.

The term radical, while still in common use in the chemistry of carbon compounds, is not employed to any extent in discussing the chemistry of other elements. The term originally applied to any group of atoms present in a number of similar compounds which conferred certain specific chemical properties on all of them. Inorganic radicals were such groups as sulphate (SO_4), nitrate (NO_3), and ammonium (NH_4). With the development of the modern theory of ionization it was recognized that these groups existed, when compounds containing them were dissolved in liquids of high dielectric properties. Such radicals are known to possess electrical charges due to an excess or deficiency of one or more electrons, and are regarded as negative or positive ions.

Ionization is a much less common phenomenon in carbon chemistry, but in spite of the fact that only comparatively few organic radicals can exist longer than a fraction of a second, the idea of setting apart such groups and learning more about their influence in an entire organic molecule is still very useful and generally employed.

The hydrocarbon radicals are generally regarded as hydrocarbons from which an atom of hydrogen has been removed. Their names indicate their origin as: methyl, CH_3 from methane, CH_4; butyl, C_4H_9, from butane, C_4H_{10}. An exception is phenyl, C_6H_5, which bears a similar relation to benzene, C_6H_6. The name, however, is derived from phenol, C_6H_5OH.

As an example of the effect of different radicals on the properties of the same parent substance, the alkyl resorcinols may be cited. The resorcinols, in which R stands for any alkyl radical of the formula C_nH_{2n+1}, may be represented as $RC_6H_3(OH)_2$. Beginning with methyl and using those radicals with a single straight carbon chain, the antiseptic properties gradually increase with each additional carbon until the radical is hexyl, C_6H_{11}. Further increase in the length of chain is marked by a steady decrease in physiological activity.

For instructional purposes organic chemists very commonly think of many carbon compounds as being derived by the replacement of one or more hydrogen atoms by another atom or group of atoms. It is, of course, well known that relatively few carbon compounds are actually made in this way in spite of the recent rise in the use of petroleum hydrocarbons as chemical raw materials. Using the idea of hydrocarbons as a point of origin, a few substances may be considered as typical. The methyl group from methane is present in all of these substances: methyl chloride, CH_3Cl; methyl alcohol, CH_3OH; methyl cyanide, CH_3CN; methylamine, CH_3NH_2; and dimethyl ether, CH_3OCH_3.

In the middle of the past century, it was believed that the free methyl radical was produced when an iodine atom was removed from methyl iodide, CH_3I, by zinc. It was only when methods of determining molecular weights were developed that it was shown that the supposed methyl was in reality CH_3CH_3 or C_2H_6, ethane. So for many years the idea that free radicals were formed in chemical reactions and subsequently combined was an abstraction. In 1897 Prof. Moses Gomberg of the University of Michigan, in preparing hexaphenylethane, $(C_6H_5)_3C{-}C(C_6H_5)_3$, found that a free radical, triphenylmethyl, $(C_6H_5)_3C$, was formed when the saturated hydrocarbon was put into solution. Since that time a considerable number of free radicals have been made in which several ring structures in each molecule are involved.

A still more important development in the study of the mechanism of organic reactions has been in the field of unstable free radicals that are simpler than the stable free radicals heavily loaded with ring structures. Such studies deal with a series of relatively simple steps involving both free radicals and free atoms. Only the most fundamental concepts are given here.

As early as 1925 Prof. Hugh S. Taylor of Princeton suggested that free radicals might be involved in chain reactions such as the mercury photosensitized hydrogenation of ethylene. Active free radicals and atoms may be produced by heat, by the use of sensitizers, by photochemical effects, and by electrical methods. A common method of detecting and estimating free atoms and radicals is by their reactions with metallic mirrors previously deposited in glass tubes. The products of such reactions can be isolated as metallic alkyls. Other methods include the use of isotopes, paramagnetism, exchange reactions, and such physical determinations as rate of diffusion, heats of reactions, and optical effects. A typical thermal reaction involving a free radical is:

$$CH_3 + I \rightarrow CH_3I$$

METHYL ALCOHOL. See Alcohol and Methyl.

METHYLATED SPIRIT, is ethyl or grain alcohol to which has been added several per cent of methanol, methyl alcohol. While most methanol is now made synthetically, the product of destructive distillation of wood, or the common wood alcohol of commerce, it is preferred as a denaturant, being equally as toxic and possessing an unmistakable and unpleasant odor due to various impurities. The term methylated spirit is not now in common use, various grades of commercial alcohol being known as specially denatured and completely denatured and containing a number of different denaturants depending on industrial uses.

METHYLENE, Bichloride of, an organic compound of great value as an anæsthetic. It is a colorless fluid having an odor like that of chloroform, and is pleasant to inhale.

METHYLENE BLUE, an aniline dye a bluish crystalline powder having a bronze-like lustre. It is used in medicine, and in malaria is given as a substitute for quinine. See DYES.

METIS, mē'tis, *in ancient mythology,* the first wife of Jupiter, whom he was said to have devoured, after which Minerva (q.v.) was formed within his head.

METLAHKATLA, mĕt-lä-kä'tlä, or **METLAHKATLAH,** the native name of the oldest and most successful mission among the Indians of British Columbia, founded in 1857, by William Duncan, an English missionary, who developed a model community from a tribe of the lowest cannibals. A government school was opened there in 1913. Consult Arctander, K. J., 'Apostle of Alaska' (New York 1909).

METONIC CYCLE, a period of 19 solar years, after which the new and full moon fall on the same days of the year as they did 19 years before. This cycle was the discovery of Meton, a celebrated Athenian mathematician, 432 B.C. The Metonic cycle contained 6,940 days, which exceeds the true length of 19 solar years by 9½ hours nearly. On the other hand, it exceeds the length of 235 lunations, or synodic revolutions of the moon, by 7½ hours only. In the ecclesiastical calendar the number of the year in the cycle is called the golden number (q.v.). The cycle is supposed to commence with the year in which the new moon falls on the 1st of January.

METRE, mē'tėr, the unit of length in France,=39.37079 English inches, roughly one yard 3 1/3 inches. The metre was intended to be the ten-millionth part of the quadrant of a meridian of the earth. The *centimeter,* the one-hundredth part of a metre or nearly 4/10ths of an inch, possesses more advantages in physics as a unit of length; it is also found very convenient for many purposes for which the English yard is employed. See METRIC SYSTEM; WEIGHTS AND MEASURES.

In music, the equalization of time in the division of a composition. The measure (q.v.) is the smallest element in metre; two measures make a *section,* two sections make a *phrase* and two phrases make a *period.* See MUSIC.

In poetry, that measure of verse that determines the rhythm. It is commonly divided into feet and lines; a series of feet is a colon. See POETRY.

METRIC SYSTEM, The. In the latter half of the 17th century, the French astronomer, Jean Picard (1671), and the Dutch physicist, Christian Huyghens (1673), proposed as a standard unit of length that of a seconds pendulum at sea-level on the 45th degree of latitude. This is only about six millimeters shorter than the meter now in use. Some years earlier, Sir Christopher Wren had advocated that a half-seconds' pendulum should be chosen as such a unit; this would have approximated one-half the length commonly given to the ancient cubit. In 1670 the French mathematician, Abbé Gabriel Mouton, had suggested as a length unit one minute of the earth's circumference, what is now in use as a geographical mile, and he had divided and subdivided this decimally, giving a good Latin terminology for the various divisions and multiples. However, more than a century was to elapse before, under the inspiring influence of the spirit of innovation born of the French Revolution and its precursor, the American War of Independence, a new, scientific and logical system of weights and measures was created, one which has already replaced the old and illogical systems in a great part of the world and is probably destined to become, before many years shall have passed, the universal system. In view of the opposition to any change in this direction still shown by many to-day in England and the United States, it is a strange coincidence that in the very year (1790) when the first steps leading to the establishment of the metric system were taken in France, a new system of weights and measures was offered by John Miller to the British House of Commons, and also by Thomas Jefferson, the Secretary of State, to the House of Representatives of the United States. Jefferson's report formulated a decimal division of the various units. A still closer approximation to the metric system was present in that proposed by the inventor, James Watt, who selected as the unit of mass a definite volume of water, and provided for a simple interrelation of the units of length, area, volume and mass; he communicated this to Talleyrand.

As has been stated, it was in 1790 that the project for a new system of weights and measures was taken up by the French National Assembly. In March of that year, Talleyrand published a proposition to this effect, which he and Prieur des Vernois submitted to the Assembly. That body after referring the project to the Committee on Agriculture for preliminary consideration took it up on 8 May 1790 and on 22 August, a decree, sanctioned by Louis XVI, provided for the establishment of a new system, invited other nations to participate in the project and entrusted to the Académie des Sciences the task of determining on the unit to be employed as a standard. Some representatives from Spain, Italy, Denmark, the Netherlands and Switzerland took part in the discussion of the plan. The Académie des Sciences, in accord with the provisions of the decree, appointed a committee composed of the scientists Borda, Lagrange, Lavoisier, Tillet and Condorcet, and on 27 Oct. 1790, this committee submitted its report to the Assembly. To secure additional data, a second committee was appointed, in which Laplace and Monge were substituted for Lavoisier and Tillet. This second committee, in its report of 19 March 1791, recommended the adoption of the one ten-millionth part of the quadrant of the terrestrial meridian as the standard unit of length. The Assembly accepted this suggestion, and on 26 March 1791 appointed five commissions, each charged with some department of the arduous task. It was decided to make, as an exact basis of calculation, a measurement of an arc of 10 degrees on the meridian of Paris. The composition and attributions of the commissions were as follows:

1. Cassini, Méchain, Legendre; to measure the difference of latitude between Dunkirk and Barcelona, and to compute the triangles.

2. Monge and Meusnier; to compute the bases.

3. Borda and Coulomb; for the observation of the pendulum.

4. Lavoisier and Haüy; for researches as to the weight of distilled water.

5. Tillet, Brisson and Vandermonde; for comparison of ancient measures.

On 1 Aug. 1793, the Convention passed a decree, on the proposition of Arbogast, to the effect that the use of the new system should be declared obligatory at the end of the year. In this decree the nomenclature of the system was determined. Unavoidable delays in the measurement of the arc necessitated some successive modifications, and it was not until the 11th Ventôse, An III (1 March 1795) that an approximately definite report was sent in, to be followed by the decree of 18th Germinal, An III (7 April 1795), which finally established the different parts of the metric system. Lavoisier and Haüy were assisted by Le Fevre–Gireau and Fabbroni in determining the exact weight of a definite volume of water.

The decree of 7 April ordered the continuation of the operations for the exact determination of the units, and to this end provided for 12 commissions to be named by the Committee of Public Instruction. The members chosen were: Berthollet, Borda, Brisson, Coulomb, Delambre, Haüy, Lagrange, Laplace, Méchain, Monge, Prony and Vandermonde. On 16 July 1795, Borda and Brisson presented their report of the verification of the meter, but the measurement of the meridian arc, begun by Delambre and Méchain, 25 June 1792, could only be terminated in 1799. It is interesting to learn that, some years later, the work was continued in the Balearic Islands by Biot and Arago.

As a first step in the legislative enforcement of the system, a decree of 23 Sept. 1795 (1st Vendémiaire, An IV) had provided that its use should be obligatory in the commune of Paris, and in the 'Constitution de l'An IV (1795–96)' its principle was formally recognized. On 16 Oct. 1798 (25th Vendémiaire, An VII), there assembled in Paris a body composed of the delegates of 10 independent nations, designated to establish finally the fundamental units. The report, made in the following year by Van Swinden, of the Batavian Republic, gave the conclusions arrived at, and determined the length of the meter as 443 296/1000 lines of the old "Toise de Pérou," the latter being approximately equivalent to 6.3944 English feet. This report was adopted by the Convention 22 June 1799 (4th Messidor, An VII), and the prototypes in platinum of the meter and kilogram were presented by the Institute. They were immediately deposited in the Palais des Archives of Paris, copies being placed in the Conservatoire des Arts et Métiers, and in the Observatory of Paris, while iron meters were consigned to several foreign countries, including the United States.

It is well worthy of note, in view of the eventual absolute success of the metric system, that at first its progress was slow. For quite a time the people continued to cling to the old measures, and this led, under the First Empire to the promulgation of a ministerial edict, dated 28 March 1812, authorizing the employment of "transitory measures"; among which were the use of a *toise* (fathom) of 2 meters (the actual length of the old *toise* was 1.949 meters), of an *aune* (ell) of 1.20 meters, of a *boisseau* (bushel) of 12.5 liters, etc. It was not until the monarchy of Louis Philippe that absolutely final and decisive action was taken in the matter. The Marquis de Laplace presented to the Chamber a report, upon which was based the law of 4 July 1837, according to the terms of which "all weights and measures except those established by the laws of 18th Germinal, An III and of 19th Frimaire, An VIII (7 April 1795 and 10 Dec. 1799)" should be prohibited after 1 Jan. 1840. Belgium, Holland and Greece were the first countries to adopt the metric system, and before the end of the 19th century, it had become the standard with 40 nations, and had attained world-wide use in science.

Nearly a score of years before the passage of the French law just mentioned, the movement for the adoption of the system in the United States had already found able advocates, one of the most notable being John Quincy Adams, who in a report made to the Senate, on 22 Feb. 1821, proposed that an international conference should be held to study the merits of the metric system and to provide for co-operation with France tending toward its universal adoption. In the same year two metric standards, made of platinum, were sent to the United States by Albert Gallatin (1761–1849), then Minister to France. They were both authenticated by a certificate from the great physicist Arago, stating of the kilogram that it differed less than 1 milligram from the original "kilogramme des Archives." In form it is a cylinder with flat bases, the edges slightly rounded. Height and diameter are nearly equal, approximately 39.5 millimeters each. The only distinguishing mark is a faint lathe or tool mark of a point within a circle. The square mahogany box in which it was placed bore the following words engraved on a silver plate attached to the cover: "Kilogramme comparé pour son Poids a l'Étalon Protype des Archives de France, et verifié par M. Arago. Fortin fecit." Despite the assertion that its variation from the standard was but 1 milligram, it was found, when compared in 1879 with the British platinum kilogram, to be 4.25 milligrams light, and this finding was confirmed in 1884, when it was taken to the International Bureau of Weights and Measures at Sèvres, and compared with two auxiliary kilograms known to have the same values as the kilogram of the Archives. This final determination gave the error as —4.63 milligrams. The intrinsic worth of this platinum kilogram to-day, with the metal quoted at $105 per ounce Troy, would be $3,375, while at the time it was made the value would hardly have exceeded $300.

Older than the Arago kilogram is the "committee meter," as it has been called, which was given to Mr. F. R. Hassler, later superintendent of the Coast Survey, by J. F. Tralle, the deputy from the Helvetic Republic in the committee charged with providing for the production of the metric standards in 1799. It was brought by Mr. Hassler to the United States in 1805, and was a short time later donated by him to the Philosophical Society of Philadelphia. Not long afterward, when Mr. Hassler took

up the Coast Survey work, the society placed this standard at his disposal, and until 1890 it served as the standard for the determinations made by the survey. This meter is made of iron, and is marked with the stamp of the committee, which was a small ellipse, having three quadrants shaded, the remaining one bearing the figures 10,000,000, that of the number of meters in a quadrant of the earth's meridian.

Almost a half century elapsed after the proposal of a metric conference by John Quincy Adams before this project was realized. On 1 Sept. 1869, a decree of Napoleon III summoned an international conference to provide for the production of new and absolutely exact metric standards of mass and length. Fifteen nations responded to this invitation, and the delegates assembled in Paris, 8 Aug. 1870. In spite of the fearful disasters of the French armies and the consequent rapid invasion of French territory by the Germans, five meetings were held before the conference was forced to disband. The following were the 15 countries accepting the invitation of the French government to send representatives to this first Paris conference, of August 1870: Austria, Ecuador, France, Great Britain, Greece, Italy, Norway, Peru, Portugal, Russia, Spain, Switzerland, Turkey, United States, Colombia.

The project was not abandoned, however, and a second conference was called two years later, under the Third Republic, and representatives of 30 nations assembled in Paris on 24 Sept. 1872, remaining in session until 12 October of that year. Their deliberations resulted in the adoption of 40 resolutions bearing on the construction of the new standards; of these 21 especially applied to the meter and 12 to the kilogram, the remainder referring to various details of the plan to be pursued, and to the precautions to be taken for the preservation of the standards when produced, as well as for the maintenance of their invariability. A most important point was the exact determination of the alloy to be employed, and the eventual decision was that it should be one of 90 per cent platinum and 10 per cent iridium, a tolerance of 2 per cent in excess or deficiency being permitted. This alloy possessed at once a high degree of hardness and of resistance to chemical action, and also was susceptible of receiving an exceedingly fine finish. A main share in the task of ensuring the production of a thoroughly satisfactory amalgamation of the metals was entrusted to the chemist, Henri Sainte-Claire Deville. The first ingot made had a weight of 238 kilograms and is commonly known as the "alloy of 1874," from the year in which it was produced. This alloy, however, did not meet with the approval of the commission, although several standards were made out of it to test its qualities. It was now determined to have recourse to the skill and experience of the great London firm of platinum refiners, Messrs. Johnson, Matthey and Company, and as a result of patient effort they were finally able to offer a casting which was found by the chemists of the International Commission, and by those of the French section, to exceed the requirments; from it were made 31 prototype meters and 40 kilogram weights. The meters were sent, early in 1887, to the International Bureau to be compared with the "mètre des Archives" and also with one another. By 1889 this task had been accomplished, and on 26 September of that year the work of the International Committee received the approval of a general conference assembled at Paris. The meter and the kilogram found to be in closest agreement with the meter and kilogram of the Archives were denominated the "International Meter," and the "International Kilogram," and were deposited at the International Bureau of Weights and Measures, in a vault provided with three separate locks, the keys to which are in the possession, respectively, of the Custodian of the Archives of France, the president of the International Committee and the director of the International Bureau. This vault must not be opened oftener than once in a year, and in the presence of the three officers to whom the keys have been confided. To each of the contributing countries were given two of each of the new standards, which were all accompanied by attested certificates of comparison, two hard glass thermometers, each of which had a table of corrections in terms referring to the hydrogen scale, and a piece of the alloy cut from the end of the bar and destined to be used in testing the coefficient of expansion; each kilogram had a rock-crystal bedplate and other requisites for its safe conveyance. The meters allotted to the United States, Nos. 21 and 27, bore corrections of +2.5 microns and —1.6 microns, respectively; the probable error of the determinations being estimated, as a result of 784 individual comparisons, at less than 0.2 microns. The two kilograms assigned were numbered 4 and 20, and had corrections in weight of —0.075 and 0.039 milligrams, and in volume of 46.418 and 46.402 milliliters, respectively. Here from 1,092 individual weighings the error of the determination is less than 0.002 milligrams. Meter No. 27 and Kilogram No. 20 were carefully packed and brought to this country under seal by George Davidson of the Coast and Geodetic Survey. On 2 Jan. 1890, President Harrison received them at the Executive Mansion. The seals were broken in his presence, and he gave a certificate to the effect that they had been received in good condition, and that he was fully persuaded they were the standards to which the report referred. The other kilogram and meter were received in July 1890, and were deposited in the Office of Weights and Measures where the meter and kilogram recognized by the President as national standards had already been placed. By a decision made by the superintendent of weights and measures, on 5 April 1893, and approved by the Secretary of the Treasury, the international meter and kilogram were made the fundamental standards of length and mass in the United States, this applying to the customary weights and measures as well as to those based on the metric units. The standards passed under the control of the Bureau of Standards on its establishment 1 July 1901, pursuant to the provisions of the act of 3 March 1901.

The International Prototype Meter is an irido-platinum bar, 102 centimeters in length. Three lines are engraved near each end of the bar; they are from six to eight microns wide, and about one-half millimeter apart, and the meter is defined as the distance between the middle line of each group, when the temperature of the bar is at 0° C. The lines used to define

the meter and its subdivisions were traced at the Conservatoire des Arts et Métiers in Paris.

While the preliminary work for the production of the new standards was in progress, in March 1875, another international conference was called by the French government, in which France, the United States and 15 other nations out of the 19 represented signed a convention on 20 May 1875, providing for the establishment and support of a permanent International Bureau of Weights and Measures, the management and control of which should be in the hands of an international committee having 14 members, each from a different country. As a site for this bureau, the French government assigned a piece of ground at Sèvres, in the Park of Saint Cloud, declaring it to be neutral territory. It was agreed that the expenses of the bureau were to be borne by contributions paid by the contracting governments, the amount being proportionate both to the population of the country and the extent to which the metric system was used there.

The routine work of the bureau is performed under the supervision of a body termed the International Committee of Weights and Measures. This is in turn subject to the control of a general conference to which all the contracting governments send delegates, and which is to meet at least once every six years. This conference is charged with all questions regarding the measures to be taken to spread the use of the metric system in the countries which have not yet adopted it, and it is also called upon to pass definitely upon any new fundamental determinations that may be proposed.

The Advantages of the Metric System and its Proposed Adoption by the United States and Great Britain.— The initial difficulty and expense incident to a substitution of the metric system for that now in use in the United States and Great Britain have been much exaggerated by many writers on the subject. There would be no necessity for absolutely replacing the machinery appliances now in use; all that would be needed in the great majority of cases would be to re-mark them in accordance with the metric scale, and to adjust their operations in accord with metric requirements. It has indeed been truly said that the only machines that would altogether lose their usefulness would be those for making the old measures. It need never be necessary to change the present lathes, drills, shapers, etc., since there would be no necessity for the manufactured objects to have a particular metric size; all that would be needed would be to have them marked and listed in the metric designations of their actual size. It should be borne in mind, in this connection, that at present the sizes of parts are seldom exact unit sizes, since they are not made to conform to an arithmetical rule but to the exigencies of their practical mechanical use.

The metric system finds an earnest advocate in Hon. William C. Redfield, Secretary of the Department of Commerce. In an address at the Fifth Annual Meeting of the Chambers of Commerce of the United States, in Washington, on 2 Feb. 1917, he said of our present system of weights and measures that it «stands as a bar across that path to foreign trade which it is necessary that we should tread.» In another address, made before the Philadelphia Chamber of Commerce, 10 Jan. 1917, he noted that it required four pages of an official publication to describe the various kinds of bushels that exist in America, and that the Philadelphia mint buys all its supplies and common metals by one kind of weights and measures, its precious metals by another, and does all its laboratory work by a third, this latter being, of course, the metric system. As at least a step in the right direction, he cites the frequent use in drawings of a decimal division of feet and inches.

As to the best means of generalizing the use of the metric system in the United States, Dr. Samuel W. Stratton, director of the Bureau of Standards, writes: «Commerce, technology, and science have, on account of their international character, availed themselves of the advantages of the metric system more than manufacturing, which is local, and, unlike exporting, not in direct touch with world markets. Hence science and commerce with their world-wide outlook should be the advisers of industry, and their conclusion is that the first principle is to supply what the customer needs, and that international business requires international weights and measures.»

As to one of the great merits of the system, we have the following emphatic opinion from the late Lord Kelvin (William Thompson, 1824–1907): «I believe I am not overstating the truth when I say that half the time occupied by clerks and draughtsmen in engineers' and surveyors' offices — I am sure at least one-half of it — is work entailed upon them by the inconvenience of the present farrago of weights and measures. The introduction of the French Metrical System will produce an enormous saving in business offices of all kinds — engineering, commercial, and retail shops.»

The Rt. Hon. Arthur J. Balfour, replying in 1895 to a deputation advocating the introduction of the system in England, used the following words: «Upon the merits of the case I think there can be no doubt whatever that the judgment of the whole civilized world, not excluding countries which still adhere to the antiquated systems under which we suffer, has long decided that the metric system is the only rational system.»

As a step in the direction of the metric system, the decimalization of the coinage has found some favor in England recently, the present florin (a two-shilling piece) being proposed as a new monetary unit since it is exactly one-tenth of a pound sterling. As the British farthing is one ninety-sixth of a florin, an exceedingly trifling reduction of its value would make of it a «cent» representing the one-hundredth part of the florin, and worth only a very small fraction less than one-half of the United States or Canadian cent. Another idea has been to add ten-pence to the value of the pound, which would then contain 250 pence or 1,000 farthings of unchanged value. A new florin, as the tenth of this new pound, would then be worth 100 farthings. It is interesting to note that the proposition to decimalize the British coinage by making the florin, the tenth part of a pound sterling or sovereign, a money of account, and sub-dividing it into hundredths, has for several years been essentially introduced in Peru, where

TABLE OF THE METRIC SYSTEM AND EQUIVALENTS

	Correct English spelling		Standard abbreviations
Length	10 millimeters	= 1 centimeter	10 mm = 1 cm
	100 centimeters	= 1 meter	100 cm = 1 m
	1000 meters	= 1 kilometer	1000 m = 1 km
Capacity	1000 milliliters	= 1 liter	1000 ml = 1 l
Weight	1000 milligrams	= 1 gram	1000 mg = 1 g
	1000 grams	= 1 kilogram	1000 g = 1 kg
	1000 kilograms	= 1 metric ton	1000 kg = 1 t

LENGTH

1 centimeter	= 0.3937 inch	1 inch	= 2.5400 centimeters
1 meter	= 3.2808 feet	1 foot	= 0.3048 meters
1 meter	= 1.0936 yards	1 yard	= 0.9144 meters
1 kilometer	= 0.6214 statute mile	1 statute mile	= 1.6093 kilometers
1 kilometer	= 0.5396 nautical mile	1 nautical mile	= 1.8532 kilometers

CAPACITY

1 milliliter	= 0.0610 cubic inch	1 cubic inch	= 16.3867 milliliters
1 milliliter	= 0.2705 U. S. fluid drachm	1 U. S. fluid drachm	= 3.6966 milliliters
1 milliliter	= 0.0338 U. S. fluid ounce	1 U. S. fluid ounce	= 29.5729 milliliters
1 liter	= 1.0567 U. S. liquid quarts	1 U. S. liquid quart	= 0.9463 liter
1 liter	= 0.9081 U. S. dry quart	1 U. S. dry quart	= 1.1012 liters
1 liter	= 0.2642 U. S. gallon	1 U. S. gallon	= 3.7853 liters
1 milliliter	= 0.2816 British fluid drachm	1 British fluid drachm	= 3.5515 milliliters
1 milliliter	= 0.0352 British fluid ounce	1 British fluid ounce	= 28.4123 milliliters
1 liter	= 0.8799 British liquid quart	1 British liquid quart	= 1.1365 liters
1 liter	= 0.2200 British imperial gallon	1 British imperial gallon	= 4.5460 liters

MASS OR WEIGHT

1 gram	= 15.4324 grains	1 grain	= 0.0648 gram
1 gram	= 0.6430 pennyweight	1 pennyweight	= 1.5552 grams
1 gram	= 0.7716 apothecaries' scruple	1 apothecaries' scruple	= 1.2960 grams
1 gram	= 0.2572 apothecaries' drachm	1 apothecaries' drachm	= 3.8879 grams
1 gram	= 0.0353 avoirdupois ounce	1 avoirdupois ounce	= 28.3495 grams
1 gram	= 0.0322 troy ounce	1 troy ounce	= 31.1035 grams
1 kilogram	= 2.2046 avoirdupois-pounds	1 avoirdupois pound	= 0.4536 kilogram
1 kilogram	= 2.6792 troy pounds	1 troy pound	= 0.3732 kilogram
1 metric ton (1000 kilograms)	= 0.9842 long tons (2240 lbs.)	1 long ton	= 1.0160 metric tons (1000 kilograms)
1 metric ton	= 1.1023 short tons (2000 lbs.)	1 short ton	= 0.9072 metric ton

the gold *libra,* coined as an exact equivalent of the British pound sterling, is divided into 10 silver *soles,* the sol thus being worth exactly $0.48665, or the same as the British florin. The sol is in turn divided into 100 *centavos* worth 0.48665 cent of our money.

The equivalents given in this article are based upon the following fundamental equivalents:

39.370000 United States inches	= 1 meter
39.370113 British inches	= 1 meter
0.2641776 United States gallon	= 1 liter
0.2199753 British Imperial gallon	= 1 liter
1 United States avoirdupois pound	= 0.4535924277 kilogram
1 British avoirdupois pound	= 0.4535924300 kilogram

A quantity can usually be expressed as a whole number if the proper metric weight or measure is selected. Even when a fraction is needed to express the metric equivalent of another weight or measure, one or two figures to the right of the decimal point generally give sufficient accuracy. Equivalents such as those in the tables here given are intended to be used only to the required degree of accuracy. For example, four inches is equal to about 10 centimeters; if greater accuracy is desired 10.2 centimeters or 102 millimeters may be taken.

GEORGE F. KUNZ.

METROPOLIS, Ill., city and Massac County seat; altitude 329 feet; on the Ohio River; 15 miles northwest of Paducah, Ky.; on the Burlington; Illinois Central; and Paducah and Illinois railroads; has large line service on the river. Here crates, baskets, tool handles, and railroad ties are made; also underwear, gloves, and furniture. The city has a Carnegie library, a hospital, and a courthouse. Nearby, in 1757, Fort Massac was built by the French; it was destroyed by the Cherokee Indians; its site was occupied by the British from 1765 to 1778; and the fort was rebuilt by "Mad Anthony" Wayne (q.v.) in 1794. A neighboring settlement became the city of Massac; between it and the fort was Metropolis City, which in 1843 became county seat. The two cities were merged under the present name in 1892. In 1908 the site of the fort was designated as a state park. It was here that George Rogers Clark (q.v.) crossed the Ohio on his way into the Northwest Territory; a statue of him stands in the park. Pop. (1940) 6,287; (1950) 6,093.

METROPOLITAN, the Greek name of an archbishop, whose see is the chief place or metropolis of a province. The metropolitan is above the bishop, but below the patriarch. The title of patriarch, however, is in use only in the Eastern churches. In Russia, the metropolitan is at the head of the hierarchy. In the Roman Catholic Church an archbishop may bear this title even though he does not have a metropolis as a see, thus the archbishop of Westminster is styled metropolitan.

METROPOLITAN MUSEUM OF ART, The, was founded in 1870. The present building in Central Park opened to the public ten years later. Its collections, the most extensive in the Western Hemisphere, cover a period of 5,000 years, representing the cultures of the ancient world and the Near and Far East as well as the arts of Europe and America.

Among the collections are the paintings, which include oils, pastels, water colors, miniatures and drawings. There are over 5,000 examples, among which are the works of Italian, Spanish, Dutch, Flemish, German, French, English and American artists.

Special collections include: the Benjamin Altman Collection (notable for Dutch paintings,

Renaissance decorative arts, and Oriental rugs and ceramics); the Theodore M. Davis Collection (notable for Italian paintings, Egyptian antiquities and European and Oriental decorative arts); the Michael Friedsam Collection (notable for early French and Netherlandish paintings and European and Oriental decorative arts); the H. O. Havemeyer Collection (notable for 19th century French paintings, Oriental paintings and decorative arts and prints); the George Blumenthal Collection (notable for paintings and decorative arts of the Middle Ages and the Renaissance); the Jules S. Bache Collection, which includes masterpieces of all the European schools of painting.

The collection of prints consists of woodcuts, engravings, etchings and lithographs dating from 1450 to the present.

The Egyptian Wing presents a vivid chronological picture of a highly-developed civilization. Outstanding in the display is a mastabeh tomb erected about 4,400 years ago for a Memphite dignitary named Pery-neb, rebuilt in its original form. The arts of Greece and Rome are well represented. Notable are a Greek statue, the best preserved of the early Attic Kouroi, and a bronze statuette of a horse from the 5th century B.C.

The collection of ancient art of Mesopotamia, Persia, Palestine, and Syria was augmented through substantial purchases made in 1947 and is represented by sculpture, metalwork, and pottery. Notable examples of ancient Assyrian art are a colossal winged bull and winged lion and a number of reliefs, the gifts of John D. Rockefeller, Jr., and of J. Pierpont Morgan.

The collections of Near Eastern art from Egypt, Turkey, Syria, Iraq, Iran, and India are highlighted by outstanding Oriental carpets, Arabic glass, Islamic pottery and metalwork inlaid with gold and silver. A number of Syrian mosque lamps and other pieces of enameled glass of the 13th and 14th centuries are among the rarest and most precious objects.

The collection of Far Eastern art is notable for a fine selection of Chinese sculpture, which includes superb pieces ranging in date from the late Chou dynasty (about 1050–249 B.C.) to the Ch'ing (1644–1912). Other oustanding phases of the collections are the early Chinese potteries, the later decorated porcelains, the early bronzes and the extensive group of paintings.

The collections of medieval art in the Metropolitan Museum together with those at The Cloisters form the most important assemblage of medieval art in America. Collecting toward the turn of the century by the late J. Pierpont Morgan and subsequent gifts to the Museum by his son, J. P. Morgan, brought to the Museum world-famous groups of Early Christian, Byzantine, Romanesque and Gothic objects.

The decorative arts of the Renaissance include numerous outstanding objects from the well-known Morgan, Altman, Havemeyer, Friedsam, Blumenthal, and Wentworth collections. Notable are the intarsia room from the Ducal Palace at Gubbio, the sculpture, the majolica and the goldsmith's work including the famed Cellini cup in the Altman Collection. French decorative arts of the 17th and 18th centuries are well represented as are the decorative arts of England from Elizabethan times through the 18th century.

The collection of musical instruments of all nations with some 4,400 objects, is the most comprehensive assemblage of this kind in the world. It includes prehistoric instruments as well as those of Europe, Asia, Africa, Oceanica and America. Reconstruction work, still in progress, has brought many instruments back into playing condition.

The collections of Arms and Armor—consisting of armor, weapons, horse equipment and other war gear from both Europe and the Orient and dating mainly from 1400–1800—ranks with European national collections in scope and quality. Signed works by the best-known artist-armorers of Augsburg, Nürnberg, and Milan and over 450 pieces with historical associations are included.

The American Wing is devoted to American decorative arts from the 17th through the first quarter of the 19th century. In rooms, most of them reconstructed with original woodwork, there have been assembled furniture, metalwork, ceramics, glass, prints and paintings to present the characteristic background of our ancestors.

The collection of the Costume Institute (formerly the Museum of Costume Art, at 18 East 50th Street) includes some 10,000 items of costume and accessories ranging from the 17th to the 20th centuries and a library of reference materials—periodicals, costume histories, old costume plates, patterns, sketches of Paris openings, etc.

Study-storages of costume, millinery, shoes and other accessories; specially-equipped designer workrooms where designers may work in privacy, a classroom and library facilities are available to Costume Institute members. Changing special exhibitions of historic and regional costumes are open to the public.

The Cloisters.—A branch of The Metropolitan Museum of Art, devoted to European medieval art is The Cloisters in Fort Tryon Park, New York.

METROPOLITAN OPERA ASSOCIATION, INC., an organization known as such since 1932, producing opera and music drama at the Metropolitan Opera House, New York City. Previous to 1932, the organization was known as the Metropolitan Opera Company, a term which had already been applied in the East to a succession of organizations which, under various types of management, had functioned there since 1883, when the theater was built. By the Metropolitan Opera Association, Inc., is meant, accordingly, the organization which has been regularly producing lyrical performances at the Metropolitan Opera House since 1932; however, the group of singers, instrumentalists, and other artists and technicians participating directly in production, including specifically all members who accompany the troupe on tour, have continued to be referred to loosely as the Metropolitan Opera Company, as distinguished from the association. The Metropolitan Opera and Real Estate Company, a corporation formed in 1892 to represent the interests of certain boxholders, had emerged the following year as owner of the building itself, and had thereafter leased the property to each successive producing agency, reserving for its stockholders, in lieu of rental, the use of the parterre boxes for all subscription performances. This corporation was dissolved in 1940, the Metropolitan Opera Association having raised through public subscription the sum of $1,057,000, from

166,000 donors, which enabled it to obtain possession of the opera house.

When the theater was completed in 1883, Henry E. Abbey, though appointed manager by a board of directors, initiated the enterprise as his own venture, and incurred a personal deficit during the first season estimated at from $300,000 to $600,000. Gounod's *Faust* was presented on the opening night (Oct. 22, 1883), with Christine Nilsson and Italo Campanini heading a cast that included Sofia Scalchi and Giuseppe Del Puente. On the second night, October 24, Marcella Sembrich appeared for the first time in America, in Donizetti's *Lucia di Lammermoor.*

The stockholders directly sponsored the second season, under the leadership of Leopold Damrosch. The latter gave all performances in German, predominantly of Wagner and other German composers, but including also works by Meyerbeer, Rossini, Halévy, and Auber. Amalia Materna, Marianne Brandt, and Anton Schott were among the singers.

A fire destroyed much of the building back of the stage in August 1892, and the following season was consequently omitted. Abbey, Schoeffel, and Grau leased the house again in 1893. The Metropolitan Opera-House Company, Ltd., was reorganized at this time as the Metropolitan Opera and Real Estate Company. Emma Calvé, Nellie Melba, and Pol Plançon joined the company when the house reopened, and all-star casts distinguished many performances.

The triumvirate managing the company dissolved in 1896, and the house remained empty until 1898, when Grau took charge alone. Ernestine Schumann-Heink and Antonio Scotti then joined the company, and Sembrich and Nordica returned, with the result that the next two seasons achieved unprecedented brilliance.

Edmund C. Stanton became executive director when Damrosch died in 1885, and Anton Seidl and Walter Damrosch, son of Leopold Damrosch, became first and second conductors respectively. Distinguished additions to the roster of singers during this regime included Lilli Lehmann, Emil Fischer, and Max Alvary. First American performances were given of *Die Meistersinger, Tristan und Isolde, Das Rheingold, Siegfried,* and *Die Götterdämmerung.*

The season of 1891–1892 was directed by a triumvirate consisting of Henry E. Abbey (who had been the first director), John B. Schoeffel, and Maurice Grau; and the organization's roster of singers was supplemented by Lillian Nordica, Emma Eames, Emma Albani, and the de Reszke brothers, Jean and Édouard.

When Grau retired because of ill-health in 1903, the Conried Metropolitan Opera Company was formed on a stockholding basis. The new organization had 12 directors headed by Heinrich Conried, who held $150,000 worth of the capitalized amount, and was paid an annual salary of $20,000. During Conried's regime, Wagner's *Parsifal* was performed for the first time anywhere outside of Bayreuth; and Enrico Caruso made his American debut in Verdi's *Rigoletto* (1903), thereafter remaining, until his death 18 years later, the chief attraction of the house. Richard Strauss' *Salome,* with Olive Fremstad as the exotic princess, achieved its American premiere in 1907, but the work was so violently assailed by clergy and critics for immorality that it was banished from the repertory, after one performance, until 1934. Puccini's *Madama Butterfly* was first sung at the Metropolitan on Feb. 11, 1907, with a cast that included Geraldine Farrar, Louise Homer, Caruso, and Scotti.

Conried resigned on Feb. 11, 1908, and the organization then became known, for the first time, as the Metropolitan Opera Company. A joint management was formed. Giulio Gatti-Casazza, who had been general director of La Scala at Milan, was appointed general manager, and Andreas Dippel, who had sung leading tenor roles with the organization for some time, became administrative manager. Gatti-Casazza brought Arturo Toscanini with him from La Scala as chief conductor, and the latter soon became extremely popular. Gustav Mahler conducted the German wing. However, the double management proved unsatisfactory, and after two years, Dippel resigned in order to assume management of the Philadelphia-Chicago Opera Company. Toscanini resigned at the end of the 1914–1915 season because of retrenchments which affected the artistry of performances which he conducted; and when Gatti-Casazza refused to resign with him, the two men became estranged. A reconciliation was not effected between them until April 1932. Meanwhile, the Metropolitan had made every possible effort to induce Toscanini to return, but without success.

Following the entry of the United States into World War I in April 1917, the contracts of a number of German artists were canceled, and German works were dropped from the repertory until Feb. 19, 1920, when *Parsifal* was produced in English, after which the German repertory was resumed. Caruso died on Aug. 2, 1921, and Geraldine Farrar retired the following year.

The economic depression which began in 1929 made itself felt at the Metropolitan in 1931, when a cut of 10 per cent in salary was accepted by most of the personnel. Otto H. Kahn, who had been a member of the board of directors since 1903, and chairman of the majority stockholders' committee since 1924, resigned as both chairman and president of the Metropolitan Opera Company on Oct. 26, 1931.

Much wealthy patronage on which the Metropolitan had largely depended for its maintenance was withdrawn at this time, and the organization turned toward the public for support. A campaign for funds from the public raised $150,000 by the spring of 1932, and on March 3 of that year it was announced that the company was being reorganized on a membership instead of a stockholding basis. It was at this time that the name of the organization was changed from the Metropolitan Opera Company to the Metropolitan Opera Association, Inc. The new organization was headed by a triumvirate consisting of Cornelius N. Bliss, George A. Sloan, and Charles M. Spofford.

On March 23, 1932, Paul D. Cravath, chairman of the Metropolitan's directorate, announced that the guaranty fund of $550,000, which had been available for some years at the beginning of every season, had been exhausted by the expenses of the two previous seasons. On April 16 it was announced that the following season would be cut from 24 to 16 weeks, and a further cut in salary was accepted by most of the artists and technicians. On Feb. 9, 1933, the directors of the Metropolitan stated they would be unable to renew the lease on the opera house, expiring May 31, unless the public would contribute a guaranty fund of $300,000. A public "Save the Metropoli-

tan" campaign for funds, headed by the distinguished soprano Lucrezia Bori, was waged by a subsidiary group formed to enlist public support.

The first broadcast from the stage of the Metropolitan during an actual performance had been made on April 21, 1931, by the League of Composers, presenting Stravinsky's *Oedipus Rex*, conducted by Leopold Stokowski. The Metropolitan first broadcast one of its own performances on Dec. 24, 1931, when Humperdinck's *Hänsel und Gretel*, Karl Riedel conducting, was performed. This experiment proved so successful that Saturday afternoon performances were thereafter broadcast regularly as a sustaining program, a factor which proved invaluable to the Metropolitan in its 1933 campaign for funds from the public. The Juilliard Foundation, which had contributed $5,000 to the previous year's campaign, now contributed $50,000 in return for special privileges, and other large sums were contributed, including $25,000 donated by the Carnegie Corporation. The quota of $300,000 was fulfilled, the season, however, being cut to 14 weeks.

To the 1934 campaign the Juilliard Foundation contributed $40,000; and in 1935 the same foundation pledged $150,000, the Metropolitan raising an additional $100,000. Public interest and attendance were greatly stimulated by the Metropolitan Opera Guild, a membership organization founded in 1935 by Mrs. August Belmont. This organization also made it possible during the first 12 years of the project for over 125,000 high school students to witness performances of grand opera at the Metropolitan at prices ordinarily charged for motion pictures.

Other factors working toward the broadening interest in opera were nationwide broadcasts, made with a sustaining program for the first two seasons, namely 1931–1932 and 1932–1933. During the next season of 1933–1934, the broadcast was sponsored by the American Tobacco Company, and the following year by the Lambert Pharmaceutical Company. Then, for five years, they were carried as a sustaining program, sponsored by the Radio Broadcasting Company of America, starting with the 1936–1937 season. The Texas Company began sponsoring them in 1940–1941. From the beginning, Milton Cross during this period was either the announcer or commentator.

Public interest received additional stimulus after 1935 from Kirsten Flagstad's phenomenal singing of Wagnerian roles. Flagstad made her first appearance at the Metropolitan as Sieglinde in *Die Walküre* on Feb. 2, 1935. The productions in which she participated thereafter, together with Lauritz Melchior, provided the public with the most exhilarating performances of Wagner heard at the Metropolitan in many years.

Gatti-Casazza's regime ended when his contract expired in May 1935. Singers who had become popular during his administration included Caruso, Farrar, Elisabeth Rethberg, Maria Jeritza, Rosa Ponselle, Frieda Hempel, Lucrezia Bori, Frances Alda, Margarete Matzenauer, Louise Homer, Margarete Ober, Sophie Braslau, Giovanni Martinelli, Beniamino Gigli, Feodor Chaliapin, Friedrich Schorr, Clarence Whitehill, Edward Johnson, John Charles Thomas, Lawrence Tibbett, Lauritz Melchior, Kirsten Flagstad, and Ezio Pinza.

On Gatti-Casazza's retirement, Herbert Witherspoon, who had previously sung bass roles at the Metropolitan and, more recently, had functioned as director of the Chicago Opera and as a member of the faculty of the Juilliard Graduate School, was appointed director of the Metropolitan Opera Association. Edward Ziegler, assistant to Gatti-Casazza for many years, remained at his post. Edward Johnson, who had sung tenor roles at the Metropolitan since 1922, was enlisted as assistant general manager, to direct a series of supplementary spring sessions, but became general director of the Metropolitan Opera Association when Witherspoon died of a heart attack on May 10, 1935.

Following the change of administration in 1932, the policy of the Metropolitan broadened in certain respects. More native singers were used; occasional performances in English were introduced; more attention was paid to the concept of opera as musical theater, with emphasis on the ensemble; and a more balanced repertory was established. Singers who achieved popularity under Edward Johnson's administration include Lotte Lehmann, Helen Traubel, Bidu Sayao, Marjorie Lawrence, Zinka Milanov, Eleanor Steber, Licia Albanese, Kerstin Thorborg, Bruna Castagna, Risë Stevens, Gertrud Wettergren, Enid Szantho, Gladys Swarthout, Emanuel List, Nicola Moscona, Set Svanholm, Leonard Warren, Jussi Bjoerling, John Brownlee, Charles Kullman, Jan Peerce, and Ferruccio Tagliavini. Prominent conductors during this era included Artur Bodansky, Thomas Beecham, Georg Szell, and Bruno Walter.

As a producing organization, the Metropolitan in 1947 was still handicapped by the limitations of its large, outwardly unsightly, inconvenient, old-fashioned theater, which seated 3,389 people in five balconies and the main floor (210 in the single tier of boxes), and provided standing room for 380 persons. The theater was antiquated in conception even before it was built, Wagner's model theater at Bayreuth having surpassed all other opera houses in design a decade earlier. The architect of the Metropolitan Opera House was Josiah Cleaveland Cady, who had never designed a theater and is reported to have boasted that he "had never entered a playhouse." The interior has always been luxuriously furnished in the tradition of the Old World opera houses, but the plain, homely, yellow-brick façade, ostensibly in Italian Renaissance style with Romanesque panels, eventually earned the building the affectionate title of The Warehouse. The first figured gold damask curtains and red draperies were hung in 1905; a new gold curtain was hung in 1940. The stage, with its trap doors, elevators, hand ropes for scene shifting, and other trappings, had become as antiquated in 1947 as its five stories of dressing rooms, offices, and studios.

Television was first used at the Metropolitan on March 10, 1940, when one act of Leoncavallo's *I Pagliacci* was televised.

In 1946 the Metropolitan signed a contract with the Columbia Recording Corporation to record operas directly from the stage of the Metropolitan Opera House in the same manner that they are presented in performance.

Consult "The Metropolitan Opera Company" in *The International Cyclopedia of Music and Musicians*, ed. by O. Thompson (New York 1946); Kolodin, I., *The Metropolitan Opera, 1883–1939* (New York 1940); Seltsam, W., *The Metropolitan Annals* (New York 1947).

METTERNICH, mĕt'tĕr-nĭH, **Clemens Wenzel Nepomuk Lothar**, PRINCE, Austrian statesman: b. Coblenz, May 15, 1773; d. Vienna,

June 11, 1859. He was educated at Strasbourg; when only 17 represented the Westphalian princes at the coronation of Leopold II; settled in Vienna in 1794; and asured himself a place in diplomacy by marrying the granddaughter of the Austrian chancellor, Count Wanzel von Kaunitz, in 1795. This marriage not only gave him entry to the best society, but brought wealth, and at the Congress of Rastatt he represented the Westphalian collegium, where he served his apprenticeship in politics. In 1801 he was sent to Dresden by Austria; two years later to Berlin; there a part of his mission was to cultivate the friendship of the French ambassador. He did this so well that that official induced Napoleon to suggest to Austria that Metternich would be a most acceptable representative at the Tuileries; and so in 1806 he was sent to Paris, where he ingratiated himself with Caroline Murat, sister to Napoleon, and with Prince Charles Maurice de Talleyrand. On the outbreak of the war between France and Austria, Metternich was put to much personal inconvenience by Napoleon, who forcibly detained him for some time. Thereafter he entered eagerly into the anti-Napoleonic league; assisted in the formation of the Quadruple Alliance; and as Germany proved successful, took no part in the national sentiment which arose, but directed himself solely to the aggrandizement of Austria, hence doing his best to preserve the French boundaries as they had been and to render Austria the only gainer among the powers by the reapportionment of Europe. He is credited with having planned and brought about the marriage of Napoleon and Marie Louise. In the years that followed he carried things his own way in Austria, planned the Holy Alliance and was extremely reactionary in his internal and foreign policies. In the difficult times of Napoleon's supremacy and his fall Metternich guided Austrian policies with a masterly hand. As a diplomatist he was the equal of any of his time. In 1814 he visited England and formed the Quadruple Alliance. He was the master spirit at the Congress of Vienna and for 15 years thereafter was the leading statesman of Europe. The Revolution of 1830 in France showed the ill-success of his program; and the risings of 1848 and the insurrection in Vienna itself made it necessary for the Emperor Ferdinand to demand his resignation. He kept some power even then, his counsel being frequently sought.

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METUCHEN, mĕ-tŭch'ĕn, borough and residential suburb, New Jersey, in Middlesex County, five miles west-northwest of Perth Amboy; altitude 100 feet. It is served by the Pennsylvania Railroad. Manufactures include insulation materials, metal products, and chemicals. Pop. (1950) 9,879.

METZ, mĕts, city, France, capital of Moselle Department, on the junction of the Moselle and Seille rivers, 178 miles east-northeast of Paris; an important fortress and center of control of a group of forts. Its manufactures include woolens, cottons, hosiery, hats, muslin, glue, and leather, as well as machine-tools, elevators, agricultural equipment, household articles. It has also printing and brewing establishments.

History.—Metz was anciently known as Divodurum; later the Romans gave it the name Mediomatrica; under the Gallo-Romans (1st and 2d century) it was called Mettis, of which Metz is a contraction. The Romans built military roads through the territory, and a fine aqueduct, of which traces remain. It was sacked by Attila in the 5th century, and, after the retirement of the Huns, the Franks occupied Metz and made it the capital of Austrasia. In 870 it was included in East Francia, and developed under German influence. Its prosperity increased, and in the 13th century, as a free imperial city, it attained the zenith of its prosperity. It was taken by the French in 1552, and Charles IV issued there, in that same year, the Golden Bull. The Peace of Westphalia (1648) confirmed the rights of the French to own Metz, together with the rest of Alsace-Lorraine.

The peaceful existence of this territory came to an end in 1870 with the outbreak of the Franco-Prussian War, when several battles were fought under the walls of Metz and in its neighborhood. The town capitulated after a two-months siege on Oct. 28 with 180,000 officers and men under the command of Marshal Achille Bazaine. It was included in the cession of territory to Germany at the peace of 1871.

After World War I the Peace of Versailles (1919) restored Metz to France. But during World War II it was for more than four years once more under German occupation. It was liberated on Nov. 19, 1944 by the American Third Army.

Metz has a handsome cathedral of late Gothic design, and several other ancient churches and monuments, among them the Palais de Justice. On its wall a bas-relief commemorates the treaties of commerce and of mutual defense between America and France negotiated by Benjamin Franklin in 1778. A monument to Lafayette by the American sculptor Paul Weyland Bartlett, commemorating American participation in liberating Metz during World War I, was destroyed by the Germans in World War II. Pop. (1946) 65,472.

MEUDON, mŭ'dôn, commune, France, in the Department of Seine-et-Oise, southwest of Paris. It had formerly a fine château, built by Louis XIV, surrounded by the Forêt de Meudon, still a favorite holiday resort of the Parisians. This château, redecorated in 1812 by Napoleon I for Marie Louise, was a residence of the Napoleons under the Second Empire, but was ruined during the siege of Paris in 1870. An astronomical observatory has since been established in the remains of the castle. Meudon has glass works, bleach fields, and extensive government munition works. Rabelais was briefly curé of Meudon. Pop. (1946) 20,749.

MEUNIER, mŭ-nyā', **Constantin,** Belgian artist: b. Brussels, Belgium, April 12, 1831; d. there, April 4, 1905. An historical and genre painter, he first studied sculpture at the Brussels Academy and with C. A. Fraikin, then painting as a pupil of F. J. Navez. He turned from religious and historical subjects to vividly realistic depictions of life in the colliery district amid whose unlovely surround-

ings he long made his home. His *Martyrdom of St. Stephen* in the Ghent Museum is quite in the spirit of Ribera and shocks the mind by its brutal literalness. *The Peasants' Rebellion* is an example of his energy and force as a realist in modern life. His statue *The Lost Son* is in the Berlin National Gallery.

MEURICE, mû-rēs', **Francois Paul,** French dramatist: b. Paris, France, 1820; d. there, Dec. 11, 1905. He was educated at the Collége Charlemagne and entered upon a literary career. He worked for a time in collaboration with Jean Dumas, with whom he made a translation of Hamlet, and was entrusted by Victor Hugo, his brother-in-law, with the publication of his complete works (46 vols., 1880–1885). He published *Benvenuto Cellini* (1852); *Fanfan la Tulipe* (1858); *Cadio* (1868); *Le Songe de l'Amour* (1889).

MEURSIUS, mûr'sē-ŭs, **Johannes** (Latin form of Jan de Meurs), Dutch scholar and historian: b. Lovsduinen, Feb. 9, 1579; d. Sept. 20, 1639. Besides *Glossarium Graeco-Barbarum* (1614); and *Athenae Batavae* (1625); for his edition of Greek authors he wrote numerous introductory essays which J. F. Gronovius reprinted in *Thesaurus Antiquitatum Graecarum.* His complete works were edited by Lami, 12 vols. (Florence 1741–1763).

MEUSE (Flem. *Maes;* Du. *Maas*), a river which rises in northeastern France in the department of Haute-Marne and flows in a generally northerly course through France, Belgium and Holland into the North Sea where it forms a common delta with the Rhine. Its source is on the plateau of Langres, about six miles west-northwest of Bourbonne-les-Bains. Above Neufchâteau (Vosges) it runs underground for a distance of over three miles. In the neighborhood of Maastricht it forms a 31-mile sector of the boundary between Belgium and Holland. Its principal affluents are the Chiers, Semois, Lesse, Sambre, Ourthe and Roer. Parts of its course in Belgium and Holland have been canalized. The principal French cities on the Meuse are Verdun, Sedan, Mézières and Givet; Belgian cities are Dinant, Namur, Huy, and Liége; Dutch cities are Maastricht, Roermond, Venlo, Dordrecht, and Rotterdam. During World War I the upper valley of the Meuse was the scene of the most sanguinary battles, including the Battle of Verdun.

MEUSE, a northeastern department of France having an area of 2,410 square miles. The capital is Bar-le-Duc. Meuse is bounded on the north by Belgium and the department of Ardennes; east by Meurthe-et-Moselle; south by Vosges and Haute-Marne; and west by Marne and Ardennes. When France was departmentalized during the Revolution, the Meuse was constituted from a portion of Lorraine, that is, from parts of the Three Bishoprics, the Barrois and Clermontais, and derived its name from the River Meuse (q.v.) which flows centrally through it from south to north-northwest. Approximately half the department is contained in the Meuse basin. The northeastern part comprises the valley of the Orne, a tributary of the Moselle, and the Chiers. In the western part the Aisne with its tributary the Aire take their rise, the mingled waters flowing west to join the Seine. Here too is the Ornain, affluent of the Saulx, their waters debouching into the Marne. Main waterways are the canal connecting the Marne and Rhine and the Eastern Canal, which parallels the Meuse, the two having a length of 145 miles.

A rolling fertile terrain, with a rather large forested area (about one quarter), the department has no mountains. Its highest elevation, in the southwest on the line of the watershed dividing the Seine and Meuse basins, rises to only 1,388 feet. The main crops are wheat, oats, rye, barley, and potatoes. Viticulture is a minor activity. Industrial activities include lumbering, quarrying, paper milling, cheese manufactures, glass works, distilleries and flour mills. At Ligny-en-Barrois scientific instruments are manufactured. The department is divided into four arrondisements: Bar-le-Duc, Commercy, Verdun, and St. Mihiel; and these are divided into 28 cantons and 586 communes. Pop. (1946) 188,786.

MEXCALA, mâs-kä'lä, or **RIO DE LAS BALSAS,** rē'ô thâ läz väl'säs, river, Mexico, in the southern part, which has its rise in the mountains southeast of the City of Mexico, and flows generally south and west for 426 miles to the Pacific. It is on the boundary line between the states of Michoacán and Guerrero. The port of Zacatula is at its mouth. It is a swift-flowing stream, and has a number of low cascades and rapids.

MEXIA, mĕ-hā'ä, city, Texas, in Limestone County; altitude 534 feet; 29 miles southeast of Corsicana; on the Southern Pacific, and Burlington-Rock Island railroads. In 1920 there was an oil boom here, but now the oil industries are second to agriculture in contribution to the city's prosperity, and cottonseed oil, textiles, and machinery are the principal products of its industry. It has the commission form of government. Pop. (1940) 6,410; (1950) 6,627.

MEXICALI, mĕ-hē-kä'lē, town, Mexico, capital of Northern Territory, Lower California, near Calexico, Calif.; agricultural center in the Imperial Valley area. Pop. (1950) 64,658.

MEXICAN ARCHAEOLOGY. See Mexico—*Ethnology.*

MEXICAN BOLL WEEVIL. See Boll Weevil.

MEXICAN HAIRLESS DOG, a small terrier-like dog, of uncertain origin, without hair except a tuft on the crown of the head, another on the tail and a few scattering wisps on the body; the skin is grayish black, wrinkled and dry. Clavigero describes a large hairless dog found among the Mexicans by the Spanish conquerors, whose puppies were esteemed as an edible delicacy; and others are recorded as having occurred in ancient Peru and on various of the West Indian islands.

MEXICAN JUMPING BEAN. See Jumping Beans.

MEXICAN LITERATURE. See Mexico—*Literature.*

MEXICAN ONYX, a stained and banded

variety of calcite or aragonite. It is not true onyx.

MEXICAN SUBREGION, a faunal district of the Neotropical region embracing the low hot coast region of Mexico. See ZOOGEOGRAPHY.

MEXICAN TEA. See GOOSEFOOT.

MEXICAN WAR. The annexation of Texas in 1845 laid the foundation for the war with Mexico. Although Texas had been for many years practically free, and had been recognized by the United States, England, France and other countries, yet Mexico still refused to acknowledge its independence. When therefore the United States proposed to admit Texas into the Union, Mexico gave warning that the annexation would be equivalent to a declaration of war, and March 6, 1845 protested, and soon afterward withdrew her minister and severed diplomatic relations. Her acts, however, scarcely justified her threats, as at that time at least little or no preparation was made for war. It has, therefore, been claimed that had the American government used a conciliatory policy, peace might have been preserved and friendly relations re-established.

At the moment, however, the Mexican people and authorities were in a rather belligerent attitude, due in part to pride, and in part to an expectation that the United States would soon be involved in a war with Great Britain over the Oregon boundary, in which case Mexico would have a powerful ally to aid her. Did President Polk at this point seek to strengthen this hope in the minds of the Mexicans, intending at the proper moment to make a compromise and peace with England, as was done, and thus leave Mexico at the mercy of the United States? Perhaps history can never answer the question, but events at least seemed to march in harmony with the thought. For Mexico soon found herself in the dilemma that she must either sell California to the United States, receiving in return a goodly sum of money to appease her pride, or engage in a war to sustain her honor and territorial integrity. Mexico bravely, but perhaps not wisely, chose the latter alternative, not fully realizing the inequality of the contestants, nor the depth of the humiliation to which she would be subjected. Doubtless President Polk preferred to acquire California without war; but its acquisition was to be the principal measure of his administration. Hence if war was the only means to secure it, war it must be; at least enough to get possession of the desired territory.

Causes of the War.—The immediate occasion of the war was the dispute in regard to the western boundary of Texas. Proclaiming her independence in 1836 Texas asserted that her western boundary was the Rio Grande to its source, thence due north to the 42d degree of north latitude. The following year the United States recognized her independence, and in December 1845, by a joint resolution, admitted her into the Union as a state, providing that boundary disputes were to be settled by the United States. President Polk accepted the boundary line claimed by Texas, and Jan. 13, 1846 ordered Gen. Zachary Taylor to march to the eastern bank of the Rio Grande as the western boundary of the United States. Mexico insisted that the Nueces River—100 miles eastward—was the true western boundary of Texas, and therefore that General Taylor was now on Mexican soil. On April 25, 1846, the first blood was shed in a conflict between a band of Mexican troops that had crossed to the eastern side of the Rio Grande and a company of American soldiers. The news of this action was immediately communicated by General Taylor to President Polk, who sent his now noted message to Congress, asserting that war was begun by the act of Mexico on United States soil. Congress accepted, after a stormy debate in the Senate, the President's statement, and war was recognized as existing.

Other causes than the two already noted were also at work, and help to make a decision in regard to the justness of the war still more difficult. Mexico for many years had been in a chronic state of revolution. The natural result followed. American citizens in Mexico sustained property losses and doubtless were frequently unjustly arrested and even imprisoned. Claims arising from these causes had been in part settled under a convention of 1840; but many of them were still pending. Some were just; more, either unjust or extravagant in amount. President Polk united these unsettled claims with the boundary question, and demanded that Mexico receive an envoy extraordinary with power to settle both—on its face an eminently fair proposition. On the other hand, Mexico professed to be ready to receive an ambassador to settle the boundary dispute, but declined to receive John Slidell as United States minister, when he was commissioned to settle all disputes, insisting that the two questions were distinct in kind and origin and should not be united. President Polk in his message asserted that this action of Mexico was in violation of her promise to receive a minister, and hence justified his administration in its measures, and forced him to take possession of the disputed territory.

The need of more slave territory was perhaps another factor in causing the war. At least many from the South took an aggressive position on all questions in dispute between the two countries and thus made a peaceable settlement more difficult. Both the economic and the political reasons for more territory began to be felt by 1846—the one to have new soil over which to spread the land-exhausting system of slavery; and the other to have new territory out of which to carve new slave states that the equilibrium between slave and free states might be maintained. Some other forces tending to arouse the war and aggressive spirit may be noted. The cry of "manifest destiny" played a part. Many, especially in the West, felt that the Pacific Ocean was the natural western boundary of the United States. They also demanded the "Golden Gate" that commerce might be opened up with the Orient. The two great parties—the Whigs and the Democrats—divided quite sharply on the question; in fact so completely that the war became almost a party, instead of a national, issue. The Democrats, as a rule, supported the administration and its claim that the war was just. The Whigs, on the contrary, asserted that it was a most unholy and unrighteous war, and characterized it as Polk's war. Abraham Lincoln, entering Congress in 1847, became a severe critic of the policy pursued, while Thomas Corwin of Ohio went so far

as to use this language: "If I were a Mexican I would tell you, 'Have you not room in your own country to bury your dead men? If you come into mine we will greet you with bloody hands, and welcome you to hospitable graves.'"

President Polk summarized his reasons for recommending that Congress recognize war as existing as follows: "The grievous wrongs perpetrated by Mexico upon our citizens throughout a long period of years remain unredressed; and solemn treaties . . . have been disregarded. . . . Our commerce with Mexico has been almost annihilated." He then adds: "As war exists, and . . . exists by the act of Mexico herself, we are called upon, by every consideration of duty and patriotism, to vindicate, with decision the honor, the rights, and the interests of our country."

The Campaigns.—The war with Mexico was accepted as a fact by Congress, May 13, 1846. There were four principal fields of action in its prosecution. (1) Along the Rio Grande, under the command of Gen. Zachary Taylor; (2) in California, where Capt. John Charles Frémont and Commodore Robert Field Stockton were in command; (3) in New Mexico, with Colonel Stephen Watts Kearny leading the United States forces; and (4) from Veracruz to Mexico City, under the command of Gen. Winfield Scott, the commander in chief of the United States armies. Everywhere success attended the arms of the United States. Perhaps it was the first war in history, lasting two years, in which no defeat was sustained by one party, and no victory won by the other.

General Taylor defeated the Mexican troops at Palo Alto, May 8, 1846; at Resaca de la Palma the following day, and captured Matamoros on the 18th. He remained near that city for some weeks to recruit his army and prepare to advance into the interior. On September 24 he entered Monterrey, after a siege of four days, and a gallant resistance by the Mexicans. Taylor's most famous victory, however, was won Feb. 22–23, 1847, at Buena Vista. General Scott gave orders, which fell into the hands of Antonio López de Santa Anna, the Mexican general, for General Taylor to send some nine regiments to aid Scott in his proposed attack on Veracruz. Santa Anna immediately marched his whole command against Taylor, expecting to crush him in this weakened condition. It was 20,000 men against about 5,000. But the skill of Taylor, the persistence of his army, the organization and equipment of the United States troops, won a great victory. Taylor became the hero of the hour, and Buena Vista made him an irresistible presidential candidate.

Frémont's course in California has been a subject of keen controversy. As leader of an exploring expedition he was already in northern California, and early in 1846 was recalled to the Sacramento Valley. California was the goal of the political policy of Polk's administration. The means to secure its acquisition were uncertain. It might be gained by war; or by filling the territory with settlers from the United States, who in course of time might bring it into the Union as Texas had already been annexed; or it might be effected by securing the goodwill of the native Californians who were already jealous of Mexican rule. The latter policy seems to have been the one adopted by the administration. The United States consul at Monterey, California, Thomas Oliver Larkin, was developing this policy with a good prospect of success, it is claimed, when Frémont appeared on the scene. He seems to have developed a fourth policy, namely, the establishment of an independent government under the control of settlers from the United States in the Sacramento Valley. This movement resulted in the so-called Bear Flag Republic, and virtual civil war between the native Californians and the newer settlers. At this moment the Mexican War began and the Bear Flag was replaced by the Stars and Stripes. It has been claimed by some California historians that Frémont's course, had not the Mexican War come at the moment it did, might have lost California to the United States. The native Californians, alienated as they were by his course, might have put themselves under an English protectorate in revenge for the treatment accorded them. Be this as it may, by the end of 1846 all California was conquered and held by United States troops, and Frémont was regarded as the hero who had won the "Golden Gate" by his energy and decision.

Santa Fé was captured by Colonel Kearny, Aug. 18, 1846, and New Mexico secured with almost no loss of life. By the end of the year, therefore, all the territory that the administration desired was in the possession of its armies, but Mexico was still unconquered.

Scott had been chafing in Washington during the summer and fall of 1846 while Taylor was winning his brilliant victories. He asked to go to the front to assume chief command, but the administration retained him at the capital under the plea of needing his advice. As it happened this Democratic war was officered by Whig generals. Scott had already been a candidate for the Whig nomination for the presidency. The charge was now made that Scott was kept from command for fear that success might make him a more formidable candidate in 1848. Finally, when he was sent to the front in January 1847, the cry was raised that the purpose was to dim the luster of Taylor's victories, or at least to divide the popular support between the two generals in such a way as to destroy the political prospects of both.

General Scott invested Veracruz in March 1847, and by the 27th had captured the fortress of San Juan de Ulúa, which had been thought to be almost impregnable, and was ready to enter the city. On April 8 he started into the interior, and on the 18th captured Cerro Gordo; the 19th, Jalapa; and the 22d, Perote. On May 15 he entered the important city of Puebla. Remaining here for some weeks he again advanced, in August, toward the capital, and on the 10th came in sight of the city. Two important victories were won August 20—at Contreras and at Churubusco. He captured Molino del Rey, September 8, and the victory of Chapultepec, September 12–13, gave him Mexico City itself, which he entered on September 14 with an army of only 6,000 men.

The war was practically over, but the victory was so complete that it began to be a question whether there was any government left with sufficient power to negotiate a treaty of peace. An agitation began with friends both in and out of Congress, as well as in the cabinet, looking to the annexation of the whole of Mexico. John C. Calhoun on the one hand, Daniel Webster and a majority of the Whigs on the other, joined

hands to defeat this plan. President Polk was finally forced to make the ultimate decision. Nicholas Trist was sent in March 1847 to Mexico to make a treaty of peace. Failing, he was ordered in the fall to return to Washington; but disobeying instructions he remained in Mexico, and on Feb. 2, 1848, concluded a treaty of peace in harmony with his original instructions. The administration was in a quandary. To ratify meant to condone the disobedience of Trist. To reject meant a prolongation of the war, and time to perfect the intrigue for the annexation of "All Mexico." President Polk, after some hesitation, decided to send the treaty to the Senate for its consideration. Received February 23, it was ratified, after some amendments, March 10, by a vote of 38 to 14. On May 30, ratifications were exchanged and the war was at an end.

The Mexicans had fought bravely, even stubbornly and at times skillfully, yet in every contest, even when the odds were greatly in their favor, without a single victory. In part superior leadership and training won for the soldiers of the northern republic; in part their cooler and more persistent character; but in the main it was not bravery, nor generalship, nor even character that won. It was science and education applied in the equipment of the armies, the guns of the soldiers, the cannon, and the powder in the arsenals which made the one so much more effective than the other that the most daring bravery was no counterpoise.

The Treaty of Peace.—The treaty of Guadalupe Hidalgo gave to the administration of President Polk the territory that his diary informs us he intended to acquire, California and New Mexico. Mexico in return for the loss of its fairest northern provinces was paid $15,000,000, and released from all claims of all kinds held by citizens of the United States against her, estimated at $3,250,000, which the United States assumed. Boundary lines were drawn, and provision made in regard to other questions at issue between the two countries.

Results.—Usually successfully waged wars redound to the credit of the party in power. In this case, however, the Democratic Party, the author and supporter of the war, was defeated by the Whig Party, the party of opposition and criticism, in the presidential election of 1848. The Whigs made use of the popularity of a successful general (Taylor) to defeat the party that had made his glory possible. Evidently the people were ready to accept the fruits of the war, but also ready to punish the party they believed had wrought in a wrong manner.

A large number of young officers, destined to renown in later years, proved their worth in this war. Ulysses S. Grant and William T. Sherman, Robert E. Lee, "Stonewall" Jackson, and Jefferson Davis, in the great Civil War, foreshadowed, in this Mexican struggle, the greatness that was to be theirs in the "days that tried men's souls" from 1861 to 1865.

The acquisition of some 522,568 square miles of territory—about one sixth of the modern continental United States—was the most important immediate as well as remote result. It was important in the issues that its acquisition precipitated. Should it be slave or free territory? Who should determine its institutions? Out of this question grew the larger one, who had the right to control the institutions of the territories in general? To settle the first question David Wilmot, a Democrat of Pennsylvania, proposed the celebrated Wilmot Proviso which would exclude slavery forever from all territory acquired from Mexico. Four long years of intense and bitter debate followed. This question and a series of others were settled temporarily in the Compromise of 1850. The second question was answered by the phrase "nonintervention," which meant, or soon came to mean, one thing to Douglas and the Northern Democrats, and another to Davis and the South. Three main theories were evolved or defended in answer to the third query: (1) that Congress had the right to control the institutions of the territories and could make them slave or free at its will; (2) the Dickinson-Cass-Douglas doctrine of popular or "squatter" sovereignty—the doctrine that the people of a territory themselves, while yet in a territorial status, determined their own institutions; (3) the radical Southern view that slaves were property, and, as property, might be taken into any territory—the common public domain of the states—with no constitutional power anywhere to hinder or prevent.

The new territory was important secondly in its industrial and political effect on the nation. The United States now had an outlook on the Pacific Ocean comparable to that on the Atlantic. China, Japan and the Orient were brought within the circle of its influence. Conditions favorable to further expansion were prepared. In addition to the great effect on commerce thus prefigured, that on wealth and industry was not less. The gold, silver, copper, and other mineral wealth of the Rocky Mountain region was turned into the pockets of the people of the United States. This vast addition of territory and wealth tended also to emphasize national pride and ambition; to arouse a still more intense belief in "manifest destiny"; to develop a more optimistic tone, and perhaps also to produce a more materialistic spirit.

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MEXICO, mĕk'sĭ-kō, Span. mĕ'hĕ-kô (officially LOS ESTADOS UNIDOS MEXICANOS; The Mexican United States), republic, is bounded to the north by the United States of America, and to the south and southeast by Guatemala and British Honduras. Within the country, the name México is chiefly reserved for the capital, known to the English-speaking world as Mexico City; the nation as a whole being generally referred to simply as *la república* (the republic).

The most important features of geographical relief are the lofty Central Plateau bordered by two mountain ranges and these ranges themselves, the Sierra Madre Oriental on the east and the Sierra Madre Occidental on the west.

Although Mexico is usually considered as being in North America, it is perhaps more accurate from the point of view of physical geogra-

phy to include in North America only that portion between the southern border of the United States and the Sierra Volcánica Transversal (see section *The Land*); assigning the territory south of this sierra to Central America. The national territory is divided into almost equal parts by the Tropic of Cancer, or latitude 23°27′N., which transverses it.

The name and the national emblem of Mexico are derived from the Aztecs who, according to tradition, departed from Aztlan (thought to be in the northwestern part of the republic) in 820 A.D., and after a peregrination of many centuries arrived at what is today the Valley of Mexico. It is believed that they chose this site on the banks of what was then the principal lake, in response to a prophecy which instructed them to settle where they saw an eagle holding a serpent in its claws. The name Mexico was derived from the word Mexitli—another name for the Aztec god of war, Huitzilopochtli—to which was added the suffix *co*, signifying "place."

Coat of arms.

The eagle seen by the Aztecs was conserved as a symbol through the years, and when independence was achieved in 1821 it was adopted as the national emblem, which it is today. The flag, consisting of three wide vertical stripes, green at the hoist, white in the center, and red at the fly, with the emblem—the eagle standing on a cactus devouring a serpent—in the center, dates from 1821 when the Plan of Iguala (see section *Mexico from 1810 to 1910*) was approved. A minor change in design was made by an act of April 14, 1823. The words of the national hymn whose first line is *Mexicanos, al grito de guerra* were written by Francisco Gonzáles Bocanegra; and its music, by Jaime Nunó.

Spanish is the official language. The metric system is in use and the monetary unit is the peso, consisting of 100 centavos.

For the convenience of the reader, the historical, political, economic, and social development of Mexico is discussed in the following articles, written by eminent Mexican authorities.

The Land and the People

1. The Land
2. Political Divisions and Population
3. Racial Composition, Population Trends and Health
4. The Indian Groups
5. The Way of Life

Economic Development

6. Economic, Industrial, Agricultural, and Financial Factors
7. Labor Movement

Transportation and Communications

8. Transportation and Communications
9. The Press

Government

10. Government
11. Political Parties
12. Legislation and Jurisprudence
13. National Defense

Education and Religion

14. Education
15. Church and State

Cultural Life

16. Pre-Hispanic Art
17. Colonial and Modern Art
18. Architecture
19. Literature
20. Music
21. Motion Pictures
22. Science and Scientific Institutions
23. Philosophy

History

24. Prehistory and Pre-Hispanic History
25. Spanish Conquest and Colony
26. Mexico from 1810 to 1910
27. Modern Mexico
28. Relations with the United States

1. THE LAND. Mexico lies south of the United States, and north and west of Guatemala and British Honduras. It is otherwise limited by the Pacific Ocean on the west and by extensions of the Atlantic Ocean—the Gulf of Mexico and Caribbean Sea—on the east. The total length of the coastlines is 6,212 miles. The northernmost point of Mexico is at the confluence of the Gila and Colorado rivers, at latitude 32°41′N. Its southernmost point is the mouth of the Suchiate River at latitude 14°30′N.

The border with the United States was established, following the annexation of Texas by the United States in 1845 and the war with that country in 1846–1848, by the Treaty of Guadalupe Hidalgo, Feb. 2, 1848. This treaty was later modified by the Gadsden Purchase, also known as the Treaty of Mesilla, Dec. 30, 1853, by which the United States annexed other territories of the Mexican states of Sonora and Chihuahua. The frontier with Guatemala was determined by two treaties, of Sept. 27, 1882, and May 19, 1894. The frontier with British Honduras was established by treaty with Great Britain, July 8, 1893.

The calculations of the Dirección de Geografía y Meteorología place the area of Mexico at 760,579 square miles, excluding the continental shelf, which was declared incorporated into the national territory by President Manuel Ávila Camacho, Oct. 30, 1945; the decree being ratified by the legislature in a special session, Jan. 16, 1946. The area of the continental shelf claimed by Mexico is 154,633 square miles.

PHYSIOGRAPHY

Mexico is divided into nine physiographic provinces, as follows:

Northwestern Mexico.—(1) *Peninsula of Lower California.*—This is the continuation of a series of anticlines extending along the western part of the North American continent and comprising the Alaska Range, the Coast Mountains of British Columbia, the Cascade Range, the Sierra Nevada, and the Sierra de Baja (Lower) California. The anticlines of the Sierra de Baja California produced extensive lava flows during the Upper Tertiary period, but the region seems to have remained quiet throughout the Quaternary.

(2) *Gulf of California and Adjacent Lowlands.*—These are the continuation of the depressions, the basin, and range complex found throughout the western part of North America; including the basins of the Yukon, Fraser and Columbia rivers, and the Great Basin of the

MEXICO

Acámbaro, 23,038.....J 7
Acaponeta, 7,111.....G 5
Acapulco, 28,790.....J 8
Acatlán, 5,591.....K 7
Acatzingo, 4,403.....N 2
Acayucan, 5,143.....M 8
Actlzayanca, 1,165.....N 1
Actopan, 1,214.....Q 1
Agiobampo (bay).....E 3
Agua Caliente.....A 1
Agua Prieta, 10,479.....E 1
Agualeguas, 2,471.....J 3
Aguanaval (river).....H 4
Aguascalientes, 93,432.....H 6
Aguascalientes (state), 188,098.....H 6
Aguililla, 2,311.....H 7
Ahuacatlán, 2,666.....G 6
Ahualulco, 6,433.....G 6
Ajuchitlán, 2,656.....J 7
Alamo, 2,977.....L 6
Alamos, 2,921.....E 3
Aldama (*Chihuahua*), 2,818.G 2
Aldama (*Tamaulipas*), 1,559.L 5
Aljojuca, 2,427.....O 1
Allende (*Coahuila*), 5,613.....J 2
Allende (*Nuevo León*), 1,296.J 4
Almoloya, 2,702.....L 1
Altamira, 1,387.....K 5
Altamirano (Ciudad Altamirano), 4,046.....J 7
Altar, 1,137.....D 1
Altotonga, 4,478.....P 1
Alvarado, 5,776.....M 7
Alvaro Obregón (Frontera), 7,439.....N 7
Amatlán, 2,036.....P 2
Amealco, 1,729.....K 6
Ameca, 13,589.....H 6
Amecameca, 7,573.....L 1
Amozoc de Mota, 3,810.....N 2
Angel de la Guarda (island).C 2
Angostura, 1,241.....E 4
Antiguo Morelos, 683.....K 5
Apam, 4,972.....M 1
Apatzingán, 2,080.....J 7
Apizaco, 12,698.....N 1
Aquiles Serdán, 7,368.....G 2
Arandas, 7,254.....H 6
Arcas (cay).....N 6
Arena (point).....E 5
Arenas (cay).....O 5
Arizpe, 1,126.....D 1
Arramberri, 1,057.....J 5
Arrecife (reef, Spanish).....
Atlixco, 15,606.....M 2
Atotonilco, 11,038.....H 6
Atoyac, 2,147.....J 8
Atoyac (river).....N 2
Autlán, 11,356.....G 7
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Azcapotzalco, 48,650.....L 1
Azoyú, 2,178.....K 8
Azúcar (reservoir).....K 3
Babia (river).....J 2
Bacadehuachi, 1,053.....D 2
Bacalar, 619.....P 7
Bacalar (lake).....P 7
Bacanora, 990.....E 2
Bacerac, 950.....E 1
Bacubirito, 469.....F 4
Bacum, 1,624.....D 3
Badiraguato, 753.....F 4
Baja California Norte (state), 226,861.....C 3
Baja California Sur (terr.), 60,447.....C 3
Balancán, 1,703.....O 8
Ballenas (bay).....C 3
Balleza, 964.....F 3
Balsas (river).....J 7
Bamoa, 333.....F 4
Banberas (bay).....G 6
Barra (reef, Spanish).....
Batopilas, 738.....F 3
Batuc, 1,112.....E 2
Baviácora, 1,287.....E 2
Bavispe, 887.....E 1
Bavispe (river).....E 1
Blanco (river).....Q 2
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Bolsón (depression, Spanish).....
Bravo (river).....G 2
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Calkiní, 4,491.....O 6
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Calvillo, 3,486.....H 6
Camargo (*Chihuahua*), 11,942.....G 3
Camargo (*Tamaulipas*), 1,271.....K 3
Campeche, 31,274.....O 7
Campeche (state), 122,087...O 7
Campeche (gulf).....N 7
Campeche (bank).....P 5
Cananea, 18,037.....D 1
Canatlán, 3,450.....G 4
Candela (*Coahuila*), 2,334.....J 3
Candelaria (river).....O 8
Cárdenas (*S. Luis Potosi*), 11,228.....K 6
Cárdenas (*Tabasco*), 2,891...N 8
Carmen, 11,592.....N 7
Carmen (island).....D 3
Casas Grandes, 1,126.....F 1
Casas Grandes (river).....F 1
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Catoche (cape).....Q 6
Cedral, 3,543.....J 5
Cedros (island).....B 2
Celaya, 34,415.....J 6
Celestún, 872.....O 6
Cerralvo, 2,732.....J 3
Cerralvo (island).....E 4
Cerritos, 6,980.....K 5
Chalchihuites, 3,816.....G 5
Chalco de Díaz, 3,609.....M 1
Chamela (bay).....G 7
Champotón, 2,071.....O 7
Chapala (lake).....H 6
Chapulco, 1,172.....O 2
Charcas, 6,081.....J 5
Chetumal, 4,672.....Q 7
Chetumal (bay).....P 8
Chiapa, 5,450.....N 8
Chiapas (state), 904,588.....N 8
Chiautempan, 4,762.....N 1
Chichen Itzá (ruins).....P 6
Chichiquila, 1,148.....O 1
Chicoloapan, 2,135.....M 1
Chietla, 3,285.....M 2
Chignahuapan, 4,156.....N 1
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Chihuahua (state), 845,033...F 2
Chihuahua, 86,962.....G 2
Chilapa, 6,094.....K 8
Chilpancingo, 12,661.....K 8
China, 1,622.....K 4
Chixoy (river).....O 8
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Ciudad de Las Casas (San Cristóbal), 17,449.....O 8
Ciudad Doctor Hernández Alvarez (Gonzáles), 5,737..J 6
Ciudad García, 10,397.....H 5
Ciudad Guzmán, 23,639.....H 7
Ciudad Juárez, 122,598.....F 1
Ciudad Madero, 41,110.....L 5
Ciudad Mante (Juárez), 21,293.....K 5
Ciudad Obregón, 30,563.....E 3
Ciudad Serdán, 7,791.....O 2
Ciudad Victoria, 31,807.....K 5
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Coahuila (state), 719,518.....H 3
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Coatepec, 13,755.....P 1
Coatzacoalcos (Puerto México), 14,501.....M 7
Cocorit, 2,088.....E 3
Cocula, 7,706.....G 6
Coixtlahuaca, 2,596.....I 8
Colima, 28,658 .....H 7
Colima (state), 112,375.....G 7
Colón, 2,045.....K 6
Colotlán, 5,093.....H 5
Comalcalco, 3,364.....N 7
Comitán, 11,760.....O 8
Comondú, 540.....D 3
Compostela, 3,144.....G 6
Concepción del Oro, 4,847.....J 4
Concepción (river).....D 1
Conchos (river).....G 2
Concordia, 2,470.....G 5
Córdoba, 32,750.....P 2
Corrientes (cape).....F 6
Cosalá, 1,911.....F 4
Cosamaloapan, 3,740.....M 7
Cosautlán, 1,888.....P 1
Coscomatepec de Bravo, 5,266.....P 2
Cosío, 954.....H 5
Cosoleacaque, 3,237.....M 7
Cotija, 4,567.....H 7
Cotoxtla (river).....Q 2
Coyame, 501.....G 2
Coyoacán, 45,893.....L 1
Coyotepec, 4,159.....L 1
Coyuca, 1,989.....J 7
Coyula, 4,363.....L 6
Cozumel, 2,085.....Q 6
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MEXICO

MEXICO

SCALE OF MILES

0 100 200

SCALE OF KILOMETRES

0 100 200 300

National Capitals . . . . . ★ State Capitals . . . . . ■

Railroads ——

States Indicated by Numbers

1	Tlaxcala	6	Querétaro
2	Morelos	7	Guanajuato
3	Distrito Federal	8	Aguascalientes
4	Mexico	9	Nayarit
5	Hidalgo	10	Colima

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MEXICO

SCALE OF MILES
0 10 20 30 40
GULF OF MEXICO
GULF OF MEXICO
BANCO DE CAMPECHE
Tropic of Cancer
Corpus Christi Bay
Barra San Rafael
Barra San Antonio
Barra Jesús María
Cayo Arenas
Cayo Nuevo
Triángulo Oeste
Triángulo Este
Cayo Arcas
Arrecife Alacrán
I. Pérez
I. Holbox
Cabo Catoche
Isla Mujeres
Cozumel
Progreso
Mérida
Campeche
Champotón
Ciudad Victoria
Tampico
Ciudad Madero
Matamoros
Brownsville
McAllen
Laredo
Corpus Christi
Reinosa
Monterrey
Linares
Cadereyta
Montemorelos
Sabinas Hidalgo
Guerrero
Camargo
San Benito
Gral Bravo
China
Burgos
Cruillas
Fernando
Carlos S. Nicolás
Vitagrán
Hidalgo
Santander Jiménez
Padilla
Guemes
Soto la Marina
Aldama
Xicoténcatl
Tula
Ocampo
González
Morelos
Altamira
Chapulhuacán
Ebano
Panuco
Ozuluama
Tantoyuca
Alamo
Tamiahua
Huejutla
Tuxpan
Poza Rica
Papantla de Olarte
Mineral del Monte
Pachuca
Tulancingo
Zacatlán
Apan
Tezontlán
Jalapa
Pta. Delgada
Misantla
Nautla
Teocelo
Orizaba
Veracruz
Alvarado
Huatusco
Córdoba
Tehuacán
Tierra Blanca
Cuautla
Amecameca
Iztaccihuatl 17,887
Popocatepetl 17,887
Toluca
Nevado de Toluca 15,020
Cuernavaca
Taxco
Iguala
Acapulco
Chilpancingo
Tixtla
Oaxaca
Ixtepec
Tiacolula
Ayutla
Azoyú
Ometepec
Pta. Maldonado
Juchitán
Tehuantepec
Salina Cruz
Mar Muerto
Lag. Superior
Pochutla
Puerto Angel
Juquila
Jamiltepec
Loxicha
Ixtlán
Jojutla
Chietla
Atlixtlapan
Tlaquiltenango
Jonacatepec
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Tepexi
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Xochitlán
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Atlixco
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Tecali
Quecholac
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Tetecala
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Tecuhuacán
Zumpango
Coyotepec
Temascalapa
Otumba
Apam
Calpulalpam
Tlaxco
Huejotzingo
Huejotla
Xaltocan
Apizaco
Chiautempan
Tlaxcala
Tlacateco
Huamantla
Ixtenco
Libres
Tenenatel
Nauzontla
Actuzayanca
Tlahuapan
Texmelucan
Nexpalucan
Malpais
Almoloya
Amozoc de Mota
Acatzingo
Ciudad Serdán
Alchichica
Oriental
Tecamachalco
Palmar
Morelos
Tehuacán
Zongolica
Orizaba
Córdoba
Amatlan
Nogales
Mendoza
Río Blanco
Cuitlahuac
Tlalixcoyan
Veracruz
Tlacotepec
Huatusco de Chicuellar
Coscomatepec de Bravo
Medellín
Soledad de Doblado
Coatepec
Jalapa
Naolinco de Victoria
Tepetlán
Juchique de Ferrer
Misantla
Jalacingo
Altotonga
Teziutlán
San Juan Xiutetelco
Zautla
Chignautla
Chignahuapan
Zacatlán
Zacapoaxtla
Tetela de Ocampo
Tlaxco
Calpulalpam
Cuyoaco
Las Vigas
Perote
Naucampatepetl 13,411
Jico
Teocelo
Casautlán
Sattillo
R. J. Garcia
Chichiquila
Ursulo Galván
Actopan
Villa
Tlalixcoyan
Ignacio de la Llave
Ixtaczoquitlán
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Lag. de Términos
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Jonuta
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Tenosique
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Venustiano Carranza
Chinalá
Coban
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Quiriguá
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San Salvador
San Vicente
Sta. Tecla
Sta. Rosa
La Esperanza
Puerto Cortés
S. Pedro Sula
Golfo de Honduras
Belize
Stann Creek
Turneffe I.
Ambergris Cay
Xcalak
Chetumal
Bacalar
L. Bacalar
Sta. Cruz
Chico
Pto. Herrero
Felipe Carrillo Puerto
Iturbide
Pustunich
Hopelchén
Oxkutzcab
Tekax
Peto
Tenabo
Hecelchakán
Calkiní
Becanchén
Maxcanú
Halachó
Celestún
Umán
Hunucmá
Motul
Temax
Izamal
Valladolid
Tizimín
Espita
Chichen Itzá (Ruins)
Solutá
Tunkás
Ticul
Muna
Oxkutzcab
Vigía Chico
Tenabo
Campeche
Champotón
Pustunich
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Tepelmeme
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Pescados (river).....Q 1
Petachalco (bay).....H 8
Peto, 5,104.....P 6
Piedras Negras, 27,579.....J 2
Pinos, 4,670.....J 5
Pitiquito, 1,472.....D 1
Pochutla, 2,456.....L 9
Popocatepetl (mt.).....M 1
Poza Rica.....L 6
Presa (reservoir, Spanish).....
Progreso, 13,338.....P 6
Puebla, 206,840.....N 2
Puebla (state), 1,619,546.....L 7
Puerto Angel, 469.....L 9
Puerto México
(Coatzacoalcos), 19,501...M 7
Puerto Peñasco.....C 1
Puerto Vallarta, 3,150.....G 6
Punta (point, Spanish).....
Purificación, 1,344.....G 7
Puruándiro, 8,643.....J 7
Pustunich, 85.....O 7
Putla, 2,394.....L 8
Quecholac, 2,015.....O 2
Querétaro, 49,428.....K 6
Querétaro (state), 285,896.....J 6
Quintana Roo (terr.), 26,975.P 7
Rafael J. García, 1,231.....O 1
Ramos (river).....G 4
Ramos Arizpe, 2,766.....J 4
Rayón, 1,241.....D 2
Rayones, 512.....J 4
Reinosa, 34,076.....K 3
Revillagigedo (islands).....C 7
Rincón de Romos, 4,460.....H 5
Río Blanco, 11,044.....P 2
Río Grande, 5,111.....H 5
Río Grande (river).....N 8
Ríoverde, 10,107.....J 6
Riva Palacio (San Andrés),
708.....F 2
Roca Partida (island).....C 7
Rodeo, 1,020.....G 4
Rosamorada, 1,151.....G 5
Rosario (*Baja California*),
143.....B 1
Rosario (*Durango*).....G 3
Rosario (*Sinaloa*), 8,323.....G 5
Rosario (*Sonora*), 963.....E 3
Sabancuy, 882.....O 7
Sabinas, 11,256.....J 3
Sabinas (river).....J 3
Sabinas Hidalgo, 6,912.....K 3
Sahuaripa, 3,195.....E 2
Sahuayo, 12,514.....H 6
Sain Alto, 2,372.....H 5
Salada (Maculala) (lagoon)..A 1
Salamanca, 19,589.....J 6
Salina Cruz, 4,614.....M 9
Salinas, 4,255.....J 5
Saltillo (*Coahuila*), 69,874....J 4
Saltillo (*Puebla*), 707.....O 1
San Andrés Tuxtla, 15,116....M 7
San Andrés (Riva Palacio),
708.....F 2
San Andrés (*Oaxaca*), 3,968..L 8
San Antonio, 97.....D 5
San Benedicto (island).....D 7
San Benito (island).....B 2
San Blas, 752.....G 6
San Blas (river).....O 8
San Buenaventura, 3,541.....J 3
San Carlos (M. Benavides),
779.....G 2
San Carlos (Villa Ursulo
Galván), 1,349.....Q 1
San Carlos (*Coahuila*), 688....J 2
San Carlos (*Tamaulipas*),
1,118.....K 4
San Cristóbal (Ciudad de las
Casas), 17,449.....O 8
San Dimas, 1,948.....F 4
San Felipe (*Baja Calif.*), 427.B 1
San Felipe (*Campeche*).....O 8
San Fernando (*B. Cal.*).....B 2
San Fernando (*Chiapas*).....N 8
San Fernando (*Tamaulipas*),
1,471.....L 4
San Francisco, 18,193.....H 6
San Francisco del Oro,
11,458.....F 3
San Gabriel, 6,091.....N 2
San Ignacio, 1,914.....F 5
San Javier, 598.....D 3
San Jorge (bay).....C 1
San José del Cabo, 2,553.....D 5
San José (island).....D 4
San Juan Xiutetelco, 1,877....O 1
San Juan (*Coahuila*), 785.....J 2
San Juan (*Jalisco*), 5,792.....H 6
San Juan (*Querétaro*), 6,694.K 6
San Juan de Guadalupe,
2,641.....H 4
San Juan del Río, 1,956.....G 4
San Lázaro (cape).....C 4
San Lucas (cape).....E 5
San Luis de la Paz, 4,821.....J 6
San Luis del Cordero, 1,352..H 4
San Luis Potosí, 126,596.....J 6
San Luis Potosí (state),
855,994.....J 5
San Marcos (island).....D 3
San Martín Texmelucan,
11,333.....M 1
San Miguel (*Guanajuato*),
11,615.....J 6
San Miguel Canoa, 4,652.....N 1
San Nicolás, 298.....K 4
San Pablo del Monte, 7,652..M 1
San Pedro, 19,263.....H 4
San Pedro del Gallo, 1,203....G 4
San Quintín.....B 1
San Rafael (reef).....L 4
San Salvador el Seco, 4,365...O 1
San Telmo, 76.....B 1
San Vicente, 214.....A 1
Sánchez.....E 3
Santa Ana, 3,057.....D 1
Santa Ana (reef).....N 7
Santa Bárbara, 14,805.....F 3
Santa Catalina (island).....D 4
Santa Clara, 1,623.....H 4
Santa Cruz, 757.....D 1
Santa Cruz (island).....D 4
Santa Cruz Chico.....Q 7
Santa Eugenia (point).....B 3
Santa Inés (bay).....D 3
Santa María, 1,445.....G 6
Santa María (lake).....F 1
Santa María (river).....F 1
Santa Margarita (island).....C 4
Santa Rosalía, 5,451.....C 3
Santander Jiménez, 1,639.....L 4
Santiago (*B. Cal.*), 746.....E 5
Santiago (*Nayarit*), 7,322.....G 6
Santiago Tuxtla, 5,392.....M 7
Santiago Papasquiaro, 3,204..F 4
Santiaguillo (lake).....G 4
Saucillo, 3,826.....G 2
Sayula, 10,096.....H 7
Sebastián Vizcaíno (bay).....B 2
Sierra Mojada, 916.....H 3
Sierra (mts., Spanish).....
Silao, 18,463.....J 6
Simojovel.....N 8
Sinaloa, 1,290.....F 4
Sinaloa (state), 622,002.....F 4
Socorro (island).....D 7
Soledad, 2,227.....J 5
Soledad de Doblado, 3,817...Q 2
Sombrerete, 5,628.....H 5
Sonora (state), 507,853.....D 2
Sonora (river).....D 2
Sotuta, 2,923.....P 6
Soyopa, 590.....E 2
Suaqui, 1,144.....E 2
Suchiate (river).....N 9
Superior (lagoon).....M 9
Tabasco (state), 362,195.....N 7
Tacambaro, 4,173.....J 7
Tacotalpa, 628.....N 8
Talpa, 2,722.....G 6
Tamaulipas (state), 717,281..K 4
Tamiahua, 2,319.....L 6
Tampico, 94,221.....L 5
Tantoyuca, 3,916.....L 6
Tapachula de Domínguez,
30,064.....N 9
Taxco de Alarcón, 10,076.....K 7
Teacapan (inlet).....F 5
Teapa, 2,195.....N 8
Tecali, 1,409.....N 2
Tecamachalco, 4,014.....O 2
Tecolutla (river).....O 1
Tecomán, 3,295.....H 7
Tecpan de Galeana, 3,232.....J 8
Tecuala, 6,456.....G 5
Tehuacán, 23,213.....L 7
Tehuantepec (gulf).....M 9
Tehuantepec, 10,087.....M 8
Tekax, 6,061.....P 6
Teloloapan, 5,140.....J 7
Temascalapa, 1,348.....M 1
Temax, 3,312.....P 6
Temósachic, 1,504.....F 2
Tenabo, 1,990.....P 6
Tenancingo, 6,644.....K 7
Tenosique, 3,545.....O 8
Teocaltiche, 7,909.....H 6
Teocelo, 3,058.....P 1
Teotihuacán, 1,353.....L 1
Teotihuacán (ruins).....M 1
Teotitlán, 2,192.....L 8
Tepatitlán, 15,073.....H 6
Tepeaca, 3,963.....N 2
Tepehuanes, 1,230.....G 4
Tepeji, 5,815.....K 6
Tepetlaoxtoc, 1,763.....L 1
Tepexi, 1,683.....N 2
Tepic, 24,600.....G 6
Tepoztlán, 3,230.....L 1
Términos. (lagoon).....O 7
Terrenate, 947.....N 1
Tetecala, 1,892.....L 2
Tetela de Ocampo, 707.....N 1
Texcoco, 5,437.....M 1
Teziutlán, 8,386.....O 1
Tiburón (island).....C 2
Ticul, 10,235.....P 6
Tierra Blanca, 12,007.....L 7
Tierranueva, 1,420.....J 6
Tijuana, 60,740.....A 1
Tixtla, 6,130.....K 8
Tizimín, 10,651.....Q 6
Tlacolula, 5,297.....L 8
Tlacotalpan, 4,939.....M 7
Tlacotepec, 1,593.....P 1
Tlahualilo, 2,949.....H 3
Tlahuapan, 1,507.....M 1
Tlalixcoyan, 1,058.....Q 2
Tlalmanalco, 2,479.....L 1
Tlalnepantla, 10,330.....L 1
Tlalpan, 18,160.....L 1
Tlaltenango, 4,627.....H 6
Tlaltizapán, 1,966.....L 2
Tlapa, 2,976.....K 8
Tlaquiltenango, 2,518.....L 2
Tlaxcala, 3,261.....M 1
Tlaxcala (state), 284,261.....K 7
Tlaxco, 1,119.....N 1
Tlaxiaco, 6,604.....L 8
Tlayacapan, 1,743.....L 1
Tochimilco, 2,192.....M 2
Todos Santos, 1,831.....D 5
Tolimán, 2,105.....K 6
Toluca, 52,789.....K 7
Tomatlán, 741.....G 6
Tonalá, 10,500.....N 8
Topolobampo, 598.....E 4
Toronto (lake).....G 3
Torreón, 128,548.....H 4
Tres Marías (islands).....F 6
Triángulo Oeste (island).....N 6
Triángulo Este (island).....N 6
Tula, 4,558.....K 5
Tula (river).....L 1
Tulancingo, 18,543.....K 7
Tulcingo, 1,881.....M 2
Tuxpan (*Jalisco*), 6,763.....H 7
Tuxpan (*Nayarit*), 11,608.....G 6
Tuxpan (*Veracruz*), 15,707...L 6
Tuxtepec, 4,912.....L 7
Tuxtla Gutiérrel, 28,262.....N 8
Umán, 3,679.....P 6
Unión Hidalgo, 4,929.....M 8
Ures, 2,981.....D 2
Urique (river).....F 3
Uruáchic, 395.....E 3
Uruapan, 31,410.....H 7
Usumacinta (river).....O 8
Uxmal (ruins).....P 6
Valladolid, 6,402.....P 6
Valle de Santiago, 15,683.....J 6
Valle de Bravo, 3,956.....J 7
Vanegas, 1,633.....J 5
Venado, 2,011.....J 2
Venustiano Carranza.....N 5
Veracruz, 104,469.....Q 8
Veracruz (state), 2,030,462...L 7
Verde (river).....F 3
Verde (river).....L 8
Viesca, 3,370.....H 4
Vigía Chico.....Q 2
Villa Acuña, 11,355.....J 7
Villa Allende, 2,400.....G 3
Villa Coronado, 815.....G 3
Villa de Alvarez, 2,044.....G 7
Villa de Cos, 1,119.....H 5
Villa de Seris, 1,150.....D 2
Villa Frontera, 6,035.....J 3
Villa García, 1,922.....J 5
Villa Juárez, 4,797.....L 6
Villa Unión (*Durango*),
2,936.....F 5
Villa Unión (*Sinaloa*), 4,002.F 5
Villa Ursulo Galván
(San Carlos), 1,349.....Q 1
Villagrán, 1,128.....K 4
Villahermosa, 33,588.....N 8
Villaldama, 2,648.....J 3
Villanueva, 4,241.....H 5
Xaltocan, 1,373.....N 1
Xicohténcatl, 991.....K 5
Xochihuehuetlán, 2,988.....K 8
Xochimilco, 20,711.....L 1
Xochitepec, 1,532.....L 2
Xochitlán, 1,720.....N 2
Yaqui (river).....E 2
Yautepec, 4,538.....L 2
Yucatán (state), 518,798.....P 6
Zaachila, 4,513.....L 8
Zacapoaxtla, 2,163.....O 1
Zacatecas (state), 661,846....H 5
Zacatecas, 23,576.....H 5
Zacatelco, 7,029.....M 1
Zacatlán, 3,804.....N 1
Zacoalco, 6,227.....H 6
Zamora, 23,440.....H 7
Zaragoza, 3,510.....J 2
Zautla, 858.....O 1
Zimatlán, 3,970.....L 8
Zinacatepec, 4,131.....L 7
Zitácuaro, 19,940.....J 7
Zongolica, 1,296.....P 2
Zumpango (*México*), 5,583...L 1
Zumpango (*Guerrero*), 3,266.J 8

western United States. Faulting has been extensive in the Gulf of California. In adjacent plains of the states of Sonora, Sinaloa, and Nayarit are found elongated volcanic edifices of the Tertiary period.

North and Central Mexico and Yucatán Peninsula.—(3) *Sierra Madre Occidental and Sierra Madre Oriental.*—The former, which follows the western coast at some distance inland, is the most important manifestation of relief in Mexico, as well as of the entire continent; being in other places known as the Rocky Mountains. No evidence has been found of volcanic activity during the Quaternary period in the Sierra Madre Occidental, except in the southern part. The foldings of this range take on an east-west orientation, cross the Central Plateau and continue in the Sierra Madre Oriental, which follows the eastern coast at a distance from the Gulf of Mexico. The latter range began to take form during the Upper Middle Cretaceous, as the result of foldings which continued during the Tertiary. Its great elevation is interrupted only here and there from Monterrey to the Isthmus of Tehuantepec. Volcanism was active in the central part of the Sierra Madre Oriental during Quaternary times; elsewhere the range has been quiet.

(4) *Mexican Central Plateau.*—This plateau, lying between the Sierra Madre Occidental and the Sierra Madre Oriental, is the continuation of the Great Plains of the western United States and Canada. It was formed mostly by marine sedimentations during the Cretaceous period, then emerged from the sea during an uplift which continued during Tertiary and Quaternary times. The plateau is crossed by folds of the Sierra Madre Occidental and the Sierra Madre Oriental systems, and by a transverse range beginning in the State of Durango and continuing across the states of Zacatecas, Guanajuato, Querétaro, and Hidalgo to the borders of Puebla. This last is characterized by numerous volcanic edifices, products of the Oligocene and Miocene periods. To the south of this range once again are found isolated plateaus, such as El Bajío (the high valley of the Central Plateau which includes most of Guanajuato and parts of Querétaro, Michoacán, Jalisco, and Aguascalientes) and the so-called valleys of Toluca, Mexico, Tlaxcala, Puebla, and Tehuacán, all of which are limited in the south by the Sierra Volcánica Transversal. Only in this last zone of the Central Plateau do earthquakes still occur.

(5) *Gulf Coastal Plain and Yucatán Peninsula.*—This division is a continuation of the coastal plain which begins east of the Appalachian Mountains and continues into Florida and along the Gulf coast of the United States. It embraces the Mexican states of Tamaulipas, Veracruz, and Tabasco, and the Yucatán Peninsula; then the plain submerges into the Yucatán Channel, later to reappear in Cuba. The uplifting of this coastal plain in Mexico began toward the end of the Cretaceous period and has continued, despite numerous recessions, through the Tertiary and Quaternary. The relief of the region drops precipitously down from the highlands on the west, tapering off into a plain of very slight inclination. Except for some regions of the central and southern parts of Veracruz, which are seismic zones due to their proximity to the tectonic region of southern Mexico, the coastal plain is free of earthquakes in the present era.

(6) *Sierra Volcánica Transversal.*—The Transverse Volcanic Range rises south of the Central Plateau and north of the Balsas Depression. Its historical geology is very similar to that of the neighboring physiographic divisions, with interruptions from time to time by effusions of lava, which have formed a series of lofty volcanic edifices along the 19th meridian from coast to coast. It is a region of tectonic as well as of volcanic earthquakes. The Sierra Volcánica Transversal includes the famous Popocatepetl, Citlaltepetl (Pico de Orizaba), and Colima, old but still active volcanoes, as well as the newer Jorullo and Paricutín.

Southern Mexico.—(7) *Balsas Depression.*—The depression of the Balsas River in the states of Michoacán and Guerrero, with the depressions of the rivers Atoyac (in Puebla), and Nochistlán, Verde, and Tehuantepec (the last three in Oaxaca), is part of a geosyncline which also includes the Gulf of California and the other great depressions of the continent associated with it. This region underwent the same uplifts of the Upper Cretaceous and Tertiary periods as its southern neighbor, the Sierra Madre del Sur. The foldings which formed the depression itself began during the Oligocene and continued into the Quaternary. It is also a region of frequent tectonic earthquakes.

(8) *Sierra Madre del Sur.*—This sierra, which crosses the states of Colima, Michoacán, Guerrero, and Oaxaca, is the continuation of the Sierra de Baja California and the other mountain ranges linked with it. This region experienced an uplift beginning in the Upper Cretaceous period. During the Cenozoic, the uplifting continued, accompanied by the foldings which created the mountainous relief. The present tectonic character of the Sierra Madre del Sur is reflected by frequent earthquakes.

(9) *Isthmus Region and Chiapas.*—The three physiographic divisions described immediately above end at the Isthmus of Tehuantepec, where their physiographic elements taper off to a low altitude and are scarcely distinguishable one from another. Farther east, however, in the State of Chiapas the three phenomena once again appear more pronouncedly, clearly dividing the region into three zones. The mountainous region of the Sierra Septentrional de Chiapas, in the north of that state, is a prolongation of the Sierra Madre Oriental, being prolonged even farther into Guatemala, British Honduras, Cuba, Haiti, the Dominican Republic, and Puerto Rico. The central depression of Chiapas is a continuation of the Balsas Depression and the associated depressions of the states of Oaxaca and Guerrero. This series of depressions continues through Guatemala and British Honduras into the Caribbean, where it is known as the Bartlett Deep. The Sierra Madre de Chiapas, in the west, is a prolongation of the Sierra Madre del Sur which continues across Guatemala and Honduras, later reappearing in Jamaica and Haiti. In this physiographic division, volcanic activity is at present concentrated in the south.

Volcanoes.—Volcanism in Mexico was at its maximum activity during Tertiary times, especially during the Oligocene period, although it has continued to the present. Volcanic activity is concentrated mainly along the 19th meridian of latitude, in the range formed by various volcanic edifices, called the Sierra Volcánica Transversal. The most important volcanoes of this

range, with their approximate heights, are: Colima Volcano (12,984 feet) and the Nevado de Colima (14,108 feet), in western Jalisco; El Quinceo (9,016 feet) and Tancitaro (11,148 feet), in Michoacán; the Nevado de Toluca (14,944 feet), in Mexico State; Cempoala (14,036 feet), in Morelos; Popocatepetl (17,705 feet) and Ixtaccihuatl (17,671 feet), both within sight of Mexico City; Malinche (14,623 feet), between Tlaxcala and Puebla; and Citlaltepetl, or Pico de Orizaba (18,843 feet), the highest point in the republic; and Cofre de Perote (13,475 feet), in Veracruz.

In the Revillagigedo Islands, lying along the 19th parallel in the Pacific, are found Monte Evermann, on Socorro Island, and Monte Gallegos and Monte Tent on Clarión Island. Smaller Mexican volcanoes include: Ceboruco (7,100 feet) and Sanganguey, in Nayarit; Tequila, in Jalisco; Calmini, Virgenes, and Loreto in the Sierra de Baja California; Chacahua, Ometepec, and Pochutla in the Sierra Madre del Sur; the volcanoes of the Tres Marías Islands off the coast of Nayarit; and San Bartolomé, Zontehuitz, San Cristóbal, Hueytepec, and Chicón, in Chiapas. The youngest volcanoes of Mexico are Jorullo (4,331 feet; erupted first in 1759) and Paricutín (in 1943), both in Michoacán.

Rivers and Lakes.—The principal rivers of Mexico, with their alternate names and approximate total lengths, are given in the following paragraphs.

Rivers which drain into the Gulf of California are: the Colorado, most of whose course is in the United States; the Concepción (or Magdalena, 200 miles long); Sonora (250 miles); Yaqui (420 miles); Mayo (220 miles); Fuerte (175 miles—350 miles with its affluent the Verde); Sinaloa (200 miles); and Culiacán (175 miles).

Those entering the Pacific are, in central Mexico, the San Pedro (250 miles—upper course called the Mezquital) and Santiago (600 miles—upper course, above Lake Chapala, called the Lerma). In the south are the Balsas (450 miles—upper course called the Atoyac in Puebla and the Mexcala in Guerrero) and its affluent the Tepalcatepec (150 miles), the Verde (200 miles—upper course called the Atoyac), Tehuantepec (150 miles), and Suchiate (100 miles) on the Guatemala border.

The most important river draining into the Gulf of Mexico in the north is the Rio Grande (or Bravo), most of whose course separates Mexico from the United States. Its chief tributaries from the Mexican side are the Conchos (300 miles) and the Salado (210 miles—upper course called the Sabinas). The San Fernando (170 miles) and Soto la Marina (160 miles) are also in the north. In the central region are the Pánuco (100 miles), which is formed by the junction of the Moctezuma (175 miles) and the Santa María (200 miles)—the lower course of the Pánuco is also called the Tamuín—as well as the Tuxpan (or Tuxpam, 100 miles), Tecolutla (257 miles), and Nautla (162 miles). In the south are the Papaloapan (or Papaloápam, 375 miles—195 miles with its headstream, the Tuxtepec), Coatzacoalcos (175 miles), Grijalva (400 miles—middle course also called Chiapa), and Usumacinta (600 miles—upper course called the Chixoy). The Grijalva and Usumacinta are connected near the coast. The Hondo (150 miles) drains into the Caribbean Sea after forming the border between Quintana Roo and British Honduras.

The Papaloapan is the most important river of Mexico, occupying seventh rank among the rivers of the world in volume of water discharged; the rate at times reaching 8,000 cubic meters per second at Tlacotalpan, where its force is greatest. The Lerma-Santiago River is also of great importance. The Lerma rises in the mountains near Toluca and drains into Lake Chapala, the largest (417 square miles) and one of the most beautiful lakes in Mexico. By way of the Santiago River, Lake Chapala drains into the Pacific, as noted above.

In the interior there are many rivers which do not drain into the ocean but into lakes which have no outlet. In the northwest of the Central Plateau, the Casas Grandes (250 miles long) drains into Lake Guzmán (56 square miles in area); the Santa María (200 miles) into Lake Santa María (30 square miles); and the Carmen (150 miles) into Lake Patos. These three rivers and lakes are in Chihuahua. In the west of the plateau, the Cadena (94 miles) drains into Lake Palomas, Chihuahua. The areas of lakes Patos and Palomas are variable, due to irrigation operations. Also in the west, the Nazas (180 miles) formerly drained into Lake Mayrán, in Coahuila; and the Aguanaval (250 miles), into Lake Viesca, also in Coahuila. These two rivers were dammed, however, and have water only in the rainy season. In Michoacán, lakes Pátzcuaro (100 square miles) and Cuitzeo (160 square miles) have no outlet to the sea; nor has Lake Sayula (79 square miles) in Jalisco.

The Moctezuma River, an affluent of the Pánuco as mentioned above, now drains the ancient lacustrian basins of the Valley of Mexico, where of five lakes, Texcoco, Zumpango, Xaltocán, Chalco, and Xochimilco, the last named is the only survivor, although only Chalco is absolutely dry in all seasons.

Islands.—Mexico possesses numerous islands off both coasts, many of which are uninhabited. The principal islands in the Gulf of Mexico and Caribbean Sea, all of which are populated, are Carmen, on which is the port of Carmen, Campeche; and Cozumel and Mujeres islands off Quintana Roo. Mujeres is notable for being the first Mexican land discovered, by Francisco Fernández de Córdoba on March 1, 1517.

In the Pacific the only populated islands are Cedros (Northern Lower California), which has a plant for packing sea food; Margarita (Southern Lower California), a naval base; and Tiburón, home of the Seri Indians, in the Gulf of California off the coast of Sonora.

Nevertheless, it is in the Pacific that Mexico has her most interesting islands, among them Socorro and Clarión in the Revillagigedos, 300 to 500 miles from the nearest point on the continent.

Guadalupe Island is one of the most interesting islands in the world. Located 180 miles west of northern Lower California, it rises sharply from the abyssal depths of the ocean to an altitude of 4,498 feet. Guadalupe is the home of the only surviving elephant seals (or sea elephants; *Macrorhinus angustirostris*).

Climate and Vegetation.—In general, altitude and rainfall are more important than latitude in determining climate. According to the classification of Wladmir Köppen, the following types of climate are found in Mexico:

(1) Tropical humid climate with rains throughout the year (type Af), in northeastern Chiapas, the southwestern tip of Campeche, southeastern Veracruz, and Tabasco except along the coast. Here the vegetation is tropical rain forest, characterized by angiospermous trees, both monocotyledons and dicotyledons, to which cling lianas or vines and epiphytes or parasitic plants. Among the trees of greatest economic importance are red cedar, mahogany, lignum vitae, quebracho, ceiba, brazilwood, logwood, and sapodilla, as well as tropical fruit trees.

(2) Tropical humid climate with intense monsoon rains in summer (Am), along the Atlantic slopes of the Sierra Madre Oriental, across the State of Veracruz, along the north of the Sierra Septentrional de Chiapas, and in the south of Campeche and Quintana Roo.

The natural vegetation is tropical forest, which is composed of the same class of trees as the tropical rain forest, but without lianas and epiphytes. Thus it is less dense than the rain forest. Among its most important species, in addition to those noted as belonging to the tropical rain forest, are avocados, custard apples, magnolias, guavas, and cacao trees.

The tropical forests of Quintana Roo, Campeche, and Chiapas constitute the primary forest region of the country. Their trees, which are hardwood, are used in furniture making and other industries. The sapodilla should be mentioned for the importance of its latex as a raw material from which chicle is made. Mexico is the world's leading exporter of chicle, of which 1,801,737 kilograms, valued at 23,130,044 pesos, were produced in 1951.

These forests are subjected to an immoderate exploitation, but their exuberant growth facilitates natural reforestation.

(3) Tropical humid climate, with rainfall in summer (Aw), in the coastal plain of Veracruz, the north of the Yucatán Peninsula, the Pacific coastal plain from central Sinaloa to Chiapas, part of the Balsas Depression, and the central depression of Chiapas. Vegetation is of the tropical savannah-type grassland, consisting chiefly of herbaceous plants, among which may be mentioned amaranth, jicama, gourds, pineapples, and bananas.

(4) Dry climates, steppe (BS) and desert (BW), are found in the northern stretches of the Central Plateau, in the plains of Sonora and Sinaloa, the Peninsula of Lower California, in a strip all along the western side of the Sierra Madre Oriental, and in the extreme northwest of Yucatán. In all these regions the steppe climate surrounds the desert.

There is also a type of steppe vegetation on the plateaus that extend from San Luis Potosí through eastern Puebla as far as the central plateaus of Oaxaca, as well as in the lowest part of the Balsas Depression and in other depressions, such as that of Lake Cuitzeo.

The steppe vegetation is grass and drought-resistant plants, whereas the desert has only drought-resistant plants or naked sands and rocks. Among the most important types of drought-resistant plants are cacti, agave, yucca, mesquite, candelilla, and guayule.

(5) Temperate humid climate with rains in winter (Cs) is characteristic of the northwest region of the Peninsula of Lower California. The vegetation here is either grassland or prairie (see classification 8).

(6) Temperate humid climate with rains throughout the year (Cf) occurs in the upper reaches of the sierras, and is characterized by coniferous forests.

These forests are formed chiefly of gymnospermous conifers, of which the most important are pines, oyamel (*Abies religiosa*), *abeto,* the common juniper, and the ahuehuete (*Taxodium mucronatum*). These softwood trees are found in the San Pedro Mártir and Juárez sierras in northern Lower California, in the Sierra Madre Occidental, the Sierra Madre Oriental, the Sierra Volcánica Transversal, in the highest regions of the Sierra Madre del Sur, and in the Sierra Madre de Chiapas. Being found the length of the country and being located near centers of population, they are exploited on a national scale. They supply wood for building and furniture, as well as wood pulp and resins used by medicine and industry, such as pitch and turpentine. The coniferous forests have been subjected to an immoderate exploitation, but are protected to a certain extent by their location in the mountains. The exploitation of pine represents about three quarters of the forest production of the country.

(7) Temperate humid climate with scant rainfall in all seasons (Cx') is found only in northern Tamaulipas and in some mountainous areas of Nuevo León and Coahuila. Steppe vegetation prevails (see classification 4).

(8) Temperate humid climate with rainfall in summer (Cw) occurs on the western slope of the Sierra Madre Occidental, in the southern valleys of the Central Plateau, in the Sierra Madre del Sur, the Sierra Madre de Chiapas, and in the northern mountainous region of the latter state. Vegetation is prairie grassland. The vegetation of the temperate humid prairies is formed chiefly of grasses, among the most important of which are epazote (*Chenopodium ambrosioides*), zacaton (*Epicampes macroura*), and otate (*Gradua amplexifolia*).

(9) Polar climate due to altitude (EB) is found in the higher elevations of some mountains. This classification has two subtypes: (ET) tundra vegetation, consisting of lichens and bunch grasses, is found on the Nevado de Colima, Nevado de Toluca, Cofre de Perote, and Malinche, as well as at corresponding elevations on the still higher volcanoes; the climate of perpetual ice (EF) occurs in the most elevated regions of Citlaltepetl, Popocatepetl, and Ixtaccihuatl.

Mixed Forest of Temperate Regions.—This type of forest is characterized by dicotyledonous angiosperms and gymnospermous conifers; thus, besides the conifers, there are live oaks, oaks, willows, and ash and walnut trees, among others. The mixed forests are found on the western slope of the Sierra Madre Occidental, southern slope of the Sierra Volcánica Transversal, northern slope of the Sierra Septentrional de Chiapas, and the eastern slopes of the northern and southern parts of the Sierra Madre de Chiapas.

The mixed forests, like the forests of softwood conifers (classification 6, above), are thus found the length of the country, and are exploited on a national scale. Since many of the mixed forests extend into the southern valleys of the Central Plateau, however, they have suffered a more severe exploitation than have the coniferous forests. Live oaks, oaks, and walnut trees are used chiefly in furniture making; pines, for building, furniture, and to obtain resins.

Fauna.—The animals belong to the two great

zoogeographical regions of the American continent, the Nearctic and the Neotropical, since the boundary between the two is in Mexico. This boundary crosses the Gulf and Pacific coastal plains roughly at the Tropic of Cancer, but altitude then forces it southward along the Sierra Madre Oriental in the east and the Sierra Madre Occidental in the west until it reaches the Sierre Volcánica Transversal, where it crosses the interior of the country in an east-west direction. North of this boundary the fauna is almost exclusively Nearctic (of the Rocky Mountain subregion); south of it the fauna is neotropical.

Among Nearctic mammals are the wild sheep, pronghorn, and several species of deer and bear; among Nearctic mammals with Neotropical components are the tapir, puma, jaguar, and various deer. Neotropical mammals include marsupials, such as the opossum, and those of the American type, such as the armadillo and monkeys.

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2. POLITICAL DIVISIONS AND POPULATION. The initial political division of Mexico, similar to the present division, was incorporated in the federal Constitution of Oct. 4, 1824, which divided the federation into 19 states and 4 territories, and adopted the federal popular representative form of government. The states included Texas; the territories, Upper California and New Mexico (Santa Fe). These two territories, as well as Texas—whose declaration of independence in 1836 was not recognized by Mexico—and parts of the states of Coahuila, Chihuahua, and Sonora, were ceded to the United States in the treaties of Guadalupe Hidalgo in 1848 and Mesilla (Gadsden Purchase) in 1853. The territorial extension of Mexico before these treaties was approximately 1,544,400 square miles; hence it is now less than half what it was during the colonial period and the first years of independence.

Under the Constitution of 1857 the republic was reorganized into 24 states and 1 territory. The constitution promulgated Feb. 5, 1917 recognized 28 states, 3 territories, and the Federal District, which corresponds to the District of Columbia in the United States. The admission of the Territory of Northern Lower California as a state on Jan. 16, 1952, however, changed the organization of Mexico to 29 states, 2 territories (Southern Lower California and Quintana Roo), and the Federal District, which are tabulated on the accompanying table, with their respective areas, capitals, and populations according to the census of 1950. The states and territories are divided into *municipios* (municipalities), of which there were 2,349 in 1950. The Federal Dis-

State or territory	Square miles	Population (1950) [1] Total	Per cent rural	Capital	Population (1950) [2]
North—					
Chihuahua	94,831	846,414	55.89	Chihuahua	89,961
Coahuila	58,068	720,619	42.55	Saltillo	69,869
Durango	47,691	629,874	71.35	Durango	59,496
Nuevo León	25,137	740,191	44.08	Monterrey	333,422
San Luis Potosí	24,417	856,066	69.58	San Luis Potosí	125,640
Tamaulipas	30,734	718,167	47.05	Ciudad Victoria	31,808
Zacatecas	28,124	665,524	74.96	Zacatecas	24,254
North Pacific—					
Lower California, North	27,655	226,965	35.50	Mexicali	64,658
Lower California, South	27,978	60,864	67.10	La Paz	13,081
Nayarit	10,547	290,124	65.87	Tepic	24,600
Sinaloa	22,582	635,681	72.07	Culiacán	48,963
Sonora	70,483	510,607	54.68	Hermosillo	43,516
Central—					
Aguascalientes	2,499	188,075	45.10	Aguascalientes	93,394
Federal District	573	3,062,205	5.43	Mexico City	2,233,916
Guanajuato	11,805	1,328,712	58.42	Guanajuato	23,389
Hidalgo	8,058	850,394	78.85	Pachuca	58,650
Jalisco	31,152	1,746,777	52.13	Guadalajara	377,928
Mexico	8,268	1,392,623	73.60	Toluca	52,968
Michoacán	23,202	1,422,717	67.96	Morelia	63,245
Morelos	1,917	272,842	56.62	Cuernavaca	30,597
Puebla	13,125	1,625,830	66.83	Puebla	211,203
Querétaro	4,432	286,238	75.83	Querétaro	49,209
Tlaxcala	1,555	284,551	61.23	Tlaxcala	5,071
Gulf of Mexico—					
Campeche	19,664	122,098	42.61	Campeche	31,279
Quintana Roo	19,630	26,967	73.13	Chetumal	7,247
Tabasco	9,783	362,716	78.07	Villahermosa	33,587
Veracruz	27,759	2,040,231	66.70	Jalapa	101,515
Yucatán	14,867	516,899	44.75	Mérida	142,838
South Pacific—					
Chiapas	28,731	907,026	76.94	Tuxtla Gutiérrez	28,260
Colima	2,010	112,321	39.85	Colima	28,658
Guerrero	24,887	919,386	78.33	Chilpancingo	12,662
Oaxaca	36,374	1,421,313	79.32	Oaxaca	46,741
Total	758,358 [3]	25,791,017	57.41 [4]		

[1] Preliminary report dated March 24, 1953. [2] Preliminary report. [3] Does not include uninhabited islands (2,224 square miles) or continental shelf (154,633 square miles). [4] National average.

trict, which includes Mexico City, the national capital, is divided into 12 delegations.

Population.—Mexico completed its seventh general census, by modern techniques, on June 6, 1950. This showed a population increase of 30.8 per cent over the 1940 figure of 19,653,552. The areas in which this increase was the greatest during these 10 years were Northern Lower California (187.5 per cent), the Federal District (73.5 per cent), Tamaulipas (56.3 per cent), and Morelos (49.4 per cent).

The crude birth rate in 1950 was 45.79 per 1,000 inhabitants and the crude death rate was 16.1 per 1,000, both among the highest in the world. The death rate, however, had been reduced from 26.1 per 1,000 in 1921 and 24.4 per 1,000 in 1937. The growth of population is about half a million persons per year. For the economic effects of this growth see the section *Economic, Industrial, Agricultural, and Financial Factors* (Population).

Chief Cities.—The urban population of Mexico numbered 10,983,483 in 1950, or 42.59 per cent of the total. The census showed 10 cities of more than 100,000 inhabitants; in contrast to the censuses of 1930 and 1940 in which only Mexico City, Guadalajara, Monterrey, and Puebla exceeded that figure. All these 10 cities were capitals (shown on the accompanying table), except Torreón (128,548), Ciudad Juárez (122,598), and León (122,585).

Consult O'Gorman, Edmundo, *Historia de las divisiones territoriales de México* (Mexico City 1948); Vivó, Jorge A., *Geografía de México* (Mexico City 1949).

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3. RACIAL COMPOSITION, POPULATION TRENDS, AND HEALTH. Mexico ranks among the most populous of those Latin American countries with a mixed racial origin. Mestizo (mixed) elements make up the preponderant part of the population, but a large part of this population is Indian.

Indians.—The criteria which have served to characterize the Indians as such are very diverse, since the problem of defining what is Indian is not easily solved. Alfonso Caso, in "Definición del indio y de lo indio" (see *Bibliography*), says:

> An Indian is one who feels that he belongs to an Indian community; an Indian community is one in which non-European physical elements predominate, which speaks an Indian language by preference, which possesses a large proportion of Indian elements in its material and spiritual culture, and which, finally, has a social sense of being an isolated community among the communities which surround it, which makes it distinguish itself both from white and mestizo groups.

The foregoing definition, of a practical nature (above all for the end of applying social and economic measures), is very far from what might be expected as a biological definition. Nevertheless, the statistician is more interested in knowing whether a population group lives in accordance with the characteristics of Indian culture than whether that group possesses the physical and psychic traits corresponding to a given race. Furthermore, after the many contacts which have taken place in the past, not only in the Mexican population but over the entire globe, it is useless to continue insisting on pure races.

For many years the linguistic criterion was the only one considered valid for purposes of the census. This was criticized by anthropologists like Manuel Gamio, and beginning with 1940 later censuses took into account not only language but the presence of other cultural traits, which bring students of these statistics closer to reality. Theoretically, perhaps, it might be thought that biological data would be the only sure data for classification, but this is invalidated by racial mixture. Therefore, although as was stated above, Caso's concept seems to clash with the scientific rigor of physical anthropology, it is the only one valid for the social ends aimed at.

Within the same Indian group, classified as such because of language, can be found the physical variations which are precisely those which make classifications difficult. A typical example, among many others, is provided by the Trique Indians of the Mixtec area, in the State of Oaxaca; those living in the mountains differ completely from those along the coast as regards physical characteristics, and even psychic ones, and yet they are grouped together because they speak the same language.

The classification of the Indian population from the point of view of physical anthropology has been only slightly satisfactory because it has not always been possible to collect a sufficient amount of data, evaluated statistically. Nevertheless, the available statistical material does permit an overall picture adequate for forming a criterion with respect to that mosaic of native races and languages which constitutes the modern Mexican people. There is a series of coincident facts which are easily perceived, without going into details. The Indian tribes of high physical stature are found in the northwest of Mexico, and as one goes southeast they become smaller in stature. In general, this seems also to hold true for head shapes (cephalic index), since the most brachycephalous (short-headed) groups are found in the southeast, and the most dolichocephalous (long-headed) groups in the northwest. There are, however, clear exceptions to this.

Pre-Hispanic Population.—It has been noted that the Indian part of the population forms a large demographic nucleus. Since the present-day Mexican has developed from Indian roots, what is known of the Indians' origin, distribution, and principal differentiating characteristics must now be treated.

It is agreed among most anthropologists that the first inhabitants of Mexico, as of the Americas in general, were predominantly of Asiatic origin. An eclectic theory of the populating of the Americas admits both the arrival of migrations by way of the Bering Strait and sporadic influences from Polynesia. The precise date of arrival has not been agreed upon, but dates ranging from 10,000 to 25,000 years ago have been suggested. The discovery, in 1952 at Santa Isabel Ixtapan, State of Mexico, of the skeleton of a mammoth (*Archidiskon imperator*) of the Pleistocene period associated with projectile points and scrapers indicates that in this epoch the Valley of Mexico was already populated by hunters.

It is interesting to note that a high percentage of the modern Indian population is medium-headed (mesocephalic) or brachycephalous, and that the places where the bones of dolichocephal-

alous Indians have been found are sites which have been long uninhabited, as, for example, those of the Pericu Indians of the southernmost part of the Peninsula of Lower California. The present-day Indians with tendencies toward longheadedness are likewise found in marginal areas. This has been interpreted as indicating that longheads formed the first migratory waves and were displaced by shortheaded peoples and forced into less favorable regions. Much has been said of such migratory waves and there is much difference of opinion among the various authors.

In general, the hunting, fishing, and gathering groups of pre-Hispanic Mexico occupied the north, where environmental conditions are less favorable for the evolution of more complex cultures. On the other hand, the areas which anthropologists have named Meso-America (central and southern Mexico, British Honduras, Guatemala, western Honduras, and El Salvador) saw the flourishing of a whole series of peoples whose cultural manifestations have surprised modern man.

The question of what influence the environmental conditions may have had on the physical aspect and method of reacting of the diverse inhabitants of the Mexican territory has not been investigated, perhaps because of the complications which would arise, but it is easy to deduce that the people who reached the Central Plateau from the north did so in large measure under the pressure of the scarcity of means for supporting life. Nomadic tribes, with an economy based on hunting and gathering, suffered great privations in the mountains and deserts of the north. The climate in this region is very extreme, and such living conditions were surely a sufficient stimulus for them to venture southward. Once in less inclement territory, with abundant food and better possibilities for supporting life, they must have changed from a widespread nomadic existence to one close to a sedentary mode.

Later, when agriculture had satisfied their basic needs, they could begin to create all that series of cultural accomplishments whose remains we admire. It is clear that the same impulse which guided the first inhabitants of the plateau stimulated subsequent waves and was the origin of conquests and reconquests by the many peoples of whom archaeologists and historians speak. This was the panorama through which passed Chichimecs of different origin, Toltecs, Mayas, Mixtecs, Zapotecs, Tarascans, Aztecs, and others. These constant clashes always brought as a consequence more or less permanent contacts which resulted in group mixture, with a natural interchange of customs, language, myths, techniques, and what interests us here, biological mixture. Mixture certainly caused many of the variations we observe, but it is also certain that the environment acted on them, leaving more or less permanent characteristics.

There was much less movement from south to north. In the majority of cases it consisted of readjustments, or of changes sought by centers of population already established, whose commerce and highly evolved population required slaves and artisans. It is natural that good living conditions should permit an increase of population, either through a high birth rate or by the immigration of subjugated groups.

Centers of Concentration.—Upon their arrival, the Spaniards found an extensive territory, very unevenly populated. In some areas there was a large concentration of population—responsible chroniclers are of the opinion that the great Tenochtitlan (on the site of Mexico City) had no less than 60,000 houses, which is to say about 300,000 inhabitants, and in addition a series of widespread tributary towns.

The metropolis was the seat of the dominant group, the Aztecs, whose hegemony extended southward to modern Central America. In the northwest its power did not extend as far, reaching only to the borders of Michoacán. Beyond this point there are only records of a multitude of seminomadic or completely nomadic tribes, of whose customs and languages we have information, but whose numbers it is difficult to calculate.

The major concentration of population at the time of the Spanish conquest was thus located in the plateau. Perhaps in earlier times the coast and the tropical plains had had the greatest population, since the ruins in the Maya zone bespeak very large concentrations in those regions. Only the presence of hundreds of thousands of workers can explain the building of the huge edifices which were already in ruins upon the arrival of Europeans in Mexico.

Teotihuacán, with its enormous pyramids and its area of some 11 square miles with abundant remains of dwellings, must have been another great center of population, but its inhabitants were dispersed long before the conquest, perhaps by the push of tribes which were barbarian but full of combative vigor. The same fate overtook other large centers of population such as Monte Albán, Tula (Tollan), and Xochicalco.

Of all these, the only ones remaining upon the arrival of Hernán Cortés (Hernando Cortez) were the urban centers of the Valley of Mexico, seats of the great chiefs who with Montezuma (Moctezuma) formed the triple alliance of the cities of Tlacopan, Texcoco (or Tetzcoco), and Tenochtitlan, with Tlatelolco only recently dominated. We have sufficient information on the Aztecs to substantiate their flourishing civilization. That their population was constantly increasing is proven by the need of the Aztecs for expansion, notwithstanding the fact that war and other calamities must have reduced their numbers very frequently.

Outside the Aztec Empire perhaps the major center of population was Tlaxcala, for which a population of about 500,000 has been calculated for that period. The Tarascans in Michoacán formed another nucleus of demographic importance.

Precise data are lacking with respect to the total population on the eve of the conquest. Each of the investigators, like their informants, makes personal appraisals that do not resist analysis. According to the historian Gonzalo Aquirre Beltrán, the one that is perhaps closest to reality is Angel Rosenblat, who after a careful analysis estimates that 4.5 million Indians were living in the territory that now forms Mexico in 1519, the year the Spaniards reached Tenochtitlan.

Conquest and Colony.—In 1570 the Indian population diminished to 3,366,860, and in 1646, according to Aguirre Beltrán, it dropped to only 1,269,607. This tremendous decline has been variously explained. In Tenochtitlan alone, the war which decimated more than one third of the population was a tremendous depopulating factor at the beginning of the conquest. Not only did the conquest cause death directly, but it

dispersed many groups which, not being able to adapt themselves to new conditions of life, thus perished. In addition, contacts with sick Europeans and Negroes, helped by the exhaustion due to fatigue and inadequate nourishment, let loose truly catastrophic epidemics, such as those of smallpox in 1520, measles in 1529, and typhus in 1545, which took millions of lives. Gilberto Loyo cites the fact that some 2 million Indians died of matlazahuatl (Mexican typhus or tabardillo) between 1573 and 1577. The inhuman exploitation to which the Indians were subjected, the change in their way of life, their removal to different zones, and so forth, were other factors which explain the decrease in population suffered in the first periods of the conquest. The European and Negro populations may be considered still insignificant, but mestizos and *Criollos* (native-born whites) began to multiply rapidly.

The paternalistic laws for the protection of the Indians, in spite of their remaining dead letters in large part, gave rise to a situation of social as well as demographic importance. In an attempt to free the Indians from the exhausting labor to which they were subjected in the mines and in the cultivation of sugar cane, and so forth, permission was obtained in 1501 to bring Negro slaves to the Spanish colonies. In Mexico most of these were settled in the hot lands of Veracruz and Guerrero; still others were taken to the mines in Zacatecas.

Aguirre Beltrán gives the population figures in the accompanying table (the terms Euro-, Afro-, and Indo- indicate mixtures in which European, African, or Indian characteristics predominated in the mestizos).

Year	Spaniards and *Criollos*	Negroes	Indians	Euro-mestizos	Afro-mestizos	Indo-mestizos	Total
1570	6,644	20,569	3,366,860	11,067	2,437	2,435	3,410,012
1646	13,780	35,089	1,269,607	168,568	116,529	109,042	1,712,615

Social Structure.—The Negroes, with the Indians, formed the lowest stratum of colonial society, and their conditions of misery were the motive for the constant unrest manifested through mutinies and rebellions. From the mixtures among them arose the so-called castes. The word "caste," eminently biological, was given a derogatory meaning in the colonial period, comprising not so much the physical characteristics of the individuals as their social extraction, without forgetting their racial mixture. The attempt to define precisely the last degree of difference between such mixtures, as the various combinations passed through generation after generation, gave rise to terms which were ridiculously elaborate and often artificial.

The mestizos, who in the beginning had been well regarded—to the extent that some were admitted into the Spanish nobility—were relegated to a secondary status as they grew in numbers. They were considered quarrelsome individuals, and they, for their part, feeling themselves humiliated by the whites, showed their resentment in violent form. On the other hand, the mestizos looked down on the Indians for having been conquered, thus showing themselves to be what they were, unadapted beings who participated in the social environment only with difficulty.

The native-born whites, or *Criollos,* comprising a class which could have been the elite, since they had on their side all the privileges of its racial and economic condition, felt neglected before the hierarchical superiority of the Spaniards, to whom the crown entrusted the official duties.

This accumulation of circumstances unfavorable to the harmony and progress of colonial society was the leaven which, after receiving an incentive from the ideas of revolutionary France, brought on the struggle for independence.

The nucleus of white Spaniards was never numerous—only 7,904 individuals in 1793, from which it may be inferred that only a few thousand men had control of the political, judicial, military, and ecclesiastical functions, and like positions. The decline of the Indian population had finally ceased about this time and a slight increase had begun. The mestizos and mulattos were also increasing in numbers. In a total population of 3,799,561 in 1793, it is calculated that 61.1 per cent were Indians and 38.6 per cent were mestizos and mulattos; of the remainder, 0.2 per cent were Spaniards and *Criollos* and 0.1 per cent were Negroes.

Later Population Trends.—The struggle for independence (1810–1821), like all wars, brought about a series of upheavals, as well as a slight decrease in population. Soon, however, there occurred a readjustment favorable to population gains.

In conclusion it may be said that the present population of Mexico is predominantly mestizo, and that a large proportion, 20 to 25 per cent of the total population, has Indian cultural characteristics. The Indian population has been growing, although from the linguistic point of view the great majority are interested in learning Spanish in addition to their mother language and in adopting various elements of Western culture. Since the Revolution of 1910 various programs have been undertaken to provide them with lands and with economic and cultural media, to achieve the homogenization of the population.

Indian Health and Diet.—Various circumstances have influenced the disappearance of innumerable Indian groups, above all in northern Mexico, but in those places occupied by individuals who had reached a sufficiently advanced state of cultural evolution, the Indian was able to resist all that man and nature brought against him. In addition, the conquerors and the other white rulers who followed them through time, knew that land without someone to work it lacks value —from an economic point of view, the Indians were one with the land, a most valuable factor which had to be conserved. Hacienda owners bought their land making sure that with it went a sufficient number of laborers to exploit it.

Thousands of these laborers, principally members of the rural population, have continued to live in very precarious hygienic conditions. Water-borne diseases cause very serious disorders among them, weakening them physically. It is certain, however, that little by little they have become naturally immunized against the diseases brought by Europeans and Africans. There

were no returns of the great epidemics like those of the 16th century mentioned above. Nevertheless there still remain wide areas in which malaria, tuberculosis, and parasitic diseases continue to reduce their numbers. Some maladies have thrived specifically among the Indians, such as onchocerciasis, which occurs in an extensive zone of Chiapas, and pinta in Guerrero, Morelos, Michoacán, and other states.

It has been said that the Indian diet is inadequate and poor in nutrition, and that their feeble resistance to disease results from this. Such an assertion is in general false, since besides the fact that the Indian is not especially susceptible to disease, various other causes may have unfavorable effects on his resistance. The Indian diet may not include a series of foods which are considered basic in the diet of Western civilization, such as milk, eggs, and meat, but the nutritive content of such products is supplied by other foods containing the necessary factors. The basic Indian diet is composed of corn (maize), beans, and chili peppers, and in the highlands, pulque, a drink extracted from agave plants. This diet is supplemented with a series of vegetable and animal products which vary according to the region. Even in extremely poor regions, such as the Mezquital Valley inhabited by Otomí Indians, where the basic foods are corn, chilies, and pulque, the Indians have found additional foods, such as insects, larvae (including the grubs found on maguey plants, and caterpillars), and other animal products, which with beans, mesquite, and fresh vegetables complement their diet so that sicknesses due to nutritional deficiencies are not encountered among them.

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NATIONAL HEALTH

The death rates of a population are one of the best expressions of its state of health, since it is to be expected that a decline in death rate indicates a reasonable adaptation of sanitation and technical control to factors of climate and social conditions.

Mortality Rates.—The Mexican death rate has experienced a constant decline during the decades after 1930, when it was 26.6 per thousand inhabitants, but in spite of this fact it must still be considered high in comparison with other countries. The average death rate during the years 1941–1945 was 21.5 per thousand inhabitants, and it declined to 17.4 in the following five years, 1946–1950 (see Table 1). Assuming that registration in the less populated areas was complete, the average mortality during the latter period was lower in rural (16.0) than in urban surroundings (20.9).

The death rates are highest in the Central Region,[1] a fact that would indicate that the most densely populated area and cultural center of Mexico presents a greater sanitary problem than other regions in the notably hazardous tropics. Only two states of the Central Region, Jalisco and Michoacán (16.4 and 16.9), present rates slightly below the national average, and three of them, Mexico, Puebla, and Tlaxcala (23.2, 23.5, and 24.3) have the highest mortality rates in the country. With the exception of Northern Lower California (17.5) in the North Pacific Region, and Colima and Oaxaca (17.9 and 21.7) in the South Pacific Region, the death rates in the states of the other four regions were lower than the national average for the period 1946–1950.

Infant Mortality Rates.—Infant mortality plays an important role in the high general death rate. Although it too has been declining, it is still very high; 29.4 per cent of the total number of deaths during 1950 were due to deaths of children under the age of one year. The average infant death rate for 1946–1950 shows that one out of every ten children born alive dies before it reaches the age of one year (see Table 2). Again, it is in the Central Region that we find by far the highest infant mortality rates. The Federal District (134.4) and the states of Mexico (145.5) and Tlaxcala (146.8) included in this region had the highest rates in the whole country in 1946–1950.

Causes of Death.—In Table 3 the principal causes of death are arranged according to the number of deaths per 10,000 inhabitants. The three causes most disastrous to Mexico are diarrhea and enteritis, pneumonia, and malaria.

The decline in the number of deaths caused by diarrhea and enteritis, as well as by dysentery, typhoid and paratyphoid fever, can only be attributed to better general sanitary conditions, such as improved water supply and drainage, greater hygiene in the food supply, and to education and other factors.

The high number of deaths caused by pneumonia is due principally to inadequate housing conditions and clothing. In spite of the hope offered by the use of sulfa drugs and antibiotics, mortality declined only slightly and has tended to remain more or less the same.

The high death rate from malaria is due, on the one hand, to special environmental conditions, and on the other, to the lack of adequate communications, the poverty, and the low standard of hygienic education characteristic of the *tierra caliente* (hot country) where malaria is endemic, that is, the southern part of Mexico and along the Pacific and Gulf coasts.

A serious problem is presented by the considerable isolation of the majority of Mexico's rural population and a shortage of physicians who are willing to sacrifice comfort and to live among people often opposed to their services because of their nonscientific conception of the causes of disease. According to the census of 1940, only 8.7 per cent of physicians were practicing in rural areas, which contain 57.4 per cent of the total population. In order to solve this problem, the federal government in 1936 organized a bureau now known as the Dirección General de Servicios Médicos Rurales Cooperativos, and every medical student is obliged to practice his profession in some rural area during five

[1] For a listing of the states comprising these regions, see *Political Divisions and Population.*

MEXICO

Top: Beautiful harbor of Acapulco. *Above left:* This Mexican girl wears a Tehuana everyday costume, state of Oaxaca. Colored yarns are woven into her braids. *Right:* Regional dress of the State of Morelos. Note the girl's shawl or *rebozo*.

American Airlines

Artisans decorating lacquer trays at Janitzio, State of Michoacan.

Mexican Government Tourist Bureau

View of the spreading sea of lava spewed out by the volcano of Paricutin, Michoacan. Notice the church tower at the right protruding above the lava.

Table 1—NUMBER OF DEATHS PER THOUSAND INHABITANTS

Region [1]	1941	1942	1943	1944	1945	Average 1941–45	1946	1947	1948	1949	1950	Average 1946–50
North	19.6	20.5	20.2	17.9	16.8	19.0	17.3	14.3	14.0	14.9	13.5	14.8
North Pacific	17.2	17.2	17.2	16.0	15.8	16.7	15.0	13.1	14.2	12.9	12.2	13.5
Central	24.4	25.2	25.0	22.9	21.7	23.8	22.0	18.2	19.0	20.7	18.2	19.6
Gulf of Mexico	18.9	20.9	19.7	19.4	17.6	19.3	15.7	14.6	13.9	14.0	13.7	14.4
South Pacific	22.9	22.1	21.8	20.1	19.3	21.2	19.4	18.0	18.0	18.4	16.7	18.1
Mexico	22.1	22.8	22.4	20.6	19.5	21.5	19.4	16.6	16.9	17.9	16.1	17.4

Table 2—NUMBER OF DEATHS OF CHILDREN UNDER ONE YEAR OF AGE
(Per thousand births)

Region	1941	1942	1943	1944	1945	Average 1941–45	1946	1947	1948	1949	1950	Average 1946–50
North	111	107	110.4	104.5	98.0	106.2	101.2	92.6	93.7	96.2	86.6	94.0
North Pacific	104	92	93.2	91.6	95.1	95.2	87.1	79.0	88.2	79.7	75.0	81.8
Central	142	137	135.5	128.9	124.0	133.5	126.8	110.9	118.2	126.3	115.4	119.5
Gulf of Mexico	92	100	79.7	93.2	81.6	89.3	77.1	62.9	64.6	74.7	63.2	68.5
South Pacific	105	94	103.2	96.9	91.0	98.0	101.4	87.2	92.3	86.5	82.7	90.0
Mexico	123	118	117.2	113.5	107.5	115.8	110.6	96.4	101.7	106.4	96.2	102.3

Table 3—NUMBER OF DEATHS FROM SELECTED CAUSES
(Per ten thousand inhabitants)

Cause	1941	1942	1943	1944	1945	Average 1941–45	1946	1947	1948	1949	1950	Average 1946–50
Diarrhea and enteritis	43.8	45.4	40.6	37.2	34.4	40.3	31.9	25.6	26.8	30.0	28.0	28.5
Pneumonia	32.7	31.7	32.3	30.9	28.9	31.3	31.0	25.6	27.7	30.5	25.3	28.0
Malaria	13.0	12.9	11.9	12.2	13.2	12.6	11.0	11.1	10.2	10.1	8.7	10.2
Whooping cough	5.4	7.2	5.5	4.6	4.7	5.5	6.6	4.7	4.7	4.5	4.6	5.0
Measles	3.3	5.0	10.2	4.6	3.1	5.2	8.6	1.6	2.9	7.5	2.9	4.7
Bronchitis	5.9	6.2	6.0	5.6	4.9	5.7	5.4	4.2	4.5	4.6	3.7	4.5
Tuberculosis	4.6	5.0	5.3	5.3	5.1	5.1	4.9	4.7	4.4	4.0	3.6	4.3
Dysentery	4.9	5.2	4.8	4.6	4.1	4.7	3.5	2.3	2.1	2.3	1.9	2.4
Typhoid and paratyphoid fever	4.3	2.8	2.5	2.4	2.5	2.9	2.4	2.0	1.8	1.8	1.5	1.9
Syphilis	1.6	1.6	1.6	1.5	1.5	1.6	1.3	1.2	1.0	0.9	0.7	1.0
Smallpox	1.2	2.0	1.9	1.1	0.5	1.3	0.2	0.2	0.5	0.2	0.1	0.2

months immediately before receiving his degree. The government has established a number of official agencies to care for the poor in urban areas, and since 1943 has enforced a program of social insurance, which includes medical attention, in several of the largest cities in Mexico.

Consult Whetten, Nathan L., *Rural Mexico* (Chicago 1948); Secretaría de Salubridad y Asistencia, *Memoria, 1943–45* (Mexico City 1951).

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4. THE INDIAN GROUPS. These groups still form an important part of Mexico's population. The area of present-day distribution of Indian groups which, to a greater or lesser degree, maintain their ethnic characteristics and group consciousness, coincides generally with the areas inhabited by sedentary peoples in pre-Hispanic times. These are central and southern Mexico and a strip in the northwest along the Pacific coast and the Gulf of California (in Sinaloa and Sonora) and the Sierra Madre Occidental. It was there that "the settled Indian was fitted into the colonial and modern economic scheme, in fact this was built upon him" (Alfred L. Kroeber, *Cultural and Natural Areas of Native North America,* University of California Press, 1939). There is a rough correlation between the pre-Hispanic density of population and cultural development, and the strength of Indian groups today.

The Indian groups may be defined on the basis of the following characteristics: (1) they are composed of individuals who are predominantly Indian from the physical point of view; (2) they possess group consciousness (they consider themselves Indian), and are considered Indians by outsiders; (3) with but few exceptions, they speak Indian languages; (4) in differing degrees they maintain in their cultures a larger proportion of pre-Hispanic or preindustrial elements than the proportion of these elements in the national (or modern Mexican) culture. The persistence of pre-Hispanic and preindustrial elements of culture is especially evident in technology and economy.

As regards point 1, there is some degree of *mestizaje* (white and Negro admixture) in most Indian groups. Nevertheless, in Mexico, cultural differences are vastly more important in the characterization of Indian groups than racial differences. The Indian who abandons his Indian mother tongue and becomes assimilated to modern Mexican culture becomes a Mexican, and is socially accepted as one. In some areas, such as the Isthmus of Tehuantepec and the Mixtec area, the use of group names (*tehuano, mixteco*) to designate specific ethnic groups is being lost. The tendency is to use these terms as regional names, regardless of racial and cultural origins.

With regard to point 4, several centuries of colonial rule and, more recently, the impact of Western industrial civilization have modified the Indian cultures to a varying extent. It is impossible to generalize about the degree of assimilation of Indian groups to modern Mexican culture.

Socially, the Indian groups form rural communities which are generally subordinate to the

[1] For a listing of the states comprising these regions, see *Political Divisions and Population.*

semiurban or urban Ladino groups; the latter consisting of individuals who speak Spanish and participate in modern Mexican culture. Racially, the Ladinos are very mixed, with a considerable proportion of white admixture. However, the distinction is cultural rather than racial, and there are possibilities of passage from Indian to Ladino, through cultural and social changes. In some areas, the relationship between Indian groups and Ladinos comes close to being a caste system—for example, in Chiapas. In other areas this relationship is rather that of a class system. This seems to depend on the different economic development of the various regions. Some Indian groups, such as the Maya in the Quintana Roo forests, the Lacandon in the Chiapas jungle, the Huichol in the mountains of Nayarit, the Tarahumara (or Tarahumare) in the mountains of western Chihuahua, live in isolation, without maintaining relationship with Ladinos.

Linguistic Divisions.—The only general criterion which permits a statistical evaluation of the importance of the Indian groups in modern Mexico is the linguistic one. According to the 1940 census there were 1,237,018 individuals more than five years old who spoke only Indian languages (monolinguals), and 1,253,891 individuals more than five years of age who were bilinguals or plurilinguals, speaking Spanish as well as one or more native languages. The total number (2,490,909) of monolinguals and bilinguals more than five years old represented 15 per cent of the total population in that age category. The corresponding figures from the 1950 census showed 795,069 monolinguals and 1,652,540 bilinguals, or a total of 2,447,609, a considerable reduction in view of the fact that the total population of Mexico increased some 30 per cent during the decade.

Taking the Indian population by groups, the most important is made up of the people who speak Nahuatl, the language of the Aztecs (355,295 monolinguals; 360,071 bilinguals; total: 715,366), and live in the states of Puebla, Veracruz, Hidalgo, Morelos, Guerrero, and in the Federal District. All the figures refer to the population more than five years of age, in 1940. There follow, in order of importance: Maya (131,836 monolinguals; 114,011 bilinguals; total 245,847), in Yucatán, Campeche, and Quintana Roo (see also the article MAYA); Mixtec (111,391; 124,994; total 236,385), in Oaxaca and the adjacent zone of Guerrero; Zapotec (111,660; 104,661; total 216,321), in Oaxaca; Otomí (94,693; 87,404; total 182,097), in Hidalgo and the State of Mexico; Totonac (58,561; 59,242; total 117,803), in Veracruz and Puebla; Mazatec (45,254; 55,743; total 100,997), in Oaxaca and Puebla.

Among the groups smaller than 100,000 we find the Tzotzil (75,207, total of monolinguals and bilinguals) in Chiapas; Mazahua (68,855) in the State of Mexico; Tzeltal (66,861) in Chiapas; Mixe (51,261) in Oaxaca; Huastec, or Huaxtec (46,631) in Veracruz and San Luis Potosí; Chinantec (37,577) in Oaxaca; Tarascan (34,880) in Michoacán; Chol (34,624) in Chiapas; Tlapanec (27,698) in Guerrero; Tarahumara (26,007) in Chihuahua; Chatino (16,794) in Oaxaca; Zoque (15,732) in Chiapas and Oaxaca; Amuzgo, or Amishgo (13,219) in Guerrero and Oaxaca; Mayo (12,831) in Sonora and Sinaloa; Tojolabal (11,653) in Chiapas; Cuicatec (10,005) in Oaxaca. There also exist many groups of less than 10,000 individuals.

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5. THE WAY OF LIFE. Modern Mexican life presents a complex of striking contrasts: Parisian fashions alongside Aztec mantles; Coca-Cola and the thousand-year-old nectar of the gods, pulque; the baseball field and the bull ring; and most significant, minds molded in ancient ritualistic patterns mastering 20th-century machine tools. As in the Far East, the new has met with the old, the European with the native. A clash was inevitable, and the results—economic, political, and social—are only now taking definitive form.

Food and Drink.—In Aztec times the basic diet consisted of corn (maize), beans, and chili. Corn was prepared in an infinite variety of ways, the most popular being the *tortilla,* a thin, flat, unleavened bread. Tamales (corn dough steamed in corn husks) and the less well-known *pozole* (corn soup) were common fare. The ancient Mexicans supplemented their diet with turkeys, boars, rabbits, fowl, and a great variety of fruits, herbs, and insects. All these foods have retained their importance and still may be said to constitute the main diet of the Indian population. Cattle, wheat, and certain fruits such as oranges, apples, and grapes were perhaps the most significant European contributions.

Following the Spanish tradition, the main meals are the *desayuno* (breakfast), the *comida* (a large meal of several courses served about two o'clock in the afternoon), and the *merienda* (a very light supper at eight or nine in the evening). In the large cities this customary eating pattern has changed somewhat during this century. Many of the middle class now favor a lunch at midday, as in the United States, and a heavier *cena* (supper) in the evening.

The most popular drink of the Indians is pulque, the fermented juice of the maguey, a cactus plant. Its alcoholic content is slight. More potent than pulque are tequila and mezcal, also derived from the maguey. The excellent beers of the European type brewed at Monterrey, Nuevo León, in the north, and at Orizaba, Veracruz, near the east coast, are extremely popular throughout the republic and have replaced pulque to a considerable extent.

Dress.—In pre-Hispanic times among the majority of the Indian population, dress was extremely simple. Men usually wore a loincloth, sandals, and a cotton mantle (the Aztec *tilma*) draped and tied over the right shoulder. A long cotton blouse and a skirt held to the waist by a

sash constituted the general female attire. The Spanish manner of dressing changed male clothing habits radically: the natives of most rural districts are now to be seen wearing white cotton trousers, a shirt, and inevitably, a straw hat. Except in the warmest areas, they will usually be seen wearing or carrying a serape (or *sarape*), a woolen blanket whose design and colors vary from region to region. This is perhaps the only Aztec remnant in male attire, and stems from both the ancient cotton *tilma* and the Spanish capote, or cape. The women of some Indian groups may still be seen dressed in the ancient, pre-Hispanic blouse and skirt. Statistics reveal that approximately one half of the population has not adopted shoes of the European type.

In the cities the average well-to-do or middle-class Mexican wears very much the same clothing as is worn in the United States or Europe. A certain amount of formality, not so often seen in the United States, is noticeable among the men; materials are darker as a rule, tailoring is conservative, and sports clothes are not as commonly accepted. Hats are seldom worn by women, and on those rare occasions when head covering is in order, the *rebozo* (shawl), the veil, and the Spanish mantilla are the most common forms of headgear among all social classes. A revival of interest in folk costumes has taken place since about 1940. The decorative *rebozo*, as an article of high fashion, has come into its own. *Huaraches*, the attractive native sandals, have become increasingly popular for resort wear among the Mexicans.

Sports.—The traditional spectacle and main source of hero worship in Mexican life, bullfighting, has continued to maintain its popular appeal. Nevertheless, some *toreo* impresarios and enthusiasts lament the fact that the new generation is turning more and more to football (which in the United States would be called soccer), basketball, and baseball as recreational outlets. The decades after 1920 witnessed an ever-increasing interest in these athletic "imports." Contrary to the general trend in the United States, the emphasis in Mexican sports is primarily on the amateur and the spontaneous. In the larger cities a Sunday morning finds thousands engaging personally in ball games; even the most primitive native villages generally can boast an open-air field, equipped at least for basketball.

A growing rivalry, sportswise, between the various colleges has created a demand for better playing fields and more adequate spectator accommodations. The Olympic Stadium of the Universidad Nacional easily seats 100,000 persons. Radical in design, this great elliptical bowl is the sports center of the capital's ultramodern University City, which was dedicated in 1952.

On the professional level, *frontón* (or *jai-alai*), a court game of Basque origin, maintains an almost fanatical following. Betting is an integral part of the game and fortunes can be made—or lost—nightly at the Frontón México in Mexico City.

Fiestas.—The great Christian festivals are still celebrated with considerable liturgical pomp, attracting enormous crowds of the devout to churches and shrines. Household celebrations of these same feasts are often occasions for informal gatherings. One of the foremost among these great holy days is *Los Santos Reyes* ("The Holy Kings," that is Epiphany, or the feast of the Wise Men). On this day, January 6, children receive their gifts from the Three Kings of the East; the Santa Claus tradition is unknown except among the city sophisticates. *Semana Mayor* (Holy Week) inspires a truly popular outburst of religious fervor. A number of Indian communities have become famous for their Passion plays and public processions on Friday of this week.

The most significant Aztec religious festival, the feast of the offerings to the spirits of the dead, oddly enough coincided with the remembrance of the faithful departed in the Catholic calendar (November 2). Many pagan practices persist to this time: special household altars are prepared and covered with curious ceremonial breads (*pan de muerto*), meat dishes, *tortillas*, cigarettes, toys, and other articles to placate the dead.

December 12 finds hundreds of thousands of Mexicans, particularly the Indians, converging on Mexico City and thronging the great basilica of the Virgin of Guadalupe, patroness of the republic, which is north of the city.

The nine days preceding Christmas represent the happiest and most carefree of the religious year. *Posadas* (literally "inns"), representing the journey of Mary and Joseph to Bethlehem and their search for an inn, are enacted nightly in many homes. In more recent years these celebrations have taken on a more frivolous tone, and cocktails and dancing have come to be expected.

Regional Differences.—These, as they are found today, are direct or indirect results of the colonial policies followed by the conquerors during the three centuries of Spanish hegemony.

In the southern part of Mexico the European colonizers encountered flourishing centers of native culture, such as the Aztec, Maya, and Zapotec confederations. Sedentary in nature, these ethnic groups tilled the land, consolidated their political positions, and had reached a high point of refinement in the arts and sciences. While many of their political, social, and religious institutions suffered an almost total eclipse with the conquest, the basic patterns of folk culture persisted and came to constitute an integral component of the Hispanic-Mexican civilization. With these groups the Spanish crown accepted and even encouraged intermarriage, which resulted in the emergence of the mestizo (mixed) population.

On the other hand, in the northern desert stretches the Spanish settlers found only barbarous, nomadic tribes. Agricultural stability was virtually unknown, and life was devoted to hunting, fishing, foraging, and intertribal warfare. In a word, the culture pattern of this region was strikingly similar to that prevailing among the Indians in United States territory. As often happens with such marginal and submarginal groups, contact with the European resulted either in the annihilation or cultural ineffectiveness of the native. At the present time, tribes such as the Tarahumara of Chihuahua and the Yaqui of Sonora roam the plains and mountain ranges exactly as they have in centuries past; the Indian reservation is an institution unknown to the Mexican people. These fiercely independent tribes take little part in civic activity, and numerically constitute an almost negligible part of the modern population.

European stock, therefore, has remained rel-

atively pure in northern Mexico. This in turn has facilitated the assimilation of ideas, customs, and attitudes from the United States. Such has not been the case in certain southern states, such as Oaxaca, Puebla, Guerrero, Tlaxcala, and Chiapas.

While inhabitants of both regions possess a deep-rooted consciousness of national spirit, the southern mestizos and Indians tend to regard the *norteños* (northerners) as more frank, thrifty, businesslike, and self-assertive, though too "Americanized" in their language, manners, and general way of life. Mexicans of the north, particularly in Sonora, Chihuahua, Coahuila, and Nuevo León, find it difficult to accept their southern neighbors' Indian ceremoniousness, passivity, and general fatalistic attitude. Mexico City is a case in itself, with an atmosphere all its own. Here, Indian currents and those from Europe and the United States have found a meeting place, contributing to the formation of a complex, cosmopolitan way of life.

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6. ECONOMIC, INDUSTRIAL, AGRICULTURAL, AND FINANCIAL FACTORS. The economic situation of Mexico offers a picture which reflects her level of natural and human resources and her system of economic institutions, both public and private. Mexico is a product of her geography, her demographic structure and movements, and her history, pre-Hispanic, colonial, and independent. Remodeled by her revolution, fought from 1913 to 1925, she is engaged in an economic development which asserts her national independence and adds greatly to her wealth and income measured above all in the general welfare of her citizens—displaying, moreover, an authentic determination to strive with the rest of the world for pacific ends.

Territory.—Frank Tannenbaum has said that "Mexico is a beautiful place in which to live, but a tough place in which to make a living" (*Mexico; the Struggle for Peace and Bread*, Knopf, New York 1950).

Mexico's geography is violent and diversified. In a space equivalent to a little more than one fifth that of the United States including Alaska, her physical geography imposes severe obstacles to the settlement and the efforts of her inhabitants, and to the easy circulation and consumption of the fruits of their labor. Since most of her territory contains rugged mountains, vast deserts, and jungle lands, which can be only sparsely inhabited, there are only limited areas where the temperature and climate, the precipitation and the soil's fertility constitute an environment that is favorable to the full development of an economic culture. Mexico lacks the advantages of great navigable rivers, wide and safe ports, as well as facilities for the laying of the paths of ground communication by means of which her natural resources might attain a maximum value.

But when everything is considered this same varied geography opens up an infinite number of possibilities to the persevering efforts of the Mexicans. On the diverse climatic levels, from the *tierra caliente* (hot land) of the coastal lowlands or subtropical zones to the alpine passes, grow the most varied botanical and zoological species of economic value to man. The geological structure encloses mineral deposits which attracted the greed of conquerors eager for gold and silver, offered modest reserves of iron and coal in the preliminary stages of Mexico's modern industrialization since the beginning of this century, and later added petroleum and industrial and strategic minerals whose exploitation has meant a vital contribution to the economy. Adding to all this a respectable hydroelectric potential, Mexico has sufficient effective assets for waging the battle for economic progress, without the limitations of countries like Cuba, Venezuela, Bolivia, or El Salvador, whose economy is based on one or a limited number of products, or of those other countries to which nature has denied the bases of adaptation to the changing requirements of a modern economy. Her geographic location is to be envied: the wide northern frontier places Mexico right next to the strongest and most prosperous economic power in the world; her coasts look out upon the two great oceans of present-day civilization; and the Isthmus of Tehuantepec links Mexico to a Latin America which considers her the leading partner in the community of Spanish-speaking peoples.

Despite impressive advances since about 1925, the beginning of peaceful and constructive revolution, Mexico has realized barely a minimum part of her economic potential. Perhaps some of her resources have been overestimated through a misunderstood patriotism; also, over broad regions of her territory there exist forms of primitive human life which act as a factor retarding progress, the elimination of which will be slow and difficult. But the deficient knowledge and superficial exploitation of her resources may soon be replaced by a serious inventory and a deep exploration of the Mexican potential, providing gratifying surprises to coming generations, and assuring their full employment to meet the increasing demands of progress. It is generally believed, not solely among Mexicans but especially among foreigners, that Mexico is paving the way to a better utilization of her resources, and that there remain many plus-values to be gained. To climb step by step to more and more elevated levels of this mastery is the ultimate goal and the surest pledge for the future well-being of the Mexicans.

Population.—The total population growth of Mexico is quite considerable, and the rate keeps increasing—in contrast to the highly developed countries of the world. The censuses of population reflect this impressive development: 1930, 16.6 million inhabitants; 1940, 19.7 million; 1950, 25.8 million. During the 1930's the average yearly increase was about 310,000 inhabitants; during the 1940's about 610,000.

This very substantial increase in population possesses a significant economic importance: year after year the demographic increase spells greater pressure upon available resources. But this situation is further aggravated, first, because the economically active population does not grow at the same rate as the total (active population in relation to the total: 31 per cent in 1930; 30 per cent in 1940; 29.5 per cent in 1950); and second, because the agricultural pop-

ulation not only keeps increasing in absolute terms (3.6 million in 1930; 3.8 million in 1940; 5 million in 1950), but also maintained virtually the same percentage level during the decade 1940–1950 in the economically active population of the country (70.6 per cent in 1930; 65.4 per cent in 1940; 58.0 per cent in 1950—this last percentage being similar to that of the agricultural labor force in the United States in 1850).

Transportation.—For the normal economic development of a growing nation, a well-planned, efficient system of transportation is almost unanimously considered as indispensable. The reader is referred to the section in this series on *Transportation and Communications* for this information.

NATURAL RESOURCES

Minerals.—*Precious Metals.*—The proverbial wealth of Mexico in minerals for more than three and a half centuries was based on the circumstance that the precious metals were, according to the ideas of mercantilism, the most conspicuous indication of the wealth of nations and the economic potentiality of states; and that Mexico stood out as the leading producer of argentiferous metal. The entire world accumulation of silver barely totaled 50 million kilograms (a kilogram equals 32.2 ounces troy) until the exploitation of the Mexican mines in the Guanajuato region began in 1555. Since then some 210 million kilograms of silver have been extracted from the Mexican subsoil, the peak of production taking place in the five-year period 1926–1930, with more than 3 million kilograms per year. Despite declining figures (2.6 million kilograms in 1942; 1.36 million in 1951) Mexico still leads in world production, with 42 per cent in 1951, followed at a considerable distance by the United States, a country which exercises the decisive influence over this precious metal by virtue of being the primary purchaser of the product and the principal investor in Mexican silver mining. The decline in silver is not due so much to the exhaustion or scarcity of reserves as to the impact of phenomena manifested since the period following World War I, among them the discard or decline of metallic monetary standards, the oscillations of United States silver policies, and the disturbing effects of political changes after 1946 in countries of the Orient and southern Asia, such as China and India, which in the past fed the demand for silver by their high propensity for hoarding.

In comparison with this extremely valuable Mexican silver production, the exploitation of gold-bearing lode deposits results in quantitatively modest returns. While the productive capacity at the end of the 18th century was, on a yearly average, 1,610 kilograms, with an approximate value of one million pesos of that era, and although the production for 1950 (12,700 kilograms) represented an enormous increase which brought 123.7 million pesos, the income from Mexican gold production occupied only fifth place (see Table 1) in the country's mineral production of 1950, while the income from silver (in third place) in the same year amounted to 312.5 million pesos.

Other Minerals.—In the course of the years other minerals required for the industrial uses of our manufacturing epoch have replaced the

precious metals in their importance to Mexico. At the head of these other products of the Mexican subsoil are zinc, lead, and copper; but the contributions of antimony, cadmium, and manganese are also noteworthy (see Table 1). If to these minerals are added the values of iron (see following section), graphite, tin, mercury, arsenic, tungsten, and bismuth, the value of mineral production in 1949 reaches a total of 1,748 million pesos; in 1950, 2,003 million pesos. The data relative to 1951 soar to figures still higher, in Mexican currency, although strong disconcerting factors are introduced by monetary devaluations and by inflated quotations in the international market, as a consequence of postwar demands directed above all toward building up strong stocks in the United States and using conservatively the reserves of these nonreplaceable products in that country.

Table 1—MINERAL PRODUCTION

	1940		1949		1950	
	Production (tons).	Value (million pesos)	Production (tons)	Value (million pesos)	Production (tons)	Value (million pesos)
Lead	196,000	123	221,000	606	238,000	579
Zinc	115,000	91	178,000	402	224,000	593
Copper	37,600	52	57,000	195	62,000	244
Antimony	12,000	21	5,750	37	5,878	31
Cadmium	816	8	820	31	130	2.5
Manganese	307	a	24,000	15	14,461	10.2

a Not available.

Coal and Iron.—Three nonreplaceable raw materials of the Mexican subsoil present problems of a different character: coal, iron, and petroleum. Coal and iron are the mainstays of industrialization. Unfortunately, these reserves are not the ones that define Mexico's mineral wealth. The total production of pit coal, extracted almost entirely in Chihuahua, barely exceeds a yearly average of one million tons (0.05 per cent of world production). A lack of progress in the exploitation of known deposits is revealed by the fact that the average monthly extraction in 1937 was 103,500 tons, a figure not attained in any month in 1950. Known reserves are estimated at about 2,000 million tons (the world production for one year). It is only comparatively recently that the Oficina de Investigaciones Industriales of the Banco de México has attacked the problem of redeeming for the iron and steel industry the losses of raw material (about half) due to inadequate techniques in the coking process.

The full use of modern treatment processes, and the possibility of extending and deepening the geologic-mineral explorations and of incorporating the new districts of Coahuila, Oaxaca, and Chiapas in the Mexican reserves, may alleviate the extreme scarcity of the present situation.

Nor is the panorama of iron deposits much more attractive. A deposit of good quality (60 per cent) in the Cerro de Mercado of Durango has been the basis for the siderurgical prosperity of Monterrey for half a century, but despite the first fantastic expectations, the estimated reserves do not exceed 50 million tons. Including a great number of small lodes scattered mainly among the states in the north of the republic, there exist barely 200 million tons (a trifle more than 0.5 per cent of the world reserves).

The gravity of the problem is immediately patent in the following figures: the quantity of mineral extracted in 1940 was just over 70,000 tons (175,000 in 1945; 285,000 in 1950). In 1940 iron and steel production was 130,000 tons, and it registered a constant increase until 1947 (300,000 tons), but imports of iron, scrap, and steel were also considerable (88,000 tons in 1940; 312,000 in 1947), giving together an apparent consumption of 218,000 tons in 1940, of 612,000 in 1947, and of 668,000 tons in 1950. At this primordial line, the subservient position of Mexico's iron and steel production is evident, in times when the threatening possibility exists that such extremely necessary imports may fluctuate in relation to international events. This problem and that of locations made compulsory by the presence of the deposits, with the ensuing transportation complications, mean great obstacles to the industrial progress and satisfaction of the consumption needs of the country.

Not everything spells limitation, however: Jenaro González Reyna, Luis Torón, Adrián Esteve, and Leonardo Martín Echeverría, with excellent knowledge of the possibilities of Mexico, state that until now the geologic-mineral investigations in Mexico have been deficient and superficial. Carried to greater depths in the earth by means of a laborious effort of many years, they may discover—and this the geology of Mexico leads one to suppose—new and extremely important deposits, and what is still more important, locations that are more strategic and in better combination, to answer the increasing demands of Mexican industrialization and consumption.

Mining Policies.—The main problem of Mexican mining is the clash of interests between foreign investors and the Mexican economy. Foreign investments in Mexican mining were 626 million pesos in 1940 and 892 million in 1948. Including the nationalized production of petroleum and natural gas, this economic sector gave employment to only 1.82 per cent of the economically active population, the same in 1940 as in 1950. Thus we have the paradox that the mining labor force presents the highest index of productivity among all activities, but this quite deceptive appearance fades when we recall the relatively high capitalization in mining.

A concrete fact is the high fiscal income issuing from the mining enterprises. In 1951 they paid 800 million pesos in taxes to the government, an amount comprising 20 per cent of the federal income; the value of production of mining enterprises being only 5.84 per cent of the gross national product in that year. The mining entrepreneurs complain that the government has abandoned them, as evidenced by such a heavy tax burden and by the fact that the greater part of government incentives is concentrated in the field of manufacturing enterprises. In the opinion of the miners, the extractive industry languishes for want of a strong stimulus—without reaching the high productive figures of 1926–1929—and thus the bases for the success of the industrial programs are reduced and narrowed.

The government, however, justifies these high tax charges by the fact that minerals constitute an exhaustible reserve whose earnings for the most part go to foreigners, aggravating the problem of deficits in the balance of payments—an injury even more revealing when one considers that it is necessary to import the finished products of Mexican mineral raw materials in order to satisfy the needs of ultimate consumption and, above all, of equipment for manufacturing plants in Mexico.

Without a doubt, Mexican mining enterprises

have not passed beyond the most elemental levels in the field of transformation industry (preparation of concentrates), due to which circumstance mining products account for a high percentage of the load carried by Mexican railroads, a factor deeply disconcerting to the country's very poor system of transportation.

The only viable solution in this field would consist in leveling the taxes imposed on mining until they were fixed at a rate similar to other incomes derived from capital. In exchange for this, the enterprises should undertake to compromise so as to reinvest a sizable portion of their profits in installations of high transformation, capable of producing a part of the articles needed for national consumption, thus saving production costs, tariffs, and costs of insurance and transportation, all of which are at present ultimately shifted onto the Mexican consumer.

Petroleum.—In dealing with the Mexican petroleum problem, the temper of the nation and the will of its leaders are fully revealed. The *chapopote* of the natives before the conquest, the *stercor diabolus* (devil's dung) of the missionary friars, petroleum has been the best exponent of Mexican history in the 20th century. In 1900 and 1901 Englishmen and United States citizens began drillings in the Isthmus of Tehuantepec and in La Huasteca (Lower Pánuco River region), respectively. In the rich zone called Faja de Oro, in Veracruz, a concession of the British company El Águila, the well Potrero del Llano No. 4 gushed forth in 1910, and its production in a few years reached the incredible figure of 157.1 million barrels (1920), to which were added healthy contributions from the fields of the Huasteca Petroleum Company and the Poza Rica zone in Coatzintla, Veracruz.

At the beginning of the 1920's (maximum production, 1921: 193.4 million barrels) Mexico was second in world production, although considerably below the United States. But the appearance of strong, successful competitors in the world market, particularly Venezuela, brought Mexican production to a low of 32.8 million barrels in 1932, in the midst of a world depression. As a defense against unilateral decisions of the petroleum companies, in an attempt to guard this valuable asset of national patrimony by removing it as much as possible from the fluctuations of the world market, and in order to satisfy the requirements of Mexican transportation and of industry, President Lázaro Cárdenas decreed the nationalization of petroleum on March 18, 1939, relying upon the legal basis of the Mining Ordinances (Ordenanzas de Minería) promulgated by Philip II in 1559 and Article 27 of the Constitution of 1917, and upon the assent of all sectors of opinion of the Mexican people. The Mexican professor Jesús Silva Herzog and the Committee on Interstate and Foreign Commerce of the United States House of Representatives have each described with considerable erudition (see *Bibliography*), and each from a different point of view, this transcendental event, viewed by foreign investors and governments as one of the worst attempts against the institution of property and human rights. Since that time the ability of the Mexican people to attempt a technological exploit reserved until then for the oligopolies of the great industrial powers has stood trial. (See also the following subsection on economic policy.)

The report of the director of Petróleos Mexicanos (which exploits the nationalized petroleum resources), published March 18, 1952, summed up the strides made in these terms (comparing the years 1946 and 1951 except as noted): the crude petroleum reserves increased from 1,058 million barrels to 1,424 million; adding the equivalents of reserves of natural gas and distilled products, the hydrocarbon reserves of the nation rose to 1,796 million barrels. Annual production increased from 49 million barrels to 79 million. The number of wells drilled in 1951 was 268, as compared with 64 (1947). Refining plants at Azcapotzalco, Federal District; Salamanca, Guanajuato; Reynosa, Árbol Grande, and Ciudad Madero, Tamaulipas; and Mata Redonda, Minatitlán, and Bella Vista, Veracruz, went from a production of 42 million barrels (1945) to 57 million (1951); distributed products rose from 34 million barrels to 50.6 million. Exports were raised from 9.7 million barrels to 22 million. Revenues of Petróleos Mexicanos rose from 570 million pesos to 1,839 million ($66 million and $213 million, respectively). The sum invested in explorations rose from 28 million pesos ($3.3 million) to 177 million pesos ($20.4 million). Taxes paid to the Mexican government increased from 191 million pesos ($22 million) to 505 million ($58 million); that is to say that the nationalized petroleum industry by itself yields five sevenths of the taxes derived from the country's mining activities.

All these facts, together with the advantage afforded by natural gas, the production of sulphur and fertilizers, the presence of an attractive formula for subsoil exploitation by nationals and foreigners, and the low selling price of the product in the internal market constitute an extremely favorable outcome to the daring patriotism of the Mexicans, and permit the hope that the industry will continue to meet the requirements of an increasing consumption and also produce an exportable surplus to invigorate the balance of payments.

Electric Energy

Perhaps one of the most eloquent indices of the economic development of Mexico is that expressed in the increase registered by the generation and consumption of electricity, for residential purposes as well as for those associated with the production of goods and services, in the private sector and in the public. In 1933 the total generation of electricity was 1,529 million kilowatt-hours, of which 204 million were generated privately by industry and 23 million were imported, with a total consumption of 1,351 million kilowatt-hours. The corresponding figures for 1950 were a total of 4,423 million kilowatt-hours generated (1949.5 million hydroelectric; 2474.0 million thermic), 874 million generated privately, 125 million imported, and a total consumption of 4,187 million kilowatt-hours. The total billing recorded by the Dirección General de Electricidad was for 208 million pesos in 1949, and 383 million in 1950. Despite this and a tripling of the supply of electricity since 1930, the demand, stemming mainly from industrialization, above all in the Federal District, and the Puebla-Veracruz, Chihuahua-Nuevo León, and Jalisco regions, is still greater.

In those areas provided with electricity, the consumption per capita is very close to that of the United States taken as a whole. But this picture changes entirely when one considers that in 1950 only 13 per cent of the Mexican population enjoyed the benefits derived from electricity.

In addition to the companies that initiated the country's electrification in the early years of the present century, led by the powerful Compañía

Mexicana de Luz y Fuerza Motriz, the government also has been seriously concerned with the problem of creating, through juridical regulations and direct promotions, the bases for this service, so fundamental and indispensable to the fostering and growth of Mexican industries and services. The Comisión Federal de Electricidad (Federal Electricity Commission) was instituted on Aug. 14, 1937, and is governed by the statute of Jan. 14, 1949. Its objective is to "organize and direct a national system of generation, transmission, and distribution of electric energy, on a nonprofit basis, with the aim of getting the greatest possible returns at a minimum cost for the benefit of the general interest." Its most important creation is what is now called the Sistema Hidroeléctrico Miguel Alemán, which was actually begun in 1937 during the administration of Lázaro Cárdenas, and is scheduled for completion in 1957. This comprises seven hydroelectric plants with a total capacity of about 404,000 kilowatts.

The most pressing problems of the immediate future consist in raising the capacity of generation to such an extent that lack of electricity will not curb the country's economic development, and then achieving the standardization of frequencies and voltages. During the years 1948–1950 more than 670 million pesos were invested by the Comisión Federal de Electricidad, the Compañía Mexicana de Luz y Fuerza Motriz, and the Nueva Compañía Eléctrica de Chapala. The major portion of investments were made by the Comisión Federal, which utilized more than 300 million pesos in international credits; the Compañía Mexicana obtained a credit of $25 million in 1949 from the International Bank of Reconstruction and Development, guaranteed by the Mexican government; the Eléctrica de Chapala in turn received a credit of $3.5 million which it invested almost entirely between 1948 and 1950. Forty-two per cent of the investments were made through internal financing and the remainder originated in international organizations.

Fishing

Of the five large fishing areas into which the country is divided, and which produced a total of 125,000 metric tons in 1949, the most important were Zone 1, comprising North and South Lower California, Sonora, Sinaloa, and Nayarit (1949 production, 100,000 tons; valued at 40 million pesos), and Zone 2, comprising Tamaulipas and Veracruz (1949 production, 13,000 tons; valued at 19 million pesos). The two main species caught were tuna fish (50,000 tons, in 1948; value 116 million pesos) and shrimp (18,000 tons in 1949; value 42 million pesos).

Those employed totally or partially in this extractive industry number some 20,000 persons, although the number of fishermen organized in cooperatives does not exceed 9,000. The local character of much of the fishing—mainly in marshy waters along the coast—the inadequate operating equipment (most of the boats are less than three-ton), and the limitation of the internal market (consumption in large internal urban centers continues to decrease), are decisive factors in the low production and reduced income obtained by the fishing community.

On Oct. 25, 1945, Mexico reaffirmed her sovereignty over her continental shelf, presupposing an extension of her jurisdiction much farther than the nine-mile limit to jurisdictional waters in effect since 1935. A recognition of this declaration, especially by the United States and Cuba, would avoid numerous conflicts brought on by discussions over limits and invasion of these areas by the fishing operations of foreigners.

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Useful information may be found in the following periodicals published in Mexico City: *El trimestre económico* (quarterly); *Problemas agrícolas e industriales de México* (irregular); Secretaría de la Economía Nacional, *Anuario estadístico* (annually); id., *Compendio estadístico* (annually); id., *Revista de estadística* (monthly); and also in the *Memorias* of the Instituto Nacional Indigenista.

AGRICULTURE

Land Reform.—Since the birth of the movement for independence in 1810 the greater mass of Mexicans have felt, in a silent, vague manner, the desire for access to possession of land. Neither the disentailment (*desamortización*) law nor the Reform Laws, of the 19th century, succeeded in fully destroying the colonial structure of land tenancy, and the reforms of Porfirio Díaz strengthened the hacienda system based on large estates and the servile condition of rural laborers, instead of establishing the foundation for a thorough agrarian reform. In 1910 it was estimated that two per cent of the population owned over 80 per cent of the land, and that 80 to 90 per cent of the rural population was landless.

The revolution of Francisco Madero (1910–1911) confined itself to overthrowing the juridical and political apparatus of the Porfirian regime. It was the armed uprising (1911) of Emiliano Zapata in Morelos, and his demand that the lands be restored to the people, that communicated to the entire country the galvanic emotion of a profound agrarian revolution. The first official reaction was the promulgation of the law of Jan. 6, 1915, issued by Venustiano Carranza in Veracruz, whose principles were embodied in Article 27 of the Constitution of 1917. This article recognized the social function of private property; the right of towns, villages, and communities to be endowed with land and water; the setting of a maximum to the properties of each economic entity, whether individual or collective; the special protection of small property; and the eminent dominion of the nation over the soil and subsoil.

There was great faith in the thaumaturgical powers of the legal text, in the idea that a mere change in ownership or dominion would solve the problem and satisfy those who were so eager for land. But distributions without adequate title, brought about in an anarchical manner, could not serve as a firm base for the reform; nor could the peons on former estates or in villages change

MEXICO

View of canal from bridge, Xochimilco.

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View of stairs of Temple of Quetzalcoatl, San Juan, Teotihuacán.

© Gendreau

The Cathedral of Mexico City is the finest and largest in Mexico.

MEXICO

© Ewing Galloway

The Castle—ruins of Chichen-Itza, Yucatan.

© Silberstein from Monkmeyer

Modern Mexican school in suburb of Mexico City.

Courtesy Mexican Government Railway System

Pyramid of the Sun, near Mexico City.

© Fritz Henle from Monkmeyer

Paseo de la Reforma, Mexico City.

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The observatory at the Chichen-Itza ruins.

© Silberstein from Monkmeyer

Front of the Cardiac Institute in Mexico City.

MEXICO

Bill Sprattling's outside silver workshop at Taxco.

A Pueblan potter at work.

© Monkmeyer

Interior of Bill Sprattling's silver workshop.

Courtesy Mexican Government Railway System

Mexican tiled kitchen.

© Ewing Galloway

Homes of peasants and gardens in the shadow of the mountains. Mt. Ixtacihuatl off in the distance.

overnight into people with the mentality of nonwage-earners, into technicians capable of valuing the lands assigned to them to their own advantage and that of the country; nor did their education permit them to submit to the rigors of a collectivist discipline, and neither they nor the country possessed the credits and equipment necessary for carrying the technological revolution into the fields. A brilliant Ley de Crédito Agrícola (Agricultural Credit Law) composed by learned jurists, which clearly stated problems and solutions, did not go beyond being an item in the files; nor did the Banco Nacional de Crédito Agrícola y Ganadero (National Agricultural and Livestock Credit Bank), established March 8, 1926, have better luck, except in some few districts where there happened to be self-denying, energetic men as directors.

President Cárdenas gave the widespread spirit of the agrarian reform a legal vigor and condition of fact by the Código Agrario (Agrarian Code) of 1934, extensive distributions of land, and the institution of the Banco Nacional de Crédito Ejidal in 1934, which gave each large rural sector its own credit organization. His period in power (1934–1940) represents the peak in the distribution of large estates.

LAND DISTRIBUTION

	Hectares (= 2.471 acres)	Persons Benefited
1915–1921	453,000	86,000
1922–1933	7,000,000	700,000
1934–1940	18,000,000	1,250,000
1940–1946	6,000,000	165,000
1946–1950	1,800,000	43,000
Total	33,253,000	2,244,000

During the 35 years ending with 1950, 33.3 million hectares were granted, by means of some 20,000 definitive titles, benefiting in all about 2,240,000 countrymen. The *ejidatarios*—individuals participating in *ejidos* (communal village lands)—numbering 2.3 million in 1951, possessed a total of some 32.3 million hectares; of which 1.5 million were irrigated lands, 7.97 million were seasonal, and 22 million were not tillable. The average area under cultivation per *ejidatario* was 4.63 hectares —actually narrowed to an average of 2.72 hectares because seasonal lands are only cultivated at a yearly rate of 50 per cent in order to replace their fertility. The average of pasture and woodlands was 12.93 hectares.

The insufficiency of available land for the rural individual is disclosed in the following data from the 1940 census: of the 1,233,609 registered pieces of land property, some 40 per cent consisted of less than one hectare and another 35 per cent involved parcels of between one and five hectares in size, a proof that the agrarian reform was determined to give lands to all who sought them, rather than to fix an adequate minimum for the parcels distributed. According to provisional figures from the 1950 census, of the 1,370,625 registered pieces of property, 993,545 were of less than five hectares.

The distributions become more and more difficult because in order to assign lands it becomes necessary to resort to lands divided previously, to reduce still further the *ejidal* parcels, or to effect difficult transfers en masse; all this without including the fact that the powerful increase in population imposes an ever greater human burden upon a rigid availability of lands. Traditional agrarian thinkers, with an advanced ideology, would like to carry the distribution to its definitive level, adhering to the legal codes and limiting or curbing a new growth of large estates through political influence. Other groups would like to turn the agrarian reform into a purely technological revolution in order to consolidate in behalf of the farmer conquests which now stand in danger because of a lack of efficiency and productivity on the part of the beneficiaries. There are also those who recommend proceeding with extreme caution in the future, since a radical change either way may sink a group comprising the most important portion of the economically active population of Mexico in utter misery.

According to the 1950 census, of the total of 18.2 million hectares under cultivation in Mexico, 14.7 million were unirrigated, seasonal arable lands, with sparse, uncertain rains, about half of which are cultivable each year; those with irrigation amounted to 2.3 million hectares, and 1.2 million were moist or humid lands (*tierras de humedad*), needing additional irrigation in some cases. It is in the first group above all that the harmful effects of erosion, the wild character of the terrain, deficient communications, damages caused by irrational cultivation, scarce investments, and similar circumstances are to be found, made even worse by the high growth of population in the zones of this group.

Irrigation.—The Comisión Nacional de Irrigación, founded in 1926, added 271,000 hectares to the available irrigated lands between 1929 and 1940; since the latter date and 1950, 1.2 million hectares have been benefited by irrigation works, to which 54,700 hectares were added in 1951 and 325,400 (provisional figure) in 1952. During the first three years (1947–1949) of the six-year plan ending in 1952—a period of vigorous action by the Secretaría de Recursos Hidráulicos (Department of Hydraulic Resources), a federal government department created on Dec. 21, 1945 as successor to the Comisión de Irrigación—the area benefited was 307,000 hectares (in addition to the area mentioned above), a bit more than one fourth of the total of 1,147,000 hectares which were to have been added, at a cost of more than two billion pesos.

Crops.—The very wide zone of traditional agriculture offers few possibilities for technological reform. The predominant crop is corn, mostly consumed by the families of the cultivators themselves, with little remaining for the market. In this type of cultivation there is no crop rotation, merely an insertion of beans to complete the wretched rural diet. On the other hand, the lands under "new agriculture" open up a field that is propitious for the cultivation of plants like cotton, sugar beets, or oilseeds, whose product is destined almost exclusively for the market, at the most profitable revenue levels. Such crops serve as raw materials for industry, or are intended for export.

Corn.—This grain, grown almost everywhere in Mexico, constitutes one of the gravest problems of the country's agricultural economy.

CORN PRODUCTION

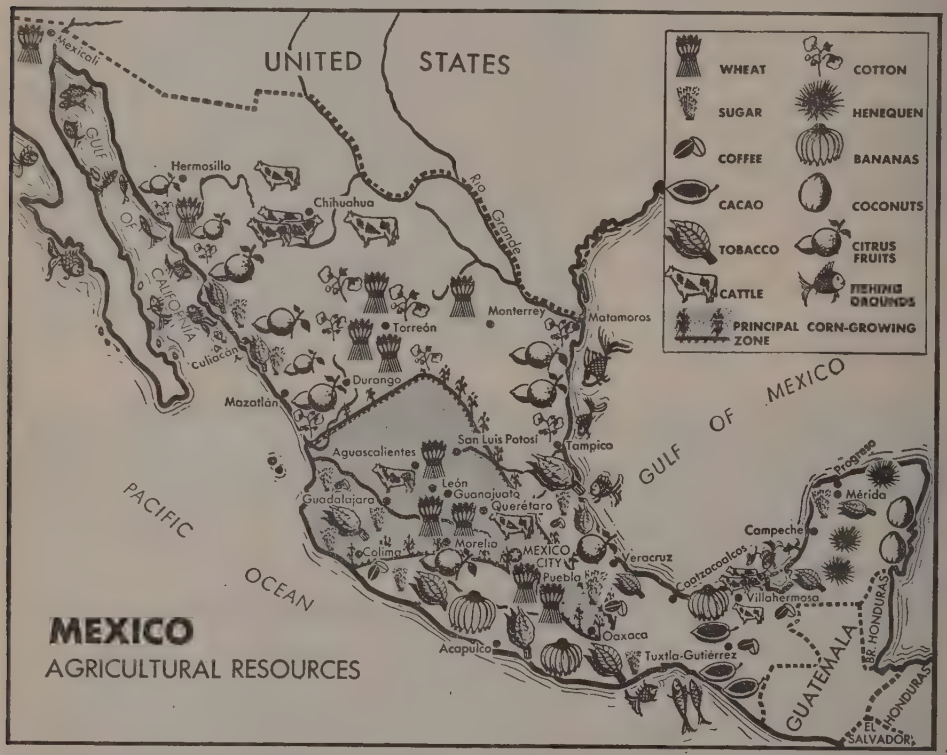
Year	Area harvested (hectares)	Production (metric tons)	Yield per hectare (kilograms)	Value (million pesos)
1950	4,327,722	3,122,042	721	1209
1951	4,427,696	3,424,122	773	1711
1952	4,712,078	3,699,343	780	1984

Major advances were achieved thanks to genetic studies made in experimental agricultural camps under the Instituto de Investigaciones Agrícolas and the Oficina de Estudios Especiales (Rockefeller Foundation) of the Secretaría de Agricultura y Ganadería (Department of Agriculture and Livestock). Despite these efforts, however, this grain has frequently been imported, in some years in volumes as considerable as 109,000 tons (1926), 117,500 (1933), or 162,800 (1944).

According to investigations by the engineer Ernesto Reza Rivera, the average annual corn production in the five-year period 1930–1934 was 1.8 million metric tons and the average rural price per ton was 56 pesos; while in 1945–1949 the average annual production was 2.6 million tons and the price was 385.50 pesos per ton. This tremendous price increase is expressive of an inflationary tendency, made acute by devaluations and other causes, phenomena which are also reflected in the production values, which increased almost tenfold from 1930–1934 to 1945–1949.

Wheat.—Special attention is merited by the case of wheat, whose consumption almost doubled in the 20 years from 1930 to 1949, in answer to pressure exerted by the demand of sections of the population which are entering more generous diet zones. Comparing the five-year periods 1930–1934 and 1945–1949: the average annual production registered only a slight advance (391,000 metric tons to 418,000 metric tons); the average rural price per ton rose (103.60 pesos to 417.20 pesos), though not to the same degree as the price of corn.

The sizable deficit registered by this cereal in relation to consumption needs, and the displacement of the interests of farmers toward other more profitable cultivations (like cotton and oilseeds) are shown in the heavy wheat imports that were required: 122,000 tons in 1940; 447,000 tons in 1948. An interesting fact to be underscored is that in the 1944 the importation figure (509,000 tons) was greater than the production figure (374,000 tons).



WHEAT PRODUCTION

Year	Area harvested (thousand hectares)	Production (thousand metric tons)	Yield per hectare (kilograms)	Value (million pesos)
1950	644	587	911	322
1951	672	589	873	443
1952	666	594	892	466

Cotton.—The cultivation of cotton has shown a vigorous increase, especially since 1946, due to full use of the soils of the Laguna district in Coahuila, and also areas of Chihuahua, Northern Lower California, Durango, and Tamaulipas. The cultivations are achieved entirely under a system of irrigation. Although the returns are far from those of the traditional cultivators of cotton in other countries, the yields have not only permitted Mexico to become almost entirely independent in regard to raw materials for domestic industry, but also provide a sizable surplus which, along with the higher prices in the world market and other favorable circumstances, furnished a great incentive for the expansion of the cotton plantations.

A motive for concern, however, is the fact that relief of international tension, together with agronomical advances in other productive areas of the world and a partial stagnation in the Mexican textile industry, can create serious fluctuations in foreign demand and disturb the development of the Mexican cotton economy. The United States absorbed nine tenths of the cotton exports in 1950, at a value of 761 million pesos.

COTTON PRODUCTION

Year	Area harvested (hectares)	Production (metric tons)	Yield per hectare (kilograms)	Rural price per ton (pesos)
1950	760,500	260,019	342	6,019
1951	883,504	287,612	324	5,226
1952 [1]	775,225	258,640	332	4,794

[1] 1952: provisional figures.

Henequen.—Within the Mexican agricultural economy, henequen—a hard fiber resembling sisal, but coming from the *Agave fourcroydes*—represents a monoculture in a region especially endowed with very suitable soil conditions, the Yucatán Peninsula. Until 1915 Mexican henequen production regulated the world export market for this fiber. Competition from new productive areas, the Philippines and Indonesia, the social repercussions of the revolution and the agrarian reform, as also the relative technological stagnation of the Mexican henequen centers—which, at first, gave their traditional technique and even their mechanical inventions to those countries interested in this crop—resulted in a decline in production, still further increased by the substitution of other products similar to henequen. Between 1930–1934 and 1945–1949 the average annual yield declined from 1,146 to 798 kilograms per hectare; production remained stationary, at a little more than 100,000 metric tons annually between 1930 and 1952. As far as the total value is concerned, there has barely been a nominal increase, corresponding to the loss in purchasing power of Mexican currency.

Coffee, Vanilla, Chick-peas.—Other export crops, such as coffee, vanilla, and chick-peas, have experienced serious reversals since 1948, without asserting themselves as products of fundamental permanence in the agricultural economy of Mexico.

Coffee, produced mainly in Veracruz, Chiapas, and Oaxaca (70,837 metric tons in 1952), maintained the same values, almost without modification, between 1930 and 1949, but the yield declined. One of the causes of the decline, it is believed, was the expropriation of German-owned coffee plantations during World War II.

Vanilla encounters difficulties in competition from synthetic products, and although production has been increasing since 1935 (179 tons in 1952), at values that likewise have increased (9.2 million pesos in 1950), it does not show signs of establishing itself securely as a promising crop for the future. Vanilla is produced chiefly in Veracruz.

The chick-pea (*garbanzo*) harvests, mainly from Sinaloa, Guanajuato, Jalisco, and Michoacán, traditionally went to Spain, almost the sole purchaser. The decline of this market resulted in an accumulation of stock from several harvests, with the exchange operation (1951) with Spain relieving the situation only in a passing manner. Production in 1952 was some 83,000 metric tons.

Livestock.—The extensive grazing and cattle-raising regions in the north of the country, despite the absence of a steady supply of water, managed to acquire the importance predicted by the early leaders of the struggle for independence. However, the internal market, because of poor communications with the large consumer centers in central Mexico, failed to provide sufficient stimulus. Thus, cattle-raising (14.4 million head in 1948; value, 2,872 million pesos) was oriented primarily toward exportation "on the hoof" to the United States, but the *aftosa* fever epidemic (hoof and mouth disease), which affected many states of the republic after 1947, meant the total suspension of such commerce until 1951. In this situation only the meat-packing industry managed to benefit when heavy demands from European countries in the first years after World War II resulted in an atmosphere of prosperity for such enterprises. Production in 1950 was 14.8 million head.

OTHER CROPS

Crop	1951 Surface (Hectares)	1951 Production (Metric tons)	1951 Value of Production (1000 pesos)	1952 [a] Surface (Hectares)	1952 [a] Production (Metric tons)	1952 [a] Value of Production (1000 pesos)
Avocados	8,483	62,744	55,975.8	8,600	64,110	58,428.0
Bananas	17,329	153,783	36,709.1	17,590	160,400	39,980.0
Barley	231,024	163,752	45,118.8	236,403	167,583	46,100.0
Beans	968,536	240,018	169,212.5	979,398	287,538	200,000.0
Cocoa	29,881	8,609	36,830.3	30,120	9,119	40,500.0
Copra	b	48,804	62,067.9	b	52,000	63,900.0
Oranges	60,783	502,254	131,123.3	65,600	560,800	144,200.0
Peanuts	54,275	67,825	43,336.0	57,200	71,074	45,225.0
Rice	104,044	179,767	78,340.6	82,414	151,004	67,044.0
Sugar	b	665,824	b	b	691,754	b
Tobacco	35,257	35,480	69,939.4	35,600	36,800	71,110.0
Tomatoes	59,608	358,500	184,001.8	59,564	351,121	183,160.0

[a] Provisional figures. [b] Not available.

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INDUSTRY

Process of Industrialization. Mexico's desire to become industrialized dates back to the beginning of its independent life (1821). Certain patriotic and learned statesmen, such as Lucas Alamán (1792–1853), were concerned with offering government help—in a modest but well-meant gesture of federal aid—so that the country might benefit immediately from the technical advances of the Industrial Revolution which started in England and certain regions of the Old World. In the field of the entrepreneur, Esteban de Antuñano founded La Constancia Mexicana in Puebla in 1837. This was the first modern textile company in Mexico, as measured by the standards of the time. In the public field the Banco de Avío and the Dirección Industrial were established in 1831; the former to finance the importation of machinery and raw materials for private concerns, the latter to implement the new economic policy. Their great interest lies in the fact that they reflect a youthful but decided sense of planning, inspired by the necessity of furthering, in accordance with Mexican aspirations, an industrial development whose integration was hindered by demographic, politico-economic, fiscal, and educational problems.

These farsighted men, acting in difficult times and with poor resources, believed that industrialization must not grow as an isolated vine, but must surround itself with other developments; it must not mean the wealth of a few fortunate entrepreneurs but must bring about a general welfare. This inspiration was renewed a century later, after the Revolution of 1910. On its correct application, without forgetting any useful factor, depends the successful future of Mexico.

The Liberal epoch, strongly evident in the Constitution of 1857, although fortunate in many other aspects, was not as successful in its attempt to accomplish the industrial development of Mexico as was the previous period. The greatest accomplishment was in the epoch—politically a dictatorship—in which Gen. Porfirio Díaz ruled (1876–1911). The present industrial development of Mexico dates from the last 20 years of the 19th century. It is reminiscent, particularly in the emphasis on transportation, of the growth of Germany in the time of Georg Friedrich List (1789–1846), although on a smaller scale.

This earlier concern for industrialization was interrupted by the widespread revolutionary activity between 1910 and 1925. During this period, the peaceful atmosphere and the right institutional organization for a definite progress in the production field were lacking.

The brilliant and well-aimed administration of Gen. Plutarco Elías Calles (1924–1928) provided the bases of organization for subsequent steps up to the present. The administration of Gen. Lázaro Cárdenas (1934–1940) emphasized agrarian reform, attempted to incorporate the great Indian masses into the cultural work of the country, converted the labor class into the forgers of Mexico's future, and strongly affirmed Mexican economic sovereignty in regard to the nationalization problem, as evidenced in the petroleum industry and railroads. His aim in industrialization was directed toward processing the soil's products to the greatest possible extent in their place of origin, in order to avoid the disadvantages emerging from a concentration of manufacturing in urban centers.

With less emphasis on the agrarian revolution, although still endeavoring to create a farmer with sufficient purchasing power, Gen. Manuel Ávila Camacho's regime (1940–1946) underscored the necessity of industrialization for the economic progress of Mexico—in addition to his cooperation in the war effort of the democratic powers in World War II. The early 1940's were a period of weak investments by industrialists, both nationals and foreigners. Some economists attributed this partial withdrawal to fear that new and important industrial promotions would be in danger of a future nationalization program by the government. In the opinion of others, however, much capital available for investment had been liberated as a result of the agrarian reform, and awaited only the advent of the proper occasion for new industrial undertakings. That opportunity came during the administration of President Ávila Camacho. The outbreak and spread of World War II deprived Mexico of imported necessities and encouraged investors to establish light industries, to expand those that could provide basic products, and to improve necessary public services. The government, by offering investors valuable incentives, also contributed to this development. Among the encouragements offered, the Ley de Industrias de Transformación (Transformation Industries Law) of April 21, 1941 (amended Dec. 31, 1945) may be mentioned as an example. This provided for important tax exemptions for new and necessary industries with respect to machinery, equipment, and importation of raw materials, and it also eliminated the fiscal encumbrance of the first schedule of the income tax for maximum periods of from 5 to 10 years.

The Oficina de Investigaciones Industriales of the Banco de México, which supervised the implementation of the above-mentioned law, obtained complete information on nearly 900 industries benefited by this plan, and provided the government with very useful criteria for a future program of industrial protection. Of course some of the industries that arose as a result of the incentives offered by the law disappeared when World War II ended and foreign competition re-entered Mexico and the international market. The majority, however, subsisted and even improved; this being, together with the presence of older companies and those that were modernized, the reason for the obvious industrial progress of Mexico during the presidential term of Miguel Alemán (1946–1952).

Evidence of the progress achieved is found in the fact that government pump-priming is no longer necessary to industrial investment. An effort is being made, thanks to acquired experience, to channel new investments into fields where gaps are still to be found, preferring a localization that will fit national industrialization into an integrated plan. At the same time, an attempt is being made to promote companies producing basic materials used by secondary industries, in order to reduce the economy's dependence on foreign economies, whose cyclical oscillations disturb Mexico's development. This does not mean, however, that Mexico expects to attain an impossible self-sufficiency; the object is to push the available means, now increasing in number, to the purchase of capital goods, so necessary in sustaining the rhythm of industrialization.

Debate Over Basic Policy.—There has been a great controversy, international in scope, in regard to this subject. As far as the Mexicans are concerned, industrialization is justified for many reasons, among them the following: the fact that it concerns a country which has a diversified economy; the necessity of absorbing—especially in the

secondary industries—important numbers of the excessive farm population; and the convenience of giving foreign companies an opportunity to make sizable profits, while at the same time preventing the continuous drain of natural resources resulting from the exportation of exhaustible raw materials. Foreign writers, for their part, have generally tried to show the advantages of an international division of labor, making of Mexico a nation limited essentially to providing the superindustrialized countries with raw materials. Those countries furnishing capital feared that Mexico, with its limited financial resources and with its exportations of raw materials as the almost exclusive source of its wealth, would not be able ultimately to sustain its industrialization rhythm without falling into painful and repeated devaluations. The fact is that despite an almost permanent deficit in its balance of payments, Mexico is reaching higher and higher levels of development and is directing its policies toward the safeguarding and improvement of the positions gained.

The persistent attempts of authors in the United States to analyze the problem is to be highly appreciated—with regard to industrialization, especially the efforts of Sanford Alexander Mosk (see *Bibliography*) and Frank Tannenbaum, who, in *Mexico, the Struggle for Peace and Bread* (1950), adopted the view of industrialization held by the Cárdenas administration (1934–1940), mentioned above. Their recommendations emphasize the necessity of attaining a more considerate and proportionate development of the human and material resources actually available. If in some cases a return to the "philosophy of small things" is suggested, this advice does not mean a return to rural and backward forms, but reflects a desire to rescue the unmistakable human qualities of the Mexican from the destructive forces of urban crowds arising from the rapid progress of industrialization.

The fundamental aim of the industrialization program is the creation of a large national market for industrial products on the basis of a healthy stability, even an increase, in the farmer's income. Thus a fruitful industrialization, pleasing to Mexican patriotism and constantly attempting to raise the people's income, is advancing by firm steps. Mexico has sufficiently demonstrated its capacity to produce more and more of the goods which satisfy its economic needs; the government aims at developing an equal ability to raise the general purchasing power of the masses of its population, so that all its inhabitants may reach a higher and more satisfactory standard of living.

Production.—Industrial production has registered an amazing development: its total value increased from 2,113 million pesos in 1939, to 9,514 million in 1946, and to 16,794 million in 1950, according to data quoted by Ramón Beteta, then secretary of the Treasury. These data to a large extent reflect the effects of monetary devaluation. But taking the total volume of production in manufacturing in 1939 as a base equal to 100, the percentage for 1946 was 174.6 and for 1950, 228.2. If industrial production is considered as a whole, including manufacturing, mining, petroleum, and electric energy, the flow of industrial goods seems to increase at a yearly rate of 4 per cent (between 1939 and 1948, a total increase of 35 per cent).

In the following paragraphs is a summary of data of some of the heavy and light industries most characteristic of the modern industrial development of Mexico. These are only small samples of the industrial development which has reached all manufacturing branches, with the exception of those which, because of the large amount of financing required, because of the lack of an internal market, or because of the need of costly equipment for technological investigation, are not within the reach of the present level of Mexican economic development, but are reserved, so far, for the superindustrialized countries. This is the case with industries manufacturing heavy machinery, highly accurate scientific instruments, and even transportation vehicles. In the latter case, a solution was sought in plants assembling automobiles from imported parts, but this experiment was not completely satisfactory to the country's consumers, who did not find lower prices for the same quality. An enterprise sponsored by Italians, which was promoted in 1951 in an attempt to solve the problem of freight transportation on highways, is assembling diesel trucks, and plans to enter the manufacturing field at a later stage.

Iron and Steel.—The only company producing pig iron at the beginning of the present century was the Compañía Fundidora, of Monterrey, whose first furnace started production in 1903 with a volume of somewhat less than 22,000 metric tons a year. (All tons in the following are metric.) In 1950 it had two furnaces, with a daily theoretical capacity of 800 tons, and the annual production amounted to a total of 119,000 tons of pig iron and 139,000 tons of steel. La Consolidada, founded in 1912 (with branches in Piedras Negras, Coahuila; Mexico City; and Tlalnepantla, State of Mexico), had open-hearth furnaces with a yearly theoretical production of 100,000 tons of ingots in 1950, producing mainly from scrap from northern Mexico and the southern United States. A third large enterprise, Altos Hornos de México, rose in answer to the limitation of supplies caused by World War II. It was financed by the Nacional Financiera, a government institution, and was established at Monclova, Coahuila, in 1942. It was limited initially to the production of steel and tin plate, begun in 1944, and it has a furnace with a daily theoretical capacity of 250 tons.

The volume of production of the iron and steel smelting plants in Mexico was 164,000 tons in 1943 and 300,000 in 1950, with respective values of 73.5 million and 415 million pesos. This, in 1950, represented a little over 9 per cent of the total value of the country's manufacturing production. Scrap importation, almost exclusively from the United States, was 119,000 tons in 1950. The importation of iron (pig iron) and steel (ingots and bars) totaled 30,000 tons, with a value of 22 million pesos, in 1950. For the same year the importation of iron and steel goods was 360,000 tons, with a value of 250 million pesos.

The most important problems of this branch of industry are the scarcity of iron deposits and their wide separation; the same is true of the limited supply of coking coal. Important coal deposits of low content were investigated in the Oaxaca zone in 1950 and thereafter. To those shortages must be added serious deficiencies in the transportation system and the exportation of some quantities of iron ore for processing outside Mexico. In 1950 this reached the considerable mark of 192,000 tons. Geological conditions and coking possibilities by modern methods are being studied by the Oficina de Investigaciones Industriales.

Cement.—This has acquired a central significance among construction materials. As late as 1900, cement had to be imported from the United States and Germany. The first factory was estab-

lished in Mexico in 1903; in 1950 there were 12 plants in operation, with a production of 1,480,000 metric tons valued at 148 million pesos (in 1939, 537,464 tons and a value of 22 million pesos). With a yearly rate of growth of 11 per cent of its volume of production, this industry is one of the most forceful in the country and one of the main supports of its development. Importation is practically nil (3,000 tons in 1950). In spite of local progress, this industry is faced with the problems of balancing the supply with an increasing demand, giving a correct location to new plants, organizing transportation and distribution, and taking advantage of favorable conditions for the exportation of its products.

Rayon.—The first governmental attempts to stimulate the building of a rayon factory appeared in 1935. In 1942, thanks to financing by the Nacional Financiera, La Celanese was established in Ocotlán, Jalisco, starting production in 1947 with 2,000 metric tons. In 1950 it produced 5,000 tons, with a value of 81.5 million pesos. This initial step was followed by the founding of a plant in Zacapu, Michoacán, with a production (1950) of 3,000 tons a year. At the same time, imports, which amounted to 3,240 tons in 1946 (the entire rayon consumption of the country) and to 1,435 tons in 1950, have been reduced. The main problem is the dependence of this industry on its raw material, cellulose, which must be imported. The production of cellulose in Mexico is one of the important goals to be pursued in the coming decades of the economic development of the country.

Fertilizers.—Among the chemical industries, a group which attained the most impressive progress after 1940, those manufacturing fertilizers are truly essential to Mexico because of their significance to agricultural progress. In order to satisfy the food demands of a constantly increasing population, the scarce arable lands (around 8 million hectares in 1950) must be given the nitrogen they lack due both to the natural physical condition of the soil and to the effects of an irrational agricultural exploitation during many centuries. The magnitude of the problem is apparent in the fact that in 1947 the entire country consumed only 21,000 tons of fertilizers. In 1944, Guanos y Fertilizantes de México (financed by the Nacional Financiera) started its productive activities, although on a small scale, with its three plants, in Guadalajara, San Luis Potosí city, and the Federal District. A plant at Cuautitlán, State of Mexico, was founded in 1951, with a yearly production of 66,200 metric tons of ammonium sulphate, utilizing gas from the Poza Rica oilfields in Veracruz as raw material. This plant also was financed by the Nacional Financiera. The production of the Cuautitlán plant, one of the most perfect of its kind, is subject to such a large demand that plans for further expansion in fertilizer production, limited only by the difficulties in acquiring equipment, and, as in other cases, the scarce transportation facilities for the products, are more than justified.

Cotton Textiles.—Among the so-called light industries, the textile branch deserves special mention. Cotton is particularly significant because of its century-old tradition and its great importance in modern times, as well as because of the large number of workers employed and the pressing need of increasing production—especially of low cost fabrics, since several million inhabitants in the rural districts lack the most indispensable clothing and cannot satisfy that vital necessity due to their limited purchasing power. In 1945 the cotton textile factories manufactured products with a value of 676 million pesos; in 1950, 1,162 million. In the latter year, the raw material consumed had a value of 359 million pesos. The cotton textile industry employs 48,000 looms and 1,000,000 spindles. In 1950, of the 180 plants of this branch, only 10 were completely modern, 15 were modernized, 46 were established after 1925, and 109 before that date. Many managers, with their amortized plants and with difficulties in matters of credit, besides the numerous labor conflicts, are not in favor of the modernization of their equipment, as stimulated by the government. The workers, for their part, regard this technological progress with suspicion, believing, perhaps with good reason, that it will result in the unemployment of some 25,000 workers.

Until 1939, production greatly exceeded demand, and the managers, compelled by labor legislation and the impossibility of reducing working hours and wages, overstocked their warehouses and suffered losses which meant bankruptcy for some of them. World War II, with all the misery it brought to humanity, provided an advantageous and unexpected outlet for this industry. Stocks were easily disposed of, and all the productive capacity, including that of machines which might very well be considered museum pieces, was raised above theoretical output in order to satisfy the necessities of not only the Mexican population, deprived of imports, but also the demand of other countries whose markets were normally supplied by the great industrial countries then at war.

In this, as in other cases of eventual benefits brought about by the war, profits were not directed toward the most productive and beneficial uses for the country: the consumption of luxuries by those already profiting was increased; while those interested in modernizing found their efforts to acquire machinery and equipment obstructed by slow deliveries. A drift of huge profits toward investment in real estate took place, which forced prices upward. In the postwar period, after a severe decrease in exports of cotton fabrics due to the fact that foreign markets recovered their former providers, this branch of the textile industry went through a crisis which only the few modernized plants were in a condition to meet. To end this situation permanently, internal consumption must be increased with low-cost fabrics for the large masses of the population so poorly dressed and with such small incomes. The government is attending to this problem, which affects both the industry and the standard of living of numerous consumers, with a plan to increase the production of cheap fabrics, which was drastically curtailed by private manufacturers after 1940.

Shoes.—In regard to the great problem of the purchasing power of low-income classes, the shoe industry is somewhat similar to that of cotton fabrics. According to the 1940 census, of a total of 18,900,000 inhabitants questioned only 49 per cent wore shoes, 23 per cent wore *huaraches* (a sandal of popular use) and 28 per cent went barefoot. In 1950, production for this manufacturing sector was 67 million pesos, representing only 1.47 per cent of the total value of Mexican industrial production. For the more than 150 factories, some with completely modern equipment, there are nearly 1,000 workshops, most of them domestic, using in many cases rented machinery. To this we must add a large number of unregistered workshops, which contribute about

25 per cent to the total production. The output in general is low and consequently the workers' wages are also very meager. Not so retail prices, however, which are high because of the intervention of many distributors who carry their profits to the limit of consumers' purchasing power. The 10 million pairs of shoes produced in 1950 supplied only 33 per cent of the potential demand. Nevertheless, due to the fact that Mexico can supply the larger part of the raw materials needed by this industry, and because of the high qualifications of certain sectors of the manual labor force, and other favorable circumstances, this industry foresees a prosperous future.

VOLUME OF OTHER LEADING MANUFACTURES
(1950)

Product	Production	Import	Export	Consumption
Automobiles (assembled units)	10,519	1,654	46	12,127
Beer (1,000 liters)	500,034	....	....	500,034
Canned fish (metric tons)	13,622	356	98	13,880
Cigars and cigarettes (1,000 boxes)	1,297,022	13	92,310	1,204,725
Flour, milled (metric tons)	503,273	....	....	503,273
Matches (1,000 boxes)	779,716	....	....	779,716
Paper (metric tons)	130,840	53,915	....	184,755
Soap (metric tons)	114,868	....	....	114,868
Soda (metric tons)	7,269	90,083	....	97,352
Tires, automobile (units)	380,850	26,623	....	407,473
Tires, truck (units)	253,900	17,749	....	271,649
Trucks (assembled units)	11,776	1,144	....	12,920

General Prospects.—In general, Mexico undoubtedly has the necessary bases for an industrialization of respectable volume, and it can continue industrializing at the rate of the decade 1940–1950, despite certain financial difficulties, which can, however, be overcome. The first great problem is the need to channel new undertakings, with government participation, in such a way that convenient localization and high revenue may be attained, removing these enterprises or public services from any political interference that might disturb the normal development of the economy. The second problem is still more difficult. The industrialization process has been conceived as a way of improving the faulty distribution of the economically active population, with its persistently high percentage of agricultural workers. But if industrialization prefers high-capitalization industries, with supermechanized or even automatic installations, serious difficulties will be encountered by industry in attempting to absorb the labor force. Consequently, except in basic industries and public services, enterprises in which saving of capital is attained, in preference to those leading to saving of the labor force, would seem to fit the needs of Mexico's situation more fully.

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FINANCIAL FACTORS

Profound changes have taken place in Mexico's economic and social life since 1925. On March 18 of that year the promulgation of the income tax law (effective in 1926) began the reform of the Mexican fiscal system and the establishment of the public revenue on a sound basis. The rehabilitation of the public credit was initiated in the same year, together with concern for a balanced budget, and during the next year (1926) the bases of agricultural credit were outlined, a most important factor in the attainment of the agrarian reform.

Financial Institutions.—*Banks.*—On Aug. 25, 1925, and on the basis of Article 28 of the Constitution of 1917, the Banco de México was founded. During its early life, the Banco de México went through an initial stage of participating, as did other private institutions, in the activities of a commercial bank, except for its unique privilege of coining, stabilizing the rate of exchange, and regulating interest rates. It was only when the Ley Monetaria (Monetary Law) of July 25, 1931 was passed, and other reforms, substantially ended on April 12, 1932, took effect, that this central institute started functioning as a bank of banks: establishing a rediscount system and regulating the amount of reserves to be held by private banks in the Banco de México as a guarantee for customers' deposits; aiming at the rationalization of credit; regulating the circulation of money; and defending the purchasing power of the peso in Mexico and abroad.

This banking reform was soon followed by the creation of a series of public banks to satisfy the specific needs of the economic development of Mexico: for agricultural credits, the Banco Nacional de Crédito Agrícola (1926)—now the Banco Nacional de Crédito Agrícola y Ganadero—and, later, the Banco Nacional de Crédito Ejidal (1935); for public works, the Banco Nacional Hipotecario y de Obras Públicas (1933); for industrial development, the Nacional Financiera (1934); for foreign commerce, the Banco Nacional de Comercio Exterior (1937); for the film industry, the Banco Nacional Cinematográfico (1941); for the development of cooperatives, the Banco Nacional de Fomento Cooperativo (1941); for small business, the Banco Nacional del Pequeño Comercio (1942); and, of lesser importance, for credits to members of the armed forces, the Banco Nacional del Ejército y la Armada (1947).

The Banco de México was an efficient collaborator with the government in the financing of public works, and made use of all its resources to check the inflation process as World War II accelerated the course of economic recovery from the depression of the 1930's, with the bank's cooperation. This central institute reduced to a minimum the speculations which were particularly active in raw materials and foodstuffs, and which were aggravated by "hot" or "refugee" money flying from countries at war. It handled with good judgment the eventual excess in the balance of payments during the war years, and channeled the effects of the deferred demand for capital goods, so necessary to a continuation of the country's industrialization.

Beyond the classical functions of the central bank's policies—the regulation of interest rates and open-market operations—the Banco de México realized that monetary maneuvers are only part of economic policies and therefore united its efforts to those of the government in the task of strengthening and increasing the economic power of the nation. For this purpose, the bank established a qualitative control on the total volume

of private banking credit, by raising reserve requirements and by establishing so-called *topes de cartera* (portfolio maximums). The object was to channel the credit activities of private banking houses, limiting those for commercial purposes and, at the same time, expanding those of a productive character, particularly in agriculture, industry, and basic utilities. As late as 1949 the composition of the portfolios of deposit banks, in the aggregate, was as follows: commercial credits, 48.3 per cent; industrial, 38.8 per cent; agricultural, 8.6 per cent; livestock credits, 3.9 per cent; mining, 0.4 per cent. On September 30 of that year all new deposits entrusted to banks in the future were neutralized; however, the disposal of 70 per cent of them for loans having a proved productive character was authorized. Later, the capacity of commercial banks to extend credit was curtailed, limiting it to ten times the capital, plus the reserves of the institution concerned.

Mexican banking institutions (Banco de México, national specialized institutions, and private institutions together) had total resources as follows: in 1945, 8,285.3 million pesos; 1946, 8,520 million; 1947, 8,981.5 million; 1948, 10,677.5 million; 1949, 12,385.3 million; and 1950, 15,660.4 million. Converted into dollars according to exchange rates in the respective years, the resources of the Mexican banking system were reduced from $1,700 million in 1945 to $1,400 million in 1949, surpassing the first figure only in 1950, when the resources amounted to $1,810 million.

The Banco de México had resources in 1945 of a value of 3,416 million pesos; declining in 1946 to 3,231.1 million and remaining at 3,271.2 million in 1947; but starting a rising curve in the following years: 1948, 3,813.1 million; 1949, 4,400.8 million; 1950, 5,620.7 million; and 1951, 5934.0 million. The second group (other national institutions) registered a constant increase—the most important in the entire system—in the course of those seven years (1945, 1,103.2 million pesos; 1951, 4,247.3 million). The same is true of the private institutions (1945, 3,765.5 million pesos; 1950, 6,796.8 million). In 1949 this last group led in resources, with 42 per cent of the total; followed by the Banco de México, with 35 per cent; leaving 23 per cent for other national institutions. The institutions of the system as a whole had on hand gold, silver, and foreign exchange with a value of 1,588.6 million pesos in 1949, and 2,725.4 million in 1951.

In 1949 a significant decrease was apparent in the net balances credited to Mexican banking houses by enterprises and individuals in the country; however, the system's balance in foreign money showed a very substantial increase. According to the report of the Banco de México for 1951 (published in 1952), the commercial banks, during that year, had raised the credit operations of 1950 by 24.1 per cent. During the same year (1951) the aggregate composition of the portfolios of commercial banks was as follows: 38 per cent, operations with industry; 19 per cent, agricultural credits; 36 per cent, commercial credits; 2 per cent, transportation credits; 5 per cent, consumer credits. These figures indicate an increase in the importance given to productive operations, and the favorable effect of the selective control measures of the Banco de México. However, a marked narrowness is apparent in the liquid assets of private enterprises; in 1952 private banks were softening the restrictive measures of the Mexican monetary authorities.

It is interesting to point out that the Banco de México, aside from its normal monetary and banking activities, plays a fundamentally important part in the economic development of Mexico. Other Latin American countries (Chile and Venezuela particularly) have limited their central banks to traditional activities, centralizing their objectives in regard to economic development—without any coordinating activities with the incentive programs of the government executive power—in special institutions, the *corporaciones de fomento* (development corporations). In Mexico, the central bank has taken over many of those functions, and has prevailed over the specialized public banking houses as a whole, which are organized in a system of autonomous institutions. The close connections for development purposes that the Banco de México has with the federal departments of the Treasury (Hacienda) and National Economy (Economía Nacional) must be emphasized, as also the activities of some of its own departments, in particular the Oficina de Investigaciones Industriales (Bureau of Industrial Investigations), its economic planning section. The bank also has very close relations with the Nacional Financiera in the field of industrial development.

Nacional Financiera.—The Nacional Financiera commenced its activities in June 1934. During its first stage (until 1940) it grew at a slow rate, but accumulated valuable experience. In 1937 it began turning its attention toward the stock market and issued its first bonds. In the following years it felt the blows of the unstable exchange situation, the nationalization of the petroleum industry (1938) and the beginning of World War II (1939). In 1940, legislation was passed, naming as the objectives of the Nacional Financiera:

> The vigilance and regulation of the security market, the stimulation of capital investments to create and expand productive enterprises and public utilities, and the representation, as fiduciary and agent, of the federal government and the municipal and state entities in regard to the issue and placement of stock.

In its second stage (1940–1947) important events took place. In 1941 the first participating certificates (*certificados de participación*) were issued to strengthen the position of government bonds and to begin the absorption of monetary excess in a period in which the flow of circulation was increasing constantly. These certificates, which allow their owners to participate in the enterprises financed by the Nacional Financiera, are in increasing demand by private persons because of high profit and redemption practically at sight.

The first industrial promotions were also begun in 1941—Cementos Guadalajara (cement) and Compañía Industrial de Atenquique (paper)—and the first credit ($30 million) was obtained from the Export-Import Bank in the United States. In 1942 the Altos Hornos de México (steel and plate) was established in Monclova, Coahuila, and in 1943 Guanos y Fertilizantes de México (fertilizers) and the Carbonífera Unida de Palau (coal mining) were instituted, among other incorporated promotions. At the beginning of the postwar period (second half of 1945) the Nacional Financiera devoted more than 72 million pesos to the Ferrocarriles Nacionales (railroads) and 68 million to Petróleos Mexicanos (petroleum). Between 1946 and 1947 five important sugar mills were established, in order to liquidate the national

deficit in the supply of that article. Also in 1946, the Comisión Nacional de Valores (National Securities Commission) was created to control the floating of capital stock and bond issues of new or enlarged corporations, and construction of Ayotla Textil (textiles), Industria Eléctrica de México (electrical equipment and household appliances) and other companies was started.

The third stage began in 1947 with the amendment of the law of 1940, raising the Nacional Financiera's capital from 20 million pesos to 100 million, turning it into an agent with power to negotiate long- and short-term credits from foreign, international, and private institutions, and establishing the bases of development which future promotions must follow. In 1947 Química Mexicana (chemicals), Viscosa Mexicana (rayon textiles), and other no less important companies were formed, and Sosa Texcoco (soda), Cementos Portland del Bajío (cement), Empacadora de Tampico (canning), and Vidriera Guadalupana (glass) started production. The International Bank for Reconstruction and Development in 1949 granted a credit of $34.1 million to develop electrification and $17.9 million to restore the railroads. In 1950 the study of a railroad plant was started and negotiations were begun with an Italian company for the assembly and manufacture of trucks in Mexico. In 1951 new promotions were companies for: coke and derivatives at Monclova, Coahuila; railroad car construction in Hidalgo; diesel trucks in Hidalgo; and two cellulose plants in Michoacán.

The issue of participating certificates was so successful that between 1941 and 1949 their total amount rose to 324 million pesos, and in 1950 it reached 713 million (in January 1952, 1,216 million). On Dec. 31, 1950 a new amendment was added to the legislation of 1940, and Export-Import Bank credits of $293.6 million were extended, of which $133 million had been already disposed of at the time; on Dec. 31, 1951 the authorized total was $382.6 million, of which $194.8 million had been disposed of. Between 1946 and 1950 the Nacional Financiera's total investment in industrial financing increased from 374 to 1,147 million pesos.

Public Finance.—In Mexico, as in the rest of the Latin American countries, the government has had a deep influence on economic development since 1940. In order to foster this progress, the Mexican government absorbed, through taxes, 11.4 per cent of the gross national product in 1939, 8.4 per cent in 1947, and 10.3 per cent in 1950 according to the economist Víctor Urquidi. Its effect is reflected more strongly in capitalization than in consumption: public entities, during the period 1946–1949, devoted from 31 per cent to 38 per cent of their expenses to the net formation of capital, either directly or as credits, guarantees, and other contributions. This represents from 29 per cent to 36 per cent of the net total capitalization of the country.

The net expenses of all forms of government were 753 million pesos in 1939, 2,352 million in 1946, and 5,834 million in 1951. In this last year, 4,158 million pesos were spent by the federal government; 330 million by the Federal District; 600 million by the states and territories; and 170 million by the *municipios* (municipalities)—the balance may be attributed to the expenses of various autonomous bodies. Investment expenses in 1951 amounted to 1,617.5 million pesos.

The budget results have been as follows—deficits or surpluses indicated by (+) or (—)—1936, +6.7 million pesos; 1946, —65 million; 1947, —401.2 million; 1948, —392.5 million; 1949, —49.1 million; 1950, —342.1 million; 1951, —558.5 million.

The main sources of revenue of the federal government have been: the income tax (which amounted to 7.5 per cent of the net receipts in 1939 and more than 20 per cent on an average from 1943 to 1951—25.7 per cent in the latter year); taxes on foreign trade, which have lost much of their importance as compared with other periods (34.5 per cent in 1939, 30 per cent in 1951); taxes on natural resources (44 million pesos or 7.6 per cent in 1939, and 287 million or 7.2 per cent in 1951); and taxes on industry and transportation (22.8 per cent in 1939, 6.1 per cent in 1951). Taxation on sales, excluding the sale of food and other essential products, however, became heavier—a tax on commercial incomes, instituted in 1948 to replace the stamp tax, furnishes the federal government with 1.8 per cent of net sales, and the states with 1.2 per cent. In 1948 an extra rate of 15 per cent ad valorem was established on exports to absorb 50 per cent of the exchange profits produced by the devaluation of the peso.

In 1940 an amendment to the income tax was introduced, placing an additional burden on excess profits in order to stimulate reinvestment of surpluses. In the first year (1940) this tax yielded 43.7 million pesos; in 1950, 60 million. The burden of the Mexican taxpayer is relatively light in comparison with that of people of other countries—even more so if the government's participation in economic development works is considered.

According to data compiled by the Secretaría de Bienes Nacionales (Department of National Property), which controls government purchases and payments to contractors, the finished projects which were supervised by that executive agency amounted, cumulatively, for the period from Jan. 1, 1947 to March 31, 1952, to 1,603.4 million pesos. Of this amount, 1,052.7 million pesos represented productive works of direct benefit (294.2 million in agriculture, and 758.5 million in communications), and 550.6 million represented projects for social welfare (of these 492.3 million for urban services, and 58.3 million for educational and assistance purposes). Commitments represented a total of 3,076.1 million pesos for projects, leaving therefore a balance of works in process valued at 1,472.7 million pesos.

The internal public debt was quoted on Dec. 31, 1950 as amounting to 2,079.5 million pesos, in circulation, with 1,284.9 million payable interest—a total, therefore, of 3,364.4 million pesos. The external public debt on the same date amounted to 230.6 million pesos, 15 million having been redeemed up to 1950. The balance due, therefore, amounts to 215.6 million pesos. The credit terms expire on Jan. 1, 1963 for guaranteed debts and the rest in 1968.

Of the total internal public debt in 1950, approximately 1,619 million pesos were held by the Banco de México, 180 million by the Nacional Financiera, and 279 million by other investors.

National Income.—Following the example given after 1940 by the more progressive countries (among them the Netherlands, Sweden, and the United States), Mexico has been concerned with studying the size and composition of its gross national product. It is evident that these large-scale (macroeconomic) data, although approximate,

can give a summarized idea of the progress achieved year after year, permit rough comparisons with other nations, and offer the bases, even though they be provisional, which indicate the trends of future economic progress. The four usual components of these types of studies—consumers', business enterprises', governmental, and foreign accounts—provide a pattern of the economic structure defined in broad outlines at the end of each fiscal period, even though such a picture may have a static character. If to this are added studies which bring one in contact with the income-expense relations (input-output, sources and allocations), and if, lastly, the net national income is found, Mexico will have achieved a great advance in statistical methods as compared with previous eras.

The national income at factor cost, according to the more reliable provisional figures, rose from 5,737 million pesos in 1939 to 15,551 million in 1944 and 37,816 million in 1950. For the same years, the gross national product at market prices (in which figure depreciation is included, subsidies are deducted, and indirect taxes are added) amounted respectively to 6,744 million, 17,317 million, and 43,299 million, all in pesos of the respective years. The report of the Banco de México shows a gross national product of 51,350 million pesos for 1952.

The account of consumers (considered as final distributors) shows, in salaries and nominal wages, on the income side, 1,792 million pesos in 1939, 3,719 million in 1944, and 7,491 million in 1949; and for the savings record, on the side of disposable income, the meager sums of 6.9 million, 175 million, and —186 million.

The consolidated account of the gross product of business enterprises shows, among other important entries, nominal distributed profits with a value of 1,067 million pesos in 1939, 5,007 million in 1944, and 8,454 million in 1949; and undistributed profits of 376 million, 508 million, and 3,116 million.

The federal government's gross investment was as follows: 247.7 million pesos (1939); 713.7 million (1944); 3,007.5 million (1951). Allocations to the four main categories of expenses were—agriculture and natural resources: 39.7 million pesos (1939); 124.8 million (1944); 595.9 million (1951); communications and transportation: 143.2 million (1939); 387.5 million (1944); 1,172.9 million (1951); electrical works and fuel: 27.0 million (1939); 60.4 million (1944); 687.9 million (1951); social and municipal works: 25.7 million (1939); 92.0 million (1944); 430.2 million (1951).

In the foreign account, in current transactions, the commercial balance in 1950 showed a deficit of $63.5 million (exports $533.8 million; imports $597.3 million); and in 1951 this deficit was raised to $353.1 million (exports $569.8 million; imports $922.9 million). The tourists' account, an important item in the "invisible" account, showed a net income of $162.5 million in 1950, and $175.1 million in 1951. Personal payments from abroad, particularly those received by workers in the United States, amounted to nearly $20 million in 1950, and $30 million in 1951.

In regard to the saving and investment account it is sufficient to state that the gross national savings (which balance with the gross national investments) amounted to 649 million pesos in 1939, 1,730 million in 1944, and 5,937 million in 1950.

Contributions of the main economic sectors to the national income in 1950 were, in nominal figures: wholesale and retail commerce, 30.9 per cent; agriculture, 14.1 per cent; manufacturing, 18.3 per cent; rents and interest, 6.0 per cent; private services, 7.4 per cent; government services, 5.1 per cent; mining and petroleum, 4.5 per cent; and transportation and communications, 4.3 per cent.

Taking the Mexican nation as a whole, and even making the elementary adjustments that have been made, the preceding data imply that the balance is satisfactory in regard to the past, and the general tendency for the future is clear and encouraging. But an impressive problem is immediately apparent if one is not influenced by the blurred per capita values. Carefully grouping the available data under a new light, the income derived from labor, in percentage of the gross national product, was 30.5 per cent in 1939, 23.7 per cent in 1944, and 23.8 per cent in 1950. On the other hand, the income (profits) derived from capital was 26.2 per cent in 1939, 37.6 per cent in 1944, and 41.4 per cent in 1950. In other words, in contrast with superdeveloped countries where labor participation in the gross national product increased at a fast rate after 1930, in Mexico the tendencies are moving in the opposite direction. If attention is turned to one of the first theses of the present examination—the swift demographic growth of Mexico's population—one finds, clearly defined, a task which cannot be delayed and an ultimate goal for future administrations of the country: to invert the terms of the problem, arbitrating solutions by which economic development may be attained without as costly a sacrifice by the lower economic classes of the population. To reach this objective, without at the same time decreasing the investors' legitimate profits—but on the contrary, raising them, not because of the increased consumption but as a result of its extension to vast potential zones—is undoubtedly the worthiest project for accomplishment by the Mexican government, with the help of all of the country's productive factors.

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FOREIGN TRADE

Since the end of World War I Mexico's trade relations, and its trends, have reflected the importance of the United States as the primary world creditor. That country's capacity of production introduced very important changes in the volume and composition of Mexican foreign trade. In 1935-1939 Europe furnished Mexico with only

a third of Mexican imports, Germany and the United Kingdom being the main exporters; Mexico obtained six tenths of its imports from the United States, which in turn purchased two thirds of Mexican exports during the same period. Europe received only one fourth of Mexican exports.

After 1940, during World War II, the United States became the only important market for Mexican imports and exports, although Mexican products were in demand in other countries in Latin America, and even in South Africa and southern Asia. In the peak year, 1943, imports from and exports to the United States were 88.5 per cent and 87 per cent, respectively, of the Mexican total.

The year 1948 began a return to more normal relations. The highly developed nations recovered their traditional markets, but on the other hand Mexico intensified the importation of capital goods, durable goods, and raw materials, so necessary for the industrialization programs. These included equipment for manufactures and assembly plants, railroad equipment, cellulose and nylon. Mexican imports from Latin America fell to prewar levels (2.5 per cent); even lower in 1952 (0.9 per cent), when Canada furnished 2.5 per cent of Mexican imports. Europe advanced to 13 per cent of Mexican imports, at the expense of the United States, imports from which were reduced to some 80 per cent.

In 1951 Mexican exports were distributed as follows: United States, 70 per cent; Europe, 17 per cent; Latin America, 7 per cent; rest of the world, 6 per cent.

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MODERN ECONOMIC POLICY

The Mexican social revolution began Nov. 20, 1910, with the uprising in Chihuahua. The armed struggle lasted seven years. It accounted for thousands of lives, and destroyed, mainly in the rural areas, part of the riches that had been accumulated during the 30 peaceful years of the rule of President Porfirio Díaz. Nevertheless, everything considered, the bitter fighting opened the way for the profound changes that were carried out in the economic structure of the country, as well as in its political organization and legal institutions.

The foundations of modern Mexican political economy were laid during the years 1925 and 1926, when Plutarco Elías Calles was president; this is the same policy that has been continued into 1953 and which will, most likely, go on in the near future. It has been improved with the years. No doubt the continuity of purpose for nearly 30 years and the desire of each new government to improve on the achievements of its predecessors have played a very important part in the economic advance of the nation. This would explain the progress achieved in the economy and the confidence which is noticeable in wide sectors of the population.

Legal Bases.—The new constitution, promulgated Feb. 5, 1917, contains Articles 27 and 123, which were aimed at satisfying popular demand for reform in the social and economic fields. Both articles have since had boundless repercussions on the economic development of Mexico.

Article 27 sets forth the following principles:

The rights of ownership of the land and water comprised within the boundaries of the national territory belong primarily to the nation, which has had and has the right of transferring their control to private individuals, thus giving rise to private property.

Expropriations can be carried out only for reasons of public utility and through indemnity.

The nation shall always have the right to impose on private property regulations in the public interest, as well as the right to control the exploitation of any natural elements that can be so exploited, in order to distribute public wealth on an equable basis and to care for its conservation. To this end, whatever regulations are deemed necessary will be issued for the fragmentation of *latifundia* [large estates]; for the development of private property; for the creation of new agricultural centers enjoying the tenure of indispensable land and water; for the encouragement of agriculture and to avoid the destruction of natural elements and whatever damage property may suffer to the detriment of society. Villages, ranches, and communities lacking land and water supply, or not having a sufficient amount for the needs of the community, shall have a right to being endowed with them, taking them from neighboring properties, but always respecting small holdings.

The article later continues:

The acquisition of the private property necessary to achieve the ends stated, shall be considered [as having been made on the basis] of public utility.

Regarding ownership of the subsoil, the following paragraph from Article 27 states:

The nation shall have direct control of all minerals or matter found in seams, layers, concentrations, or veins forming deposits the nature of which may be different from that of the components of the soil, such as minerals from which metals and metalloids used in industry are extracted, veins of precious stones, salt mines and also salt ponds formed directly by sea water, the products derived from the breaking up of rocks, when their exploitation makes underground working necessary, phosphates that can be used as fertilizers, solid mineral fuels, petroleum, and all carbohydrates in liquid or gaseous form.

Article 123 concerns labor laws. Among other provisions, it sets forth the following, which are the most important:

1. An eight-hour working day.
2. Children under 12 years are forbidden to work.
3. A weekly day of rest.
4. Protection to women about to become mothers, who must cease to do work requiring considerable physical effort three months before childbirth, and will also enjoy one full month's compulsory rest after childbirth; receiving their full pay and keeping their job, with every right that they shall have acquired as stated in their contract.
5. The minimum wage shall be sufficient to provide for the normal needs of the worker's life, education, and legitimate pleasures of the man considered the head of the family.
6. The employer is required to provide schools for the worker's children when the industrial premises are situated at a considerable distance from any populated area.
7. Employers are held to be responsible in certain cases of occupational accidents and sickness.
8. The right is granted for both employers and employees to organize to defend their interests; the former are granted the right to close their plants, the latter the right to strike.

Application.—These two constitutional articles have had a far-reaching influence on Mexico's economic policy since 1917. The agrarian reform has been steadily changing the old system of land exploitation through large holdings, found in the haciendas that had been in existence since colonial times. Article 27 has been the basis on which the breaking up of these large estates has been carried out, thus giving rise to the communal landholdings of the Indian villages and also to

small private property. In altering the organization of private property in rural areas, it has also been found necessary to carry out certain changes in the agricultural and cattle-raising policy of the whole nation, as will be described below.

Article 27 has also had a certain influence on mining laws and on government policy concerning petroleum. The mining companies, mostly British- or United States-controlled, had never raised any international problems for the Mexican government; on the other hand, the oil companies had always been the cause of disagreements, sometimes far-reaching, between Mexico and the other two countries. Of the capital invested in oil in Mexico at the time of expropriation, United States firms held approximately 38 per cent, British firms 60 per cent, and Mexican firms 2 per cent. The expropriation of the holdings of these firms in March 1938 was based on Article 27.

Article 123 was regulated by rules set forth in the Ley del Trabajo (Labor Law) of 1929. This law and the before-mentioned article together regulate economic and social relations between workers and employers.

Land Reform.—There was no clearly defined economic policy in the years from 1917 to 1924, under presidents Venustiano Carranza, Adolfo de la Huerta, and Álvaro Obregón. The only sign of an economic policy was the distribution of land to the villages. The peace had not yet been consolidated; those were years of reconstruction, of discussion of new plans aiming at transforming the country's organization.

The distribution of land could not be put off, since there was a general and urgent demand from the agricultural masses; without it, no lasting peace would have been possible, in spite of every Mexican's anxiety to be done with fighting. According to the census of 1910 there were in Mexico only 840 hacienda-owners, who—it was estimated—owned among them three fourths of the national territory; while, according to the same census, there were over 3 million agricultural workers without land. It thus became imperative to start distribution right away, without waiting to draw up a well-thought-out technical plan. The crying need of land had been the main cause of the revolution.

From early in 1916 until Dec. 31, 1924, 3,292,332 acres of land were distributed among various agricultural communities, with benefits accruing to 178,829 families. But it must be pointed out that they were given land which in many cases was of poor quality, without machinery, without fertilizers, and without facilities for obtaining credit. Naturally enough, the results were not very satisfactory; indeed, in some cases they were completely negative.

Credit.—In the years 1925 to 1926, it was clearly seen that the agricultural problem could not be satisfactorily solved if the government were content with merely giving land to the people, who were applying for it in ever-increasing numbers. It was at the same time necessary to grant them credit at long, medium, and short terms; long-term credit, in order to enable them to build irrigation ditches, storehouses for produce, and the like; medium-term, so that they would be able to buy agricultural machinery, such as plows, tractors, and trucks; and short-term, to make it possible for them to buy seeds and to live before the harvest. For these purposes the Banco Nacional de Crédito Agrícola (National Agricultural Credit Bank) was founded March 1, 1926; followed shortly after by the founding of small credit institutions, called *bancos agrícolas ejidales,* to provide credit for communal village lands (*ejidos*). By 1935 these small banks had been closed. They had failed, partly because they operated with very small capital. But the Banco Nacional de Crédito Ejidal was founded in their stead in the same year, 1935, and became one of the two great credit organizations which work with capital supplied by the federal government. The Banco Nacional de Crédito, Agrícola had, up to Dec. 31, 1950, granted credit to a value of 1,247 million pesos, of which it had recovered 936 million. Its capital was then 213 million. As for the Banco Nacional de Crédito Ejidal, it had on the same date a capital of 250 million pesos, had loaned 1,637 million, and the recovery amounted to 1,314 million. The federal government constantly supplies the banks with new funds.

More recently some private banking institutions have also provided funds on credit for agriculture, mostly in small amounts; among them the Banco Nacional de México, founded in 1884.

But in spite of governmental policy, it has been impossible to meet in full the demand of the nation's agriculture for credit. There are still many unsatisfied needs, which can only be attended to very slowly.

Irrigation.—The year 1926 also saw the beginning of extensive irrigation work aimed at reclaiming new lands for agricultural uses. This program has progressed uninterruptedly and continues on an increasing scale, as can be seen from the work started at the end of 1947 on the Papaloápan (Papaloápam) River in Veracruz and the Tepalcatepec in Michoacán. When the Papaloápan project is finished, Mexico will have one of the largest irrigation systems in the world.

Education.—It was also in 1926 that the first agricultural schools were organized. Their purpose was to teach agricultural workers and their children new methods of cultivation. There were 15 agricultural schools in the country in 1952, apart from the Escuela Nacional de Agricultura (National School of Agriculture) at Chapingo, State of Mexico, where a seven-year course is given, leading to the degree of agricultural engineer. The other 15 have less comprehensive plans of study, for a total of 5,000 students, who are to play an important role in the modernization of Mexican rural areas.

Minerals.—It can be said that the government has given almost complete freedom to mining firms, apart from its intervention through a system of taxation and its subsidies to cooperatives that continue to exploit impoverished properties, in order to keep such sources of employment operating as far as possible.

But the case of petroleum is entirely different. After 1917 the Mexican government had many serious, sometimes extremely serious, difficulties with the oil companies. About the middle of 1937 after a week-long strike which seriously affected the country's economy, the oil workers submitted to the companies certain demands which the latter refused to meet, arguing that their resources did not make such concessions possible. The workers demanded larger salaries and the improvement of social services, such as medical attention, hospitalization, indemnity in case of occupational accidents, and more holidays with pay. The workers' demands meant an increase in expenditure of 90 million pesos and the companies were

ready to meet them to an extent of only 13.5 million. Thus the conflict was not easy to solve.

The usual procedure in dealing with such conflicts is for the labor authorities to appoint three experts who draw up a report on the financial situation of the company or companies, as well as recommendations expressing their opinion as to the most suitable way to end the dispute. Experts were, therefore, appointed. They drew up their report and recommendations within the appointed time, stating that the oil companies could well afford to increase their expenses by 26.5 million pesos without any undue strain. The labor authorities, after hearing the objections that employers as well as employees raised to the experts' report, gave their final decision, which was in agreement with the recommendations of the experts. The companies did not agree and appealed to the Supreme Court. The court confirmed the decision of the labor authorities. The companies, however, refused to accept the decision of the Supreme Court and took a rebellious attitude. It was then, on March 18, 1938 that the government decreed their expropriation.

The first years of Petróleos Mexicanos—this was the name of the official firm which took over the companies' properties—were difficult, years spent in organizing; but as of 1953 it could be said that the Mexican oil industry was firmly established and was progressing from day to day. A new oil pipeline was built from Poza Rica to Salamanca, where a new refinery was completed in 1951, with an output of 30,000 barrels daily; hundreds of new wells have been drilled and new fields discovered. Oil production, which under the foreign companies totaled 119 million barrels in the three years 1934 to 1936, increased to 215 million barrels from 1949 to 1951 inclusive. American companies have already received full payment for the property expropriated, some $35 million; the Anglo-Dutch company (Royal Dutch Shell) had been paid $43 million as of 1952; the balance of $44 million to be liquidated by the payment of annual installments until 1962.

Transportation.—The building of motor roads was started during Gen. Plutarco Elías Calles' term of office (1924–1928); and has continued uninterruptedly. The road-building policy has tried to fulfill two aims: to join production centers with consumers, and to favor the tourist trade.

Much less has been done to develop the railways. Efforts are being made to modernize them and to put them in a position to meet the growing demand for transport efficiently, but this requires the investment of considerable sums of money. See also the section *Transportation and Communications.*

Industrialization.—A policy favoring the establishment of new industry was initiated in 1939–1940, during the last two years of President Lázaro Cárdenas' term of office. Facilities were given by granting exemption from the payment of taxes for a few years and also loans on a long-term basis. The Nacional Financiera (see below) was important in this financing. Industrialization gained a new impetus during World War II, and an even greater one after 1946. During the war there was a great lack of certain goods, sometimes indispensable ones, which had previously been easily imported from foreign countries, especially the United States. This influenced Mexicans to push on with the creation of new industries and to strengthen those already in existence.

However, Mexican statesmen, as well as economists, know full well that their country will never be able to equal the United States in industrial potentialities. But they also know that Mexico has a very good chance of becoming industrially powerful; among other reasons because it has iron, coal, oil, ample possibilities of enlarging its electric resources, and a good number of other raw materials. Moreover, economists as well as statesmen realize that industrialization will help to raise the standard of living of an important sector of the community.

Tariffs.—Mexico has always been a protectionist country, sometimes more and sometimes less, according to the circumstances. After 1940 economic policy concerning foreign trade was based openly on protection for new industries and on the opening up of new sources of employment, as in the case of automobile assembly plants. The customs duty payable on unassembled cars is very low, while that on assembled motor cars is extremely high. There is an organization, the Comisión de Aranceles (Tariff Commission), whose job it is to study and recommend to the Treasury Department (Secretaría de Hacienda y Crédito Público) any necessary changes in import and export tariffs. This commission is made up of representatives from several federal departments, and from the Confederation of Chambers of Commerce and Industry. Certain tariffs are raised on occasion, following Treasury requirements. This, of course, does not happen often.

Financial Institutions.—The Banco de México, being the central bank, is mainly concerned with loans to other banks, the issue of paper currency, the control of currency circulation and foreign exchange, and is the financial agent of the federal government. The Banco de México was founded by law on Aug. 25, 1925 and opened for business on September 1 of that year.

Besides the Banco de México, and the Banco Nacional de Crédito Agrícola and the Banco Nacional de Crédito Ejidal (described above), there are other banking institutions most of whose stock is owned by the federal government. Among these, the Nacional Financiera, the Banco Hipotecario Urbano y de Obras Públicas, and the Banco Nacional de Comercio Exterior deserve mention.

The Nacional Financiera has become very important since about 1939, mainly because of its intervention in financing new industries. It owns the greater part of the stock in many of them. Its policy consists in contributing whatever capital it may be necessary to add to private investments to facilitate the creation of new industry that will play a useful part in the economic progress of the nation. As soon as these industrial concerns are fully developed, however, the Nacional Financiera tries to get rid of its stock by sale to private investors. Sometimes this institution issues bonds to bearer to be placed among various investors. These bonds return an annual interest of six or seven per cent, as for instance, *certificados de participación* (participation certificates) and *bonos de caminos* (highway bonds). It also buys on the stock exchange.

The Banco Nacional Hipotecario Urbano y de Obras Públicas (National Urban and Public Works Hypothecary Bank) is concerned mainly with loans to states and *municipios* (municipalities) for the construction of sewage facilities and waterworks. The Banco Nacional de Comercio Exterior (National Foreign Trade Bank) con-

trols, among other things, certain business operations carried out between Mexico and foreign countries.

There are, besides, a number of private credit institutions that help in the economic development of the country and sometimes make considerable profits. Most of them are banks doing only deposit and discount operations, and they issue loans usually on a short-term basis. They have grown considerably in number since 1940; both because banking has turned out to be very lucrative in Mexico, and because of the facilities granted by the Ley General de Instituciones de Crédito (General Law for Banking Institutions), in 1937 and thereafter, and the stimulating policy of the Treasury Department. Banking policy has consisted in authorizing the formation of new banking concerns, always in accordance with the law and wisely defined to avoid duplication. It is the job of an official institution, the Comisión Nacional Bancaria (National Banking Commission), to keep a constant watch over all banking concerns and so to secure the public interest.

Taxation and Expenditures.—In the 1920's the federal government depended on mining and petroleum taxation for a considerable part of its revenue. Such taxation has steadily been losing importance since 1942. The income tax, which became effective for the first time in Mexico in 1926, now accounts for most of such income and grows constantly. A comparison of the years 1940 and 1951 shows that the income of the federal treasury, reckoned in dollars, increased fivefold; the increase of production and the development of business, as well as an improved budgeting technique accounting for the increment.

A fact of singular importance, which reveals a certain aspect of the government's economic policy, can be observed in its expenditure. The War Department headed the list of public expenditure in 1925, while in 1950, for instance, communications came first, followed by capital investments; education came third; waterworks fourth; followed by national defense in fifth place.

The most serious problem of Mexico as regards contemporary economic policy is the achievement of a better distribution of the national income, since the mass of the people has in no way enjoyed the undeniable overall increase of such income.

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7. LABOR MOVEMENT. The lack of an industrial movement during the 19th century retarded the growth of labor unions in Mexico during that period. Few labor groups were formed, the most important being the Gran Círculo de Obreros (Grand Circle of Workers), founded in 1876.

Labor activity increased up to 1884, when it was effectively suppressed by Porfirio Díaz. From 1865 to 1877 there was a period of labor unrest with many strikes.

In 1906 the Círculo de Obreros Libres (Circle of Free Workers) was founded, and a series of strikes was organized by this group among textile workers to obtain an eight-hour day and minimum wage levels, but these strikes were broken in the same year.

During the years 1907 to 1911 new organizations made their appearance in Mexico City. The most important of these was the linotypist union, Unión Linotipográfica de la República Mexicana. The Casa del Obrero Mundial (World Worker's House), founded in Mexico City in 1912, was the first labor organization to receive government backing. It was supported by President Venustiano Carranza's government, and during the revolution organized the so-called red battalions which fought on the side of that government.

CROM.—In 1918 dissident elements of the Casa del Obrero Mundial founded the Confederación Regional Obrera Mexicana (Regional Confederation of Mexican Workers) and affiliated themselves with the Amsterdam Syndicalist Federation. The leader of this group was Luis Morones, who later served under President Plutarco Elías Calles as minister of commerce, industry and labor. Morones, called "Czar of Labor" by the American writer Lesley Byrd Simpson, and his followers were the founders of Mexican labor *liderismo*, an absolute domination of union and members by the leaders; strikes often being called or stopped according to their personal interests. Morones and the CROM's central governing committee, the Grupo Acción, attained the peak of their power during the Calles administration.

The CROM had an initial membership of 7,000 members. By 1927 it counted 2,500,000 members in its ranks. During the years 1924 to 1926 it was affiliated with 76 national organizations, 106 unions located in the Federal District, and with about 1,000 syndicalist groups and 1,500 peasant unions scattered throughout Mexico. Without a doubt, the CROM was the most important labor body in Mexican history. In 1936 it became a member of the London World Syndicalist Federation.

CTM.—The speed with which the CROM grew was matched by the rapidity with which it disintegrated, a decline due to its submissiveness to the government and loss of zeal. The groups that broke off met in a unification congress in 1936, which resulted in the organization known as the Confederación de Trabajadores Mexicanos (Confederation of Mexican Workers). The CTM had a starting membership of 20,000 workers. By 1940 its membership had increased to well over a million. This powerful labor group has as its motto, "Toward a Classless Society," and had as its leader the Soviet sympathizer Vicente Lombardo Toledano, who in 1936 also became the leader of a new international labor group, the Confederación de Trabajadores de la América Latina (Latin American Workers' Confederation).

The CTM suffered a severe drop in membership in 1942, which was in great part due to the communistic policies followed by its leaders. The loss of membership, however, continued even after 1949, when it broke with the Communist elements with which it was infiltrated.

Newer Unions.—Vicente Lombardo Toledano, who was ousted as leader of the CTM in 1949, organized a new labor body, known as the

Unión General de Obreros y Campesinos de México (General Workers and Peasants Union of Mexico) in the same year.

Luis Morones organized the Proletaria Nacional (National Proletariat) in 1952, which was closely linked with the *Peronista* movement emanating from Argentina and represented by the Comisión para la Unidad Obrera de Ibero América (Commission for Ibero-American Labor Unity). Three minor unions fused to form the Proletaria Nacional: the Confederación Nacional Proletaria (National Proletarian Confederation) of anarchist-syndicalist tendencies; the Confederación Nacional de Trabajo (National Labor Confederation) of communistic tendencies; and the Confederación de Obreros y Campesinos de México (Confederation of Workers and Peasants of Mexico). Prior to the merging of these three groups there were in Mexico approximately 15 national and central unions, without any link among themselves. By 1950 there were 165 federations, 20 worker syndical confederations, an employers syndical confederation, and over 8,200 local unions of all types, with more than half a million workers.

Legislation.—The Congress of Queretaro incorporated "liberty of professional association" in the Constitution of 1917. In 1929 Congress passed the Ley del Trabajo (Labor Law), establishing the Special Minimum Wage Commission, conciliation and arbitration boards, and other labor bodies. Unions were declared "public corporations subject to industrial law" by the Supreme Court in 1938.

Strikes.—The report of the National Workers Confederation Committee of the CTM, published in Mexico City in April 1938, gives the strike statistics in the following table:

Year	Strikes	Year	Strikes
1920	173	1928	7
1921	310	1929	14
1922	197	1930	15
1923	146	1931	21
1924	136	1932	56
1925	51	1933	13
1926	23	1934	202
1927	16	1935	642
		1936	659

No information is available on the numbers of strikers participating. As will be seen, the number of strikes gradually declined after 1921, the year in which the revolution may be said to have been consolidated by President Alvaro Obregón, until the effects of the great economic depression were felt in Mexico during the administration of Lázaro Cárdenas. No information is available for the years 1937–1940.

The *Compendio estadístico* (1951) of the Dirección General de Estadística gives the information in the following table.

Year	Strikes	Strikers	Year	Strikes	Strikers
1941	142	12,892	1944	887	165,744
1942	98	13,643	1945	220	48,055
1943	766	81,557	1946	207	10,202

The labor conciliation boards settled 87,327 labor-management conflicts in 1941–1946.

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8. TRANSPORTATION AND COMMUNICATIONS. Mexican transportation reflects the difficult conditions under which the system was constructed. From 600 kilometers (1 km. equals .62 statute mile) of railways in 1875, the total increased to 22,300 km. in 1949 and to 23,319 km. in 1950. By 1950 highways totaled 21,968 km., airline services extended over 159,605 km. (65,264 km. on regular schedules), and there were 2,028 km. of oil pipelines plus 1,032 km. of gas pipelines. Ocean transport accented the importance of the oil industry: in 1950, 9 steamers (16,362 net tons) flew the Mexican flag, together with 12,000 net tons of small craft and some 230,000 deadweight tons of ships connected with the petroleum industry, of which 19 were tankers.

The initial planning of land transport routes conformed to no strong national or logical criteria. During the Díaz regime (1877–1911) communication lines were developed to facilitate export of raw materials via ports and borders, and to supply the national capital with imported articles. This was reflected in the predominance of foreign investment in railroads, in correlation with investments in mining and agriculture. Not until 1907 was the Ferrocarriles Nacionales de México created, with the government as majority participant. The nationalization of railways occurred in 1937 under President Cárdenas in hope of alleviating the shortage of rail facilities (11.9 km. of track per 1,000 sq. km. of area). The expansion of railway facilities has been handicapped by deficit conditions, by deterioration of fixed equipment and rolling stock, by high wage budgets for a multitude of low-wage workers, and the heavy expense of renting numerous passenger and freight cars from the United States.

During the administrations (1940–1952) of presidents Manuel Ávila Camacho and Miguel Alemán appropriations for the Secretaría de Comunicaciones y Obras Públicas (Department of Communications and Public Works) consistently exceeded those for any other department. Trunkline communications have been improved and augmented, and new feeder lines have incorporated into Mexican economic and cultural life many areas hitherto isolated.

Motor vehicles numbered 288,368 as of January 1, 1950; about half of these were private passenger cars, the remainder were trucks, buses, and taxicabs. By January 1951, 285,600 telephones were in service; slightly over half of these were in Mexico City, and almost all of them were operated by private companies.

The postal service has modern equipment; there were 4,043 post offices with 14,499 employees in 1951, and they handled 610 million pieces of mail, including about seven tons of letters per day.

Air Transport.—Between 1930 and 1949 the total number of kilometers flown by commercial aviation increased nearly tenfold (from 4 million to 37.8 million km.). The number of passengers carried in 1930 was 21,000; in 1951 the corresponding figure was 1,128,385. In 1950 there were 38 airports and 165 smaller landing fields in Mexico; by 1952, public investment in airport construction and repair amounted to 94 million pesos. From 1940–1948 private companies invested 132

million pesos. New airports completed in 1951 included those at Campeche and León, and one of the most beautiful and efficient airports in Mexico, that of Guadalajara. The 29 domestic and 6 international airlines serve virtually every town and city of importance. Air cargo includes agricultural produce, industrial goods, sea foods, even jungle products, such as chicle. There are three schools of civil aeronautics; one, the Cinco de Mayo in Puebla, is a dependency of the Secretaría de Comunicaciones y Obras Públicas.

Railroads.—Twenty-one railroad companies operating some 1,449 miles of track were registered in 1948 with the Secretaría de Comunicaciones y Obras Públicas; the balance of about 22,300 km. being government-operated. In 1940 work began on the Ferrocarril del Sureste (Southeastern Railroad), which crosses innumerable rivers and marshlands and connects the Peninsula of Yucatán with the national network; this was completed in 1950. On the opposite side of the country the costly Ferrocarril Sonora–Baja California, which crosses the desert called Desierto de Altar and links Lower California with the rest of the country, was also completed. In July 1950, construction was begun on the Durango-Mazatlán line; the importance of this project is evident in the expectation that it will benefit 30 per cent of Mexico's population. Over 11 miles of tunnels and more than 1,000 meters of bridging will be required on this line. A line from Mexico City to Tuxpan, Veracruz, was under construction in 1952, while a new modern passenger terminal and a new freight terminal were being completed in Mexico City. A rational plan of laying heavier tracks was adopted after 1946 to facilitate higher speeds and the carrying of heavier loads; diesel units have been acquired, and a plant to manufacture railway cars is being promoted.

Highways.—The creation, in 1925, of the Comisión Nacional de Caminos provided the first positive impulse, reinforced later by the administrative efforts of the Department of Communications and Public Works, which undertook an ambitious plan of highway construction in cooperation with various state governments; under President Alemán annual appropriations for this purpose averaged 300 million pesos. From 1925 to 1940, the yearly average of construction was about 664 km. (total: 9,968 km.) and this average rose to 1,333 km. per year between 1941 and 1949. Approximately 22,000 km. were constructed up to 1949; 57 per cent were paved, 33 per cent "improved," and 10 per cent were dirt roads. During the 25 years, 2,135 million pesos were expended, of which nine tenths came from the federal government.

By 1951 main trunk routes were undertaken to tap the vast regions of Yucatán and Lower California. Construction of the Carretera Internacional del Noroeste (Northwest International Highway) from Guadalajara, Jalisco, to Nogales, Sonora (1,069 miles), was pushed intensively. At Mazatlán, this highway will connect with the Matamoros, Tamaulipas-Mazatlán, Sinaloa highway.

The year 1952 saw the completion of the 728-mile coast-to-coast road from Tampico, Tamaulipas, to Barra de Natividad, Jalisco, except for the paving of 170 miles of the section Barra de Natividad-Acatlán. Construction was in progress on the Transisthmus highway from Coatzacoalcos, Veracruz, to Salina Cruz, Oaxaca. The Mexico City-Cuernavaca superhighway, inaugurated in 1952, is a 22-meter boulevard; each of the double lanes is 7.5 meters wide. Entrance boulevards 30 to 40 meters wide had been completed for the Mexico City-Acapulco and the Guadalajara-Chapala highways.

Other completed roads include the 1,327-mile Mexico City-Ciudad Juárez route, the 760-mile Mexico City-Nuevo Laredo route, and the Carretera Cristóbal Colón (846 miles) which links the capital with Ciudad Cuauhtémoc, Chiapas, on the Guatemala border. The opening of the latter constituted a milestone in Mexican highway development, for it completed Mexico's part of the Pan American Highway and made it possible to travel on good roads from Fairbanks, Alaska, to Guatemala.

Local Roads.—The federal government's extensive program of building local roads, designed to bring a majority of the small towns and agricultural areas within range of first-class trunk highways, began with creation of a new bureau within the Department of Communications and Public Works to develop this type of road. Automobile assembling firms and tire manufacturers offered to pay an additional tax of 10 per cent, and thus financed these roads in part. A presidential decree of Oct. 12, 1949 inaugurated a plan of dividing the cost of local roads equally between the federal government, state governments, and private enterprise. Construction allocations and priorities depend upon the anticipated volume and type of traffic. Some of these roads are constructed with an absolute minimum of investment, but are designed to facilitate improvement as traffic may require. In 1952, 273 miles of such roads had been completed, and 1,324 additional miles were under construction. Some of these are gravel roads four meters wide, others are asphalt roads up to nine meters wide.

Telecommunications.—Telegraph services have been modernized by radio relay stations, multiplex transmission and printing, and other devices for simultaneous transmission of several messages on the same line. The telegraph system functions in liaison with urban and long-distance telephone systems. No state capital or city of importance lacks long-distance telephone service. There are about 214 radio broadcasting stations, and four television stations in 1952.

Pipelines.—In 1950 the daily transport capacity of oil pipelines was 817,000 barrels of crude petroleum and other products. Between 1938 and 1950, five gas pipelines totaling 447 km. in length and with a daily carrying capacity of 410 million cubic feet were constructed. Another pipeline from Monterrey to Torreón (340 km.; daily capacity, 100 million cu. ft.) was under construction in 1952.

Harbors.—There are ten harbors on the Pacific coast and twelve on the Gulf of Mexico. Of the former, Guaymas; Yavaros, Sonora; Mazatlán; Manzanillo; and Acapulco are natural harbors; on the east coast there is but one natural harbor: Ciudad del Carmen. The only breakwaters are at Veracruz, Tampico, Coatzacoalcos, and Salina Cruz.

The decreasing relative importance of sea and rail transport on the one hand and the increasing importance of air and highway transport on the other carries implications for Mexico's efforts to modernize and extend both fixed and mobile equipment. Coordination and integration of these systems depend on the skill with which

government agencies estimate the services that each factor can render most effectively in relation to the needs of the national economy.

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9. THE PRESS. The stormy history of Mexico during most of the 19th century is reflected in its journalism; political journalism was the order of the day, as were colorful names.

The first newspaper of consequence to be printed in Mexico was a *Gaceta de México* (*Mexico Gazette*), founded in 1805 by Juan Villaurrutia, a court judge, and suspended in the same year. However, a great number of pamphlets, leaflets, and journals were published soon after, under the freedom of the press briefly granted by the Spanish Constitution of 1812. Among the many publications circulating in Mexico at the time, the most outstanding were *El Pensador Mexicano* (*The Mexican Thinker*) published by Fernández de Lizardi and *El Juguetillo* (*The Plaything*) published by Carlos María Bustamante; both in Mexico City. In the same year, however, Viceroy Francisco Javier Venegas, under the pretext that the newspapers were abusing the liberty of the press granted under the constitution, suspended these and fourteen other publications. This resulted in a flood of illegal pamphlets and leaflets, which were distributed throughout Mexico.

The burning issue of the times was the independence of Mexico from Spain. Among the publications favoring independence in 1811–1812 were *El Despertador Mexicano* (*The Mexican Awakener*), published at Guadalajara as a result of Miguel Hidalgo's entry into that city; *El Ilustrador Mexicano* (*The Mexican Illustrator*), published at Zitácuaro by Andrés Quintana Roo; *El Despertador Michoacano* (*The Michoacano Awakener*), at Valladolid (now Morelia); *El Correo Americano del Sur* (*The South American Courier*) at Oaxaca, and *El Mexicano Independiente* (*The Mexican Independent*) published by José María Morelos at Iguala. The Spaniards countered by publishing the newspapers *El Fenix* (*The Phoenix*), *El Ateneo* (*The Athenaeum*), and *El Español* (*The Spaniard*); all at Mexico City, 1811–1812.

After the Independence.—After Agustín de Iturbide's army had entered Mexico City in 1821, Carlos María Bustamante published the *Avispa de Chilpancingo* (*Chilpancingo Wasp*), with other minor publications making their appearance. When Iturbide had proclaimed himself emperor the *Gaceta de México* mentioned above became the *Gaceta Imperial.* Iturbide suspended those newspapers which directed attacks against his government and it was not until his downfall in 1823 that newspaper publishing gained new force. In 1824 the Freemasons belonging to the Scottish rite, and conservative in policy, founded *El Aguila Mexicano* (*The Mexican Eagle*), while those of the York rite, liberal in policy, founded *El Observador* (*The Observer*) in the same year, together with the *Correo de la Federación* (*Federation Courier*), and in 1825, the *Amigo del Pueblo* (*Friend of the People*). The advanced Liberals had founded the *Estrella Polar* (*Polar Star*) and *El Fantasma* (*The Phantom*) in 1824. The journals of this period were shortlived and were mostly political publications.

Santa Anna Period. — Although Antonio López de Santa Anna was as much opposed to the freedom of the press as his predecessors had been, a great many publications made their appearance under his government. In 1841 *El Siglo XIX* (*The 19th Century*), a most influential Liberal newspaper, made its appearance in Mexico City. Eleven other publications of a political or professional nature were also published during this period. The *El Monitor Constitucional* (*The Constitutional Monitor*), a publication of great influence and longevity, was first published in 1842. Its name was changed in 1844 to *El Monitor Republicano* (*The Republican Monitor*).

During the occupation by United States troops (1847–1848) two newspapers favoring them were published in the State of Veracruz. These were *El Boletín de Veracruz* (*The Veracruz Bulletin*) and the Xalapa (Jalapa) *Estrella Americana* (*American Star*). Opposed to the occupation were the Mexico City *El Eco del Comercio* (*The Echo of Commerce*) and *La Patria* (*The Nation*). After the occupation was ended, Santa Anna published *La Palanca* (*The Lever*), opposed to President Mariano Arista; and another newspaper, *El Universal* (*The Universal*), favoring a monarchy with a European ruler, made its entrance onto the journalistic stage. This newspaper was destroyed by an enraged mob on Aug. 13, 1855. *El Monitor Republicano,* which had ceased publication, now reappeared, and following Santa Anna's fall from power (1855) the *Heraldo Liberal* (*Liberal Herald*) was born. The struggle between the Liberal republican press and the Conservative press now reached its highest peak.

French Occupation, Maximilian's Empire, and Reform Period.—The cleavage between the Liberal and Conservative parties was greatly accentuated during this period and was reflected in the press. The following publications favoring the monarchy were published during Maximilian's reign (1864–1867): *La Monarquía* (*The Monarchy*); *L'Estafette* (*The Courier,* published in French); *La Patria,* no relation to that mentioned above; *La Sociedad* (*The Society*); *El Cronista* (*The Chronicler*); *El Espíritu del Pueblo* (*The Spirit of the People*); *El Franco-Mexicano* (*The Franco-Mexican*); *La Constitución Social* (*The Social Constitution*); *La Raza de México* (*The Mexican Race*); and others. Opposed to the monarchy were: *La Orquesta* (*The Orchestra*); *El Hijo del Ahuizote* (*The Son of the Ahuizote*); *La Sombra* (*The Shadow*); *La Cucaracha* (*The Cockroach*); *El Espejuelo del Diablo* (*The Devil's Mirror*); *El Clamor Progresista* (*The Progressive Clamor*); *El Año Nuevo* (*The New Year*); *La Voz del Pueblo* (*The Voice of the People*); and *El Payaso* (*The Clown*). Marshal Achille Bazaine, commander of the French forces, prohibited opposition journals from publishing in 1863; however, *El Payaso* and *El Hijo del Ahuizote* reappeared and continued in business up to the regime of Porfirio Díaz.

The administration (1867–1872) of President Benito Juárez was notable in that complete freedom of the press existed. A great number of

periodicals were published during this period. His government was the subject of bitter attacks by the pro-Catholic press, namely *La Voz de México* (*The Voice of Mexico*) and *La Idea Católica* (*The Catholic Idea*), but in spite of this opposition they were permitted to continue functioning without interference from the government.

Porfirio Díaz Dictatorship.—The stability of the Díaz government (1876–1911) resulted in the creation of sound journals and journalistic principles. Many papers were opposed to the government, but there were also many which defended it. In 1896, Rafael Reyes Espindola (1860–1922) founded *El Imparcial* (*The Impartial*), the first Mexican daily to have a well-trained editorial and reportorial staff and the latest in printing presses. In 1906, with the growth of opposition to Díaz, *El Imparcial,* pro-Díaz, *El Popular,* slightly leftist, and *El País* (*The Country*), Catholic and pro-Díaz, vied for the public's favor.

Contemporary Journalism.—The end of the Porfirio Díaz dictatorship in 1911 marks the rise of modern Mexican journalism. Between the years 1910 and 1917 the most outstanding newspapers were: *El Antireeleccionista* (*The Anti-Reelectionist*), the most important of those defending the Constitutionalist revolution; *El Imparcial; El Debate* (*The Debate*), pro-Díaz; *El Nuevo México* (*The New Mexico*), anti-Díaz; *La Nueva Era* (*The New Era*), pro-Díaz; *El Mañana* (*Tomorrow*), anti-Madero; *La Tribuna* (*The Tribune*); and the anti-Díaz *El Mexicano* (*The Mexican*), *El Pueblo* (*The People*), and *El Universal.*

Excelsior was founded in 1917, as was *El Universal,* which papers were inspired by United States journalistic methods and editorial policies.

The approximate circulations of important Mexico City newspapers in 1953 were: *La Prensa* (*The Press,* tabloid) 119,300; *Excelsior,* 91,367; *El Universal,* 83,751; *Novedades* (*News*), 80,000; *Ultimas Noticias* (*Latest News;* noon and afternoon daily published by the *Excelsior*), 79,940; *El Universal Gráfico* (pictorial tabloid published by *El Universal*), 25,307; *El Nacional* (*The National,* government journal), 25,000; *El Popular* (official organ of the labor organization Confederación de Trabajadores Mexicanos), 12,000; and the sports daily *Esto* (*This*), 10,000.

There is an English-language daily, *The News* (circulation 10,000), and an English section in the *Excelsior.* The *Journal Française du Mexique* (3,000), is the only French daily of consequence.

There are countless weekly magazines published in Mexico City, of which the most important are: *Todo* (*All*), approximate circulation in 1953, 30,000; *Revista de Revistas* (*Review of Reviews*), 25,000; *Hoy* (*Today*), 20,000; *Mañana* (*Tomorrow*), 20,000; and *Tiempo* (*Time*), 20,000, which in format closely resembles the *Time* magazine of the United States. A great variety of bullfighting periodicals, such as *Redondel* (30,000) and *Claridades* (21,500), are published weekly, with another group of periodicals dedicated to all the sports practiced in Mexico. In the provinces a great number of publications are published daily or weekly, rivaling in number those published in Mexico City. Of these the largest daily papers are *El Norte* of Monterrey, *Diario de Yucatán* of Mérida, and *El Informador* of Guadalajara. The García Valseca newspaper chain publishes seventeen out-of-town newspapers.

Statistical Data.—The number of readers per copy in 1950 was 21.7, which places Mexico considerably below the United States and Great Britain. However, among the Spanish-speaking countries, Mexico occupies first place in readers per copy. In 1936 (the last year for which figures are available) the number of readers per daily was 23.1 per copy; weekly publications, 28.4 per copy; and monthlies, 24.8 per copy.

The total number of publications in Mexico in May 1952 was 1,515, of which 136 were dailies; 321 weeklies; 651 monthlies; others, 407. They may be divided by subject matter as follows: 841 general information (including 32 whose appearance was so irregular that they are not included in the foregoing); 208 religious; 184 technical scientific; 69 cultural; 44 literary; 43 political; 38 for children; 34 sports; 24 labor; and 62 miscellaneous. These figures show the progress that has been made in Mexico, and the evolutionary step taken from political journalism to informative journalism, a phenomenon which reflects the stability and coming of age of a country.

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10. GOVERNMENT. Government is the organism for the administration and realization of the aims of the state. In the case of the Aztecs, their government, as it was encountered by the Spaniards, had undergone considerable evolution since the first tribe settled on the site of Mexico City, then an island in Lake Texcoco (or Tetzcoco). In the first third of the 16th century the supreme political, judicial, administrative, and military authority was vested in the *tlacatecuhtli,* or *hueytlatoani,* who was elected by a council of four electors from the nobility. After the election of the first *hueytlatoani,* named Acamapichtli, however, this office was always bestowed upon his descendants. It thus appears that the Aztecs were governed by a single dynasty, the last of whom was Montezuma II.

To describe the colonial government would be to repeat the history of the viceroyalty (see the section *Spanish Conquest and Colony*).

During the Spanish domination Mexico was ruled by laws emanating from the Spanish crown. After its initial declaration of independence in 1810, New Spain was granted some concessions in the Spanish Constitution of 1812, which went into effect Sept. 28, 1812, but was suspended on December 5 following, and due to events in Spain was not again put into effect until 1820, only a year before Mexico achieved its independence.

Meanwhile, the Constitution of Apatzingán, abolishing slavery, had been promulgated by the Mexican insurgents on Oct. 22, 1814. Although it was never put into effect, this constitution is historically interesting, since it clearly states the concepts of the liberator, José María Morelos y Pavón, and his inner circle of followers, who established the organization of the country on a self-governing basis. It provided for universal suf-

frage, a congress which was to appoint a three-man executive, and a supreme court.

The independence of Mexico was achieved in 1821. Nevertheless, the new government was dominated by the landed gentry and the clergy for many years until the thorough-going reforms of the Constitution of 1857 were achieved.

On Feb. 24, 1821, the Plan of Iguala, considered the first Mexican constitution, was signed by Vicente Guerrero and Agustín de Iturbide, and the country was organized as a constitutional monarchy. After the overthrow of Iturbide's short-lived empire, a constitutional act of Jan. 31, 1824 reflecting various Anglo-American influences of the 18th century, was decreed and went into effect on October 4 of the same year, establishing a federal republic.

A movement toward a more centralized government took place on April 22, 1833, when a statement of basic principles was issued. These were the basis of the so-called Siete Leyes Constitucionales (Seven Constitutional Laws) of Dec. 29, 1836. This code was quite explicit with regard to individual rights, although it did not recognize freedom of religion, and organized a centralized republic, changing the states into departments. The Siete Leyes were later rejected by Antonio López de Santa Anna in his decree of June 12, 1843 (the so-called Bases Orgánicas), by which he virtually re-established the centralist organization of 1821. The federalist Constitution of 1824 was re-established, Aug. 22, 1846, to promote unity during the war with the United States.

The Plan of Ayutla, which led to the overthrow of Santa Anna in 1855, was proclaimed on March 10, 1854, and later modified at Acapulco. This federalist constitution contained a declaration of the rights of man and certain advanced ideas.

The Reform, or Constitution of 1857 (promulgated February 5), re-established the Constitution of 1824, but contained the germ of a truly liberal law creating the right of judicial protection (see *Legislation and Jurisprudence*).

In the Revolution of 1910, a violent uprising finally terminated the dictatorship of Gen. Porfirio Díaz, under which a wealthy minority oppressed the miserably poor masses. Venustiano Carranza convoked a constituent congress in Querétaro, which approved a new political constitution on Jan. 31, 1917. It was promulgated Feb. 5, 1917.

Constitution of 1917.—The Mexican government was established in the following forms:

(1) *Constitutional*, because it is governed by the Constitution of 1917, which is the fundamental charter and basis of its politico-administrative organization. This constitution establishes the other characteristics of the government.

(2) *Republican*, since the national sovereignty rests with the people, from whom are derived all public powers; they having at all times the right to reform or modify the form of their government.

(3) *Representative*, because the people, by means of organisms created by the constitution, exercise their control over the government.

(4) *Democratic*, for these powers are exercised by each and every Mexican citizen.

(5) *Federal*, for the nation is composed of states, internally free and sovereign political entities joined together by a federal pact, or constitution, which determines the relationship and powers of the federal and local governments.

(6) *Presidential*, because the president freely appoints his aides and cabinet ministers, and because of the independence which the latter enjoy in relation to the legislative chambers.

The government is exercised by federal and local authorities. The federal government is divided for its functions into legislative, executive, and judicial branches.

Legislative Branch.—This is divided into two houses. The Cámara de Diputados (House of Representatives) is composed of national constituent representatives (*diputados*), directly elected for three years, one for each 150,000 inhabitants or fraction over 75,000. Each representative has an elected alternate who takes his place in case of absence or death. In no case may there be less than two representatives for each state, nor less than one per territory. The election of July 6, 1952 named 160 representatives. The other house, the Cámara de Senadores (Senate), is composed of two members (*senadores*) from each state and two from the Federal District, also directly elected and replaced in their totality every six years. An alternate is also elected for each senator. Territories are not represented in the Senate.

Together the two houses compose the Congress of the Union. Their resolutions are called laws, if issued by the Congress, or decrees, if issued by the president when invested by the Congress with extraordinary powers. Their ordinary period of sessions is from September 1 to December 31, at the latest. During their recess there is a permanent congressional commission composed of 29 members (15 representatives and 14 senators).

Executive Branch.—The executive power is vested in a single individual, the president, who is selected by direct election for a term of six years beginning on December 1, and is not eligible for re-election. He must be Mexican by birth, the son of Mexicans by birth, at least 35 years old, and may not be a clergyman, nor have been in active military service for at least six months before election.

There is no vice president. If a vacancy occurs during the first three years of a presidential term, new elections are held; if it occurs during the last three years, Congress may elect a successor for the remainder of the term.

The Ley de Secretarías y Departamentos de Estado enumerates and distributes the administrative matters entrusted to each branch of the executive power. This law came into effect on Dec. 7, 1946; it was reformed on May 1, 1947. The following are the cabinet posts:

(1) Secretaries (heads of the *secretarías*) of: Gobernación (Interior); Relaciones Exteriores (Foreign Relations); Hacienda y Crédito Público (Treasury); Defensa Nacional (National Defense); Marina Nacional (Navy); Agricultura y Ganadería (Agriculture and Livestock); Comunicaciones y Obras Públicas (Communications and Public Works); Economía Nacional (National Economy); Educación Pública (Public Education); Salubridad y Asistencia (Health and Welfare); Trabajo y Previsión Social (Labor and Social Welfare); Recursos Hidráulicos (Hydraulic Resources); and Bienes Nacionales e Inspección Administrativa (National Properties and Administrative Inspection).

(2) Department chiefs (heads of the following *departamentos*): Agrario (Agrarian); Distrito Federal (Federal District); and Industria Militar (Military Industry).

(3) Presidential cabinet assistants: attorney general of the republic; district attorney of the Federal District and territories; and the governors of the territories.

Judicial Branch.—The judicial power is vested in the Supreme Court of the Nation, circuit courts, district courts, and the federal public minister, who is appointed by and subordinate to the attorney general of the republic. See also the section *Legislation and Jurisprudence*.

State and Territorial Governments.—The basic unit of state government is the free *municipio* (municipality) administered by its municipal council (*ayuntamiento*). The president of the *municipio* and the members of the *ayuntamiento* are directly elected by popular vote. There is no intermediate authority between the *municipios* and the state governments, consisting of a governor and a Cámara de Diputados, both directly elected by popular vote. The governors' terms are limited to six years by federal law, and neither they, nor the members of the legislatures, nor the officials of the *municipios* may be immediately re-elected, without an intervening term. The state officials are appointed by the governors.

The *municipio* is also the basis of government in the territories. Governors of territories are named by the president of the republic, and they name the other officials. There are no territorial legislatures.

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11. POLITICAL PARTIES. The political struggles of Mexico after independence was achieved in 1821 took place between two ill-defined groups loosely labeled Conservatives and Liberals. The Conservatives were the party of the professional soldiers, the church, and the large landowners—in other words, the group which had inherited the economic and political power of the colonial period. The Liberals were the party of the middle class, the merchants, the nascent industrialists, and toward the end of the century, the industrial workers. The peasant group was largely controlled by the church and therefore cannot be considered as belonging to the Liberal group.

With minor interruptions, the Conservatives ruled the country from independence until the overthrow of Antonio López de Santa Anna by the Liberals in 1855. The Liberals then embarked on a program of reform which culminated in the Reform Laws (Leyes de la Reforma) of 1859–1860, decreed by Benito Juárez, which destroyed the economic power of the church by breaking up its extensive land holdings. The Conservatives, furthermore, were compromised in the unsuccessful scheme of Napoleon III to set Maximilian on the throne of Mexico. The long dictatorship (1884–1911) of Porfirio Díaz was thus born under the auspices of a Liberal victory.

The 20th Century.—Peace reigned throughout Mexico under Díaz. This was a period of material progress, railway construction, and industrial growth, but it weighed heavily on the peasants and workers. The political, military, and peasant rebellions, which appeared during the period, continued through the Revolution of 1910 up to the revolt of Gen. Saturnino Cedillo in 1938 during the presidency of Lázaro Cárdenas.

The Díaz period saw the emergence of new political parties, based on opposition to or support of the regime. San Luis Potosí was the birthplace (in 1901) of the anti-Díaz Club Liberal (Liberal Club), while in Mexico City the Asociación Liberal Reformista (Liberal Reformist Association) made its appearance. In 1908 both the pro-Díaz Club Reeleccionista (Re-electionist Club) and the group known as the *Científicos* ("Scientists") were formed, with definite despotic tendencies; in the same year the Partido Liberal de la Oposición (Liberal Opposition Party) emerged, and supported Francisco Madero against Díaz in the elections of 1910. Although Díaz was declared elected, the Partido Constitucional Progresista (Constitutional Progressive Party), also opposed to the re-election of Díaz, which would have meant a continuation of the dictatorship, carried Madero to power, with the aid of revolts by Pascual Orozco and Francisco Villa in the north in 1910, and by Emiliano Zapata in the south in 1911. Both rebellions, however, were peasant uprisings and did not accept revolutionary guidance from the cities.

Party labels had little meaning in the chaotic period which followed. Madero was assassinated by Victoriano Huerta, who assumed the presidency, 1913–1914. Venustiano Carranza drove Huerta from office, his regime lasting until 1920 when he was overthrown, and elections were held. Gen. Alvaro Obregón was elected president with the support of the Partido Laborista Mexicano (Mexican Labor Party), founded by the labor leader Luis Morones. It is interesting to note that the Partido Comunista de México (Communist Party of Mexico) was founded in 1922.

In 1924 Plutarco Elías Calles was elected president. In 1929 he founded the Partido Nacional Revolucionario (or PNR; National Revolutionary Party) as the official government party. The PNR has continued in existence, under various names, up to the present period. This political organization is a conglomeration of individual adherents, groups of varying political interests, and labor unions—all interested in maintaining the party in power. The army, which until 1914 had been a support of the conservatives, has become the supporter of constitutional rights and guardian of the conquests of the revolution.

During President Calles' term the Ley de Cultos was passed. This law was a definite blow at the church, and gave rise to the *Cristero* (Christist) revolt which began in 1927 and lasted up to President Portes Gil's regime in 1929. Gen. Lázaro Cárdenas, who gained wide popularity with the peasants and received the political support of the labor union Confederación de Trabajadores Mexicanos, in 1938 changed the name of the PNR to Partido de la Revolución Mexicana (PRM; Party of the Mexican Revolution), which launched as its candidate for the presidency in 1940 Gen. Manuel Ávila Camacho, who defeated Gen. Juan Andreu Almazan. General Almazan's Partido Revolucionario de Unificación Nacional (National Revolutionary Unification Party) was backed by groups similar to those which comprised the PRM.

President Ávila Camacho in 1946 changed the name of the official party to Partido Revolucionario Institucional (PRI; Revolutionary Institutional Party) which presented Miguel Alemán as its candidate for the presidency in the elections of that year. Alemán, the first civilian president after a long series of revolutionary generals, defeated Ezequiel Padilla by a vote announced as 1,800,829 to 431,487. Padilla was supported by the Partido Democrático Mexicano (Mexican Democratic Party), which was formed by dissident right-wing elements of the PRI.

The following candidates, with their respective parties and the number of votes they were officially announced as having received, participated in the elections of 1952: the victor, Adolfo Ruiz Cortines (2,713,419 votes), candidate of the PRI; Miguel Enríquez Guzmán (579,745 votes), candidate of the Federación de Partidos del Pueblo (Federation of People's Parties), a left-of-center group formed in 1952; Efraín González Luna (285,555 votes), candidate of the rightist Partido de Acción Nacional (National Action Party), founded in 1939, who was also supported by the Movimiento Sinarquista (Synarchist Movement), an adjunct of the *Cristero* movement, in the central and western states, and Vicente Lombardo Toledano (72,482 votes), candidate of the Partido Popular (Popular Party), founded in 1947, an appendage of the Communist Party.

Consult Sierra, Justo, *Evolución política del pueblo mexicano* (Mexico City 1940); also the declarations of various parties—Partido Nacional Revolucionario, *Constitución* (Mexico City 1934); Partido de la Revolución Mexicana, *Declaración de principios, programa y estatutos* (Mexico City 1938); Partido de Acción Nacional, *Declaración de principios* (Mexico City 1940); Partido Popular, *Razón histórica, principios, programa y estatutos* (Mexico City 1948); Partido Revolucionario Institucional, *Declaración de principios, programa y estatutos* (Mexico City 1950).

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12. LEGISLATION AND JURISPRUDENCE. Although Mexico had every intention of modifying its constitutional law upon achieving its independence in 1821, a large part of Spanish law, which had been in force during the colonial period, was in fact preserved for many years. It had been variously codified and was used throughout the Spanish Empire and in the laws of the Indies, applicable to New Spain (Mexico) and other colonies. Therefore, Mexico belongs by legal tradition to the system of civil law, not of common law.

CONSTITUTIONAL AND ADMINISTRATIVE LAW

The first documents of Mexican public law were three documents of 1821, the Plan of Iguala (February 24), signed by Agustín de Iturbide and Vicente Guerrero, the Convention (or Treaty) of Córdoba (August 24) signed by Iturbide and Viceroy Juan O'Donojú, but not ratified by Spain, and the Act of Independence (September 28) signed by the governing junta, which tended to organize the new state as a monarchy; and, after the fall of the ephemeral empire of Iturbide, the liberator of Mexico, the Constitution of 1824. The constitution, which had been inspired mainly by the United States model and showed some influence of the Spanish Constitution of 1812, founded a democratic, representative, federal republic. This gave rise to a long-standing conflict between monarchists and centralists, those who favored a unitarian, not federal, government, on one side, and republicans and federalists on the other.

Following the trends of this struggle, the Siete Leyes Constitucionales (Seven Constitutional Laws) of 1836 and the Bases Orgánicas (Organic Bases) of 1843, both of which were constitutional changes, marked a return to republican centralization, and the decision of the Junta de Notables (Assembly of Notables) of 1863, a return to monarchic centralization under Maximilian of Austria. On the other hand the Acta de Reformas (Reform Act, amendments to the Constitution of 1824) drawn up in 1847, and the Constitution of 1857 insisted on a federal republic. This prevailed in the end, after the execution of the Emperor Maximilian in 1867.

Constitution of 1917.—The Revolution of 1910, which put an end to the regime of Gen. Porfirio Díaz, led to the proclamation of the Constitution of 1917. This turned out to be a revision of the one of 1857, and curbed the latter's excessive individualism, having very definite social tendencies, especially as regards certain public rights (such as freedom of commerce), the right to own land, and industrial relations. This constitution, which is still in force, although it has undergone various reforms, upheld a republican government which is democratic, representative, and federal, with a threefold division of power (executive, judicial, and legislative), and a presidential system. The federal authority has no power other than that granted by the constitution, since all other power is understood to be the prerogative of the member states of the federation. Nevertheless, it sets forth the principles to be observed by the various state constitutions in the organization of their governments, which must be democratic, representative, with a division of power, and have as the basis of political and administrative division the free *municipio* (municipality).

The constitution includes a chapter declaring fundamental public rights (limitations to the activities of public power), in which are named various individual guarantees. It is of a rigid type: the approval of two thirds of the members of both houses of the federal Congress, as well as of a majority of the legislative councils of the states of the union, is needed for any change in its provisions.

Legislature and Executive.—The Congress of the Union, made up of two chambers (Representatives and Senators), whose members are elected by popular vote, is vested with the legislative power. Apart from having the powers usually vested in a federal legislative body, it may also legislate on such matters as education, commerce, labor, mining, and on everything concerned with the territories and the Federal District, which is the residence of federal power and includes Mexico City. The president of the republic, who is elected by direct universal suffrage, is the head of the executive administration; he appoints and discharges the members of his cabinet, and he alone can issue directives for the enactment of and compliance with the law. (See also the section *Government.*)

Judiciary.—The federal judicial power is vested in the district judges (*jueces de distrito*), circuit courts (*tribunales de circuito*), and the Suprema Corte de Justicia de la Nación (Supreme Court). Their principal function is to watch over adherence to the constitution through the traditional *juicio de amparo* (judgment of protection), the most valuable and useful creation of Mexican law, the object of which is to repeal, on the petition of the interested party and only in so far as concerns the individual in his particular case, the ruling of any authority, executive, legislative, or judicial, state or federal, which may be against the constitution because of a violation of fundamental public rights guaranteed by the constitution, or because a federal ruling encroaches on the prerogatives of the states, or a state ruling encroaches on federal prerogatives. Any precedents set in five rulings of the Supreme Court in five similar cases are considered binding on the courts of the whole republic, except for the Supreme Court itself, which may alter later decisions, explaining whatever reasons it may have for such action.

Social Provisions.—Constitutional provisions relating to real property, trade, and industrial relations have been the source of numerous laws supplementing the principles of the constitution, such as the Ley sobre Monopolios (Monopoly Law) of 1931, Ley Federal del Trabajo (Federal Labor Law) of 1933, Código Agrario (Agrarian Code) of 1934, Ley del Seguro Social (Social Security Law) of 1943, and Ley de Facultades del Ejecutivo en Materia Económica (Law of the Powers of the Executive in Economic Matters) of 1950. The inclusion of these provisions in the constitution is explained by the desire of the constituent power that came from the revolution to make them prevail over changes of government.

Private property is guaranteed, and may be expropriated only by reason of public utility and with indemnity. But the state may impose on property such limits and regulations as are compatible with the public interest, and it may control the exploitation of those natural resources (such as minerals) susceptible of appropriation, in order to achieve a fair distribution of public wealth and its conservation. To this end, and in

order to solve the agrarian problem, the state may order large estates to be broken up, may foster the development of small agrarian properties, and may create new centers of agricultural population. Agrarian legislation is directed mainly to restoring to villages the communal water and land of which they were deprived in the past, and to providing them for communities that do not already possess them, taking them from neighboring property, but without harming the small units already in existence. Such land is subject to special provisions which aim at full private property. Apart from this, the nation is the sole owner of all mineral deposits and, except for petroleum, may grant the rights of exploitation to private persons. Petroleum is exploited exclusively by a state enterprise, Petróleos Mexicanos, an autonomous organization commonly known as Pemex.

As regards commerce, monopolies are forbidden, as well as exclusive control of essential goods, anything that may interfere with free competition in manufacturing or commerce, any action aimed at raising prices, and generally anything intended to give exclusive or undue advantage to one or several persons, to the detriment of the general public or of a particular social class. In the exercise of this principle the law allows the setting of ceiling prices for goods considered as essential, compulsory sales, and even in some cases the control of sources of production. At the same time, official organizations have been set up to compete in inland and international trade. These enjoy special privileges and franchises not granted private tradesmen.

As regards labor, workers are protected with respect to working hours, place of work, minimum wages, holidays, and unjustified dismissal, and are provided with social security against sickness of the worker or his family, invalidism, unemployment, old age, and with death benefits. These are brought about through individual, collective, or industrial contracts, which may never be lower than the minimum advantages which the law grants labor. Minors and women workers are also protected, and the right to strike or stop work for causes specified by law is granted. There are special tribunals to try labor conflicts, and their decisions are binding. See also the section *Economic, Industrial, Agricultural, and Financial Factors* (Modern Economic Policy).

CIVIL LAW

Until 1870 Mexican civil law was essentially the same as Spanish civil law, which was in force when independence was declared (1821). The Código Civil para el Distrito y Territorios Federales (Civil Code for the Federal District and Territories) was published in 1870, and this was soon replaced by another in 1884, which was in turn replaced by that in force, which dates back to 1932. The states have always adopted for their own use, with slight variations, the Civil Code for the Federal District. This code belongs to the group known as the Napoleonic codes, although it has been influenced by Spanish and Argentine civil legislation, and by the Swiss Code of Obligation. It controls family relations, succession, property, possessions, *derechos reales* (such as mortgages and easements), obligations, and contracts. Together with the recognition of the right to private property and the autonomy of will in contracts, a marked tendency toward the protection of social interests can be observed, getting away from the individualism of the code of 1884.

Commercial Codes.—Spanish law concerning trading matters was also accepted in its greater part until the Código de Comercio (Code of Commerce), applicable throughout the republic, was written in 1884. A new Code of Commerce was published in 1889. Both were along the lines of codes of the Latin countries of Europe, that is to say, Spain, France, Italy, and Portugal. The Code of 1889, however, is now valid only in certain fields, such as general trading operations, maritime commerce, and mercantile lawsuits, since, while awaiting the issuance of a new code, several laws have been passed which replace some of its chapters. The most important of these laws are the laws on: Títulos y Operaciones de Crédito (Securities and Credit Transactions) of 1932; Sociedades Mercantiles (Corporations) of 1934; Contrato de Seguro (Insurance Contracts) of 1935; Instituciones de Seguro (Insurance Concerns) of 1935; two measures relating to national financial institutions, Nacional Financiera (1940) and Banco de México (1941); Instituciones de Crédito y Organizaciones Auxiliares (Banking Institutions and Auxiliary Organizations) of 1941; Quiebras y Suspensión de Pagos (Bankruptcy and Suspension of Payments) of 1943; (and Instituciones de Fianzas (Bonding Companies) of 1950. It cannot be said that this new mercantile legislation follows a definite school, but Italian influence is predominant.

Penal Codes.—Excepting occasional decrees mainly of a political character, Spanish penal law continued to be applied in Mexico until the first Código Penal para el Distrito y Territorios Federales (Penal Code for the Federal District and Territories) was published in 1871. It followed the theories of the classical school and, as regards procedure, adhered to the fundamental rights of the defendant, clearly set out in the declaration of rights of the Constitution of 1857. This code remained in force until 1929, when it was replaced by the Código Penal and the Código de Procedimientos Penales (Code of Penal Procedure), which followed the most modern theories of the time. As these were found difficult to execute in the Mexican environment, they were in turn abrogated and replaced in 1931 by codes having the same names. The codes of 1931, also based on new ideas concerning penal matters, but of an eclectic nature, are more practical and have survived with practically no change. The states have largely adopted the penal legislation of the Federal District.

Summing up, it can be said that Mexico enjoys legislation that is modern in every branch, but is relatively unsettled because of the special political, social, and economic conditions of a country which is in the process of development and which has not yet worked out a system that may be called fully its own, fitting its particular idiosyncrasy.

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13. NATIONAL DEFENSE. The armed forces of Mexico, as well as the whole country, have undergone a radical evolution, in accordance with advances throughout the world after World War II. The Secretaría de la Defensa Nacional (Department of National Defense) and the Secretaría de la Marina Nacional (Department of the Navy) were created on Dec. 1, 1940. These agencies had previously been joined together, under the title of the Secretaría de Guerra y Marina (Department of War and Navy).

Navy.—The Department of the Navy includes not only the fleet but also the merchant marine, and the bureaus of Obras Marítimas (Maritime Works), Dragado (Dredging), and Faros (Lighthouses) which previously belonged to the Secretaría de Comunicaciones y Obras Públicas (Department of Communications and Public Works), as well as the Departamento de Pesca (Bureau of Fishing), which had formed part of the autonomous Departamento de Caza y Pesca (Department of Hunting and Fishing). Thus, everything relating to the sea has been brought under the control of one department of the government.

The navy constructs its own lighthouses. On July 24, 1951, the port works of Mazatlán were completed, permitting the entry of ships drawing 24 feet of water. A dry dock functions at Salina Cruz, Oaxaca, for ships of 20,000 tons displacement, and another for 10,000-ton ships is in service at San Juan de Ulúa, in the port of Veracruz.

There are eight naval zone headquarters. On the Gulf of Mexico are the First, at Tampico; Third, at Veracruz; Fifth, at Carmen; and Seventh, at Mujeres Island. On the Pacific are the Second, at Margarita Island; Fourth, at Guaymas; Sixth, at Manzanillo; and Eighth, at Acapulco.

The naval academy, Heróica Escuela Naval Militar, formerly in the city of Veracruz, is at Antón Lizardo, Veracruz, in buildings completed in 1952. These are also the site of the Naval War College. The instruction imparted at the naval academy is considered among the best in the world in its field. There are also a naval aviation school at Veracruz and a school for sailors at Mazatlán. For the merchant marine, the Fernando Siliceo Nautical School at Veracruz is provided by the Department of the Navy.

The naval units are: 4 frigates, 3 gunboat-transports, 1 transport, 21 coast patrol craft, 4 auxiliary coast patrol craft, and 2 auxiliary ships. There is one marine battalion, and marine detachments, in each naval zone. The navy has about 8,000 men.

Army.—The army and its air force have achieved a notable progress in the years since 1940. The army takes considerable pride in its origins during the Revolution of 1910. By modern standards, its training and discipline place it among the best in Latin America. New officers for the army are procured from the graduates of the military academy, Heróico Colegio Militar, at Popotla, Federal District. There are also the following service schools: engineer, medical, signal, cavalry, noncommissioned officers, male nurses, nurses, and the Escuela Superior de Guerra (War College) in Mexico City; the latter being the highest level of studies in the army.

The regular army units are: 1 infantry division, 1 mechanized brigade, 1 mechanized cavalry regiment, 1 mixed brigade of presidential guards, 51 infantry battalions, 20 cavalry regiments, 2 artillery regiments, 3 independent artillery companies, 1 coast artillery battery, 2 battalions of combat engineers, 1 radar observation company, 1 signal battalion, and 1 quartermaster battalion. The corps of engineers is divided territorially into 8 engineer districts. The army and air force number about 60,000 men, exclusive of those called to the colors under the national military training program.

There is a central military hospital, modern in every respect, and an isolation hospital, both located in the capital, and six other military hospitals distributed throughout the republic. Mexican military surgeons enjoy great professional prestige.

Air Force.—This arm is part of the army, but has its own tradition—not only because the 201st Fighter Squadron fought on the Pacific front in World War II with the forces of the United States and other Allied nations, but also because Mexican pilots were the first to drop aerial bombs on warships, in 1913 during the revolution. It is composed of: 4 groups, 1 training group, 10 separate squadrons, and 1 battalion of paratroopers. Schools operated are the military flying school at Guadalajara; and the meteorology school, aviation mechanics school, and the parachutist school company at Mexico City.

National Military Service.—On Aug. 20, 1940 universal military training was commenced, obligating all 18-year-old youths to receive one year of basic training in the army. The draftees are organized under reserve officers into 43 infantry divisions, each of 3 regiments, plus 8 nondivisional regiments, all distributed according to population throughout the nation.

Military Territorial Divisions.—By a presidential decree of Feb. 20, 1952, the national territory was reorganized and divided into nine military regions (later one more was added), each commanded by a lieutenant general. Thus the 32 military zones, previously the base of territorial division, were subordinated to the respective regional headquarters, located as follows: the First, at Mexico City; Second, at Veracruz; Third, at Mérida, Yucatán; Fourth, at Ixtepec, Oaxaca; Fifth, at Guadalajara; Sixth, at Tijuana, Lower California; Seventh, at Hermosillo, Sonora; Eighth, at Torreón, Coahuila; Ninth, at Monterrey; and Tenth, at Irapuato, Guanajuato.

Military Industry.—On May 1, 1947 the Law of Secretariats and Departments of State was revised, creating the Departamento de la Industria Militar. This cabinet department is charged

with the operation of the munitions and arms factories which supply the national armed forces.

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14. EDUCATION. Pre-Hispanic.—When the Spaniards led by Hernán Cortés conquered Mexico, they encountered among the natives a fairly well-organized system of education. The education of the Maya and Aztec populations may serve as typical examples, although they are not the only Indian educational systems that might be mentioned.

Mayan education, which like science, was entrusted to their priests, was the medium through which religion and scientific learning were transferred to new generations. It is known that these learned men achieved a notable exactitude in astronomy and mathematics, and that their literary, architectural, and artistic achievements in general were of a high order. None of this could have been accomplished without an organized and efficient educational system.

Among the Aztecs, infant education was under the care of the parents, who were charged with responsibility for the physical development of their children, in conformance with a plan which indicated even the quantity of food that should be given to children and the exercises and tasks that gradually were to be entrusted to them.

The education of the Aztec people was imparted in three types of schools: the *calmecac,* the *telpochcalli,* and the *cuicalco.* The *calmecac,* joined to the great temple of the Aztec capital, Tenochtitlan, was a school for the children of both sexes of noble families, priests, military chiefs, and merchants. The education given in the *calmecac* was oriented toward the formation of public officials of the state, the priesthood, and the upper hierarchies of the army. The youths studied there from the time they were 15 until they became 22. Young girls studied in accordance with their own program appropriate to the social function of their sex, and remained in the *calmecac* completely separated from the males and under the care of instructors. The studies in the *calmecac* embraced astronomy, cosmogony, reading of the calendars, arithmetic, singing, dancing, civil and penal procedures, and military instruction.

The *telpochcalli* was an academy of the popular type; there being one in each section of the city of Tenochtitlan. At the age of 15, the sons of farmers and artisans entered these schools, remaining in them until they were 22. The teaching was oriented toward the formation of good soldiers and army officers. It consisted, fundamentally, in a gradual series of severe physical exercises to keep the students healthy and to make them strong. Knowledge of use of arms and training for combat were also taught; the latter included practice in real battles under the direction of an experienced chieftain. The excellence acquired in these practices was rewarded by distinctions which gave the young man the right to use insignia and to hold military rank. These aided the man ultimately in his entry into the army.

The *cuicalco* was a kind of general school where all the other young people of both sexes were concentrated to learn songs, dances, and religious rites under the direction of priests and matrons.

In general, Aztec education exalted the warlike virtues, respect for parents and hierarchical superiors, the cultivation of a rigid morality, the formation of religious feeling, and love of country.

Colonial.—Once the Indian peoples had been subjugated, the conquerors showed an inexorable determination to destroy the cultural institutions of the conquered. This determination is explained as a means of preventing a political and social resurgence of the conquered peoples and as a method of imposing the Catholic religion, whose propagation had been the moral justification of the conquest. As the Mexican education was intimately connected with the old religion and as it was directed toward the formation of a haughty and aggressive spirit, it was logically the target of the intolerance of the dominators.

The various religious orders that were coming to the colony founded schools in the various cities and monopolized education during the entire colonial epoch.

The new education, established in the country during the three centuries in which it was called Nueva España (New Spain), had well-distinguished characteristics. The first objectives, as far as the education of the people in general was concerned, were those of instructing them for conversion to Catholicism and imposing on them feelings of subjection toward the new social hierarchy and of resignation with respect to their destiny.

Experiments in Indian Education.—In 1536 Fray Juan de Zumárraga (1468–1548), later to become the first bishop of Mexico, with the aid of the first viceroy, Antonio de Mendoza, founded the Imperial Colegio de Santa Cruz de Tlatelolco, just north of Mexico City, dedicated exclusively to the education of Indian children. In the beginning, this school imparted elementary and advanced studies; later it was limited merely to advanced education, and it finally became an elementary school.

The children were taught in their own language, Nahuatl, and their instruction was directed by such eminent men as Fray Bernardino de Sahagún (1499?–1590). The school proposed that the Indians instructed in it be converted into missionaries of the Catholic faith and given the responsibility of going out to convert their own peoples.

Santa Cruz de Tlatelolco had such amazing success that notable Indians imbued with the humanistic spirit left its lecture halls to become teachers of the Spaniards themselves, and eventually they opened their own way to positions as mayors and governors in the colony.

But while progressive and generous spirits existed in the colony, there were many intolerant and distrustful persons in leading posts. The latter became alarmed at the success of Santa Cruz de Tlatelolco and began a decided policy of hostility against the school, until in 1595, they were successful in reducing it to an elementary institution. Its brief existence was nevertheless sufficient to demonstrate graphically the great possibilities of the native population.

In 1540, Vasco de Quiroga (1470–1565), first bishop of Michoacán, founded the Colegio de San Nicolás Obispo, in Pátzcuaro, dedicated to the Indians. In this school also, the teachers spoke to the children in the language of their

fathers, Tarascan, because, as Bishop Quiroga said, this was the only bridge over which he could reach the brain and the heart of the Indians. The teaching of subjects was organized around practical activities. The children practiced agriculture for certain hours; in others, the apprenticeship of crafts. These crafts were those which the great educator felt would best take advantage of the native artisan tradition then extant, the available raw materials, the new experiences that his European culture had brought, and the great artistic aptitudes of his students.

The experiment of Vasco de Quiroga had such a powerful effect and left such a deep impression that, after four centuries, his deeds still live in the minds of his people. Nor have they forgotten the artistic crafts he taught; even today their work attracts the admiration of both Mexicans and foreigners.

University of Mexico.—In 1539, Fray Bartolomé de las Casas assumed the initiative for the creation of a university in Mexico City and took the plan to Emperor Charles V, who in 1551, ordered the foundation of the Real y Pontificia Universidad de México (Royal and Pontifical University of Mexico), granting it the same privileges that were enjoyed by the University of Salamanca, Spain, and a subsidy for its maintenance. It opened its doors in 1553, and the pope confirmed the foundation and privileges in 1555. Thus was born the greatest institution of higher learning in the country, now called, in full, the Universidad Nacional Autónoma de México (National Autonomous University of Mexico). The National University and the University of San Marcos in Lima, Peru, are thus the oldest universities in the Americas.

The 19th Century.—With the consummation of independence in 1821, and for many years thereafter, education underwent practically no alteration, but eventually criticism against a system of education that was monopolized by the clergy and that retained medieval methods of teaching brought on a vigorous change. José María Luis Mora (1794–1850) and Valentín Gómez Farías (1781–1858) were among the ideologists of the new movement.

Gómez Farías became president of the republic in 1833 and immediately initiated an educational reform. A commission, whose duty it was to study the condition in which the centers of education were maintained, in order to propose reforms, found that the University of Mexico was a "useless, unreformable, and pernicious institution."

Until the Liberal triumph in 1865, education was a field in which incidents in the conflict between Liberals and Conservatives were well reflected. The latter were the partisans of a regime of privilege and intolerance in behalf of the Catholic Church and of a social order similar to that of the colony. The Liberals, on the other hand, aspired to a regime of religous tolerance, to the separation of church and state, and to a democratic political organization within a federal system.

While schools supported by the church declined, the Lancasterian Company, which operated through private initiative and with a government subsidy, handled the most important field of study, primary education. The success of the Lancasterian schools, organized in conformity with the ideas of the English educator Joseph Lancaster (for which see LANCASTERIAN SCHOOLS), dominated this field from 1822 to 1890.

In 1865 the Liberals, led by Benito Juárez, triumphed definitively and initiated the reorganization of education. The University of Mexico, which had been closed three times (1833, 1857, and 1861) and reestablished each time, was finally closed in 1865, since it was considered a center of the reactionary mentality; its doors remaining shut until 1910.

Higher education was established in separate professional schools, with the Escuela Nacional Preparatoria (National Preparatory School) as a common basis. The latter school, founded in 1867, taught teaching methods and prepared persons for entry into the professional schools. Its organization, the work of Dr. Gabino Barreda (1818–1881), was founded on the positivistic philosophy of Auguste Comte. It gave special preference to the teaching of the sciences and eliminated all religious or dogmatic teaching; scientific, positive, and demonstrable truth being considered valid against all types of speculative science. The plan of studies followed the order of the Comtian law of the historical appearance of the sciences: mathematics, astronomy, physics, chemistry, biology, and sociology.

To end the influence of the clergy through the educational activities of the priests, normal schools were founded, and the professional teacher, with a specialized preparation, then appeared. From that time, normal schools prepared lay teachers with Liberal views and ideas. Those who directed this movement with notable competence were: Enrique C. Rébsamen (1857–1904), of Swiss origin; Enrique Laubscher, who in 1883 founded the first kindergarten in Mexico; and Carlos A. Carrillo (1855–1903). The educational method in vogue, called the intuitive method, consisted in putting the child in direct contact with things and nature instead of telling him about them. Justo Sierra (1848–1912), undersecretary of justice and public instruction under the regime of Gen. Porfirio Díaz, was the representative of the government in educational matters.

New Education.—By 1920 the revolution which had put an end to the Díaz dictatorship had consolidated its triumph, and in 1921 the Secretaría de Educación Pública y Bellas Artes (Department of Public Education and Fine Arts) was created. It was charged with the development of educational programs and served as an organ of the federal government.

The situation that the new regime immediately encountered may be summed up: (1) a great amount of popular ignorance, with an illiteracy rate of 66 per cent; and (2) a standardized pedagogic organization imported from urban Europe, without adaptation to the necessities and characteristics of Mexico, where a large group of the population is rural.

Government-sponsored education and the educational methods adopted were a reaction against this state of affairs. The government increased, in proportions without precedent, its budgets for education—in 1921 it was four times larger than in 1920 (when it was 2,218,165 pesos); in 1922 it was 13 times larger, and in 1923 it became 15 times larger than in the initial year.

Illiteracy.—To instruct the illiterate adult population, anti-illiteracy (*desanalfabetización*) campaigns were organized and night schools were created. As a result of these efforts, the

proportion of adult illiteracy has been steadily reduced—from 70 per cent in 1910, to 66 per cent in 1921; to 59 per cent in 1930; to 47.8 per cent in 1940, and to 36.68 per cent in 1950.

Rural Schools.—Special schools were created for the rural population, beginning with 85 in 1922. The rural school was defined in 1926 as a school in which it was proposed: (1) to better the conditions of life in the community by teaching better methods of work; (2) to teach less within classrooms and more outside in the community; and (3) to teach a practical program, the knowledge to be learned to be selected according to the necessities of communal life and to be acquired in the course of managed activities to satisfy rural needs. It is not merely a rudimentary education, but a special kind of education for country people, and includes all grades from the lowest to the highest. The aim was to create a secondary educational system, and later to add a higher education. The rural schools were very successful and grew rapidly from practically nothing. In 1949 there were already 18,840 spread throughout the country.

To prepare a teaching personnel adequate for the rural schools, regional normal schools were founded; however, these were unable to produce teachers in proportion to the number of schools that were being created, and many persons without previous preparation had to be accepted. To prepare the latter group, the Instituto Federal de Capacitación was created in 1945. Their needs are being met by means of a combination of courses by mail, and short, intensive periods of study in classes.

Cultural Missions.—The *misiones culturales* were created in 1923 with a view to reducing the differences in conditions of life between city and country. Various specialists, such as agronomists, hygienists, social workers, technicians, and others, under the direction of a normal school teacher, went to the more distant and undeveloped places, which they themselves chose. There they developed programs for the improvement of economic and social life in the community, working with the citizens. The latter, upon cooperating in the program for their own betterment, learned superior methods of work and life, whose value is lasting.

Indian Education.—Indian education is focused in a special manner, since at an early date the conviction was reached that the imposition of the Spanish language on the Indian population, which speaks a variety of tongues, is not an adequate way to educate the Indian, because it produces resistances, and stumbles upon other difficulties that neutralize the effort. On the other hand, it is much easier to impart useful, scientific, and technical knowledge in the mother tongue, achieving an immediate educational influence, while at the same time opening an accessible and interesting way to learn Spanish, and a sure way of integrating the rural Indian peoples into the national community. Complementing this educational program, periodicals are published in the native languages at experimental centers. These publications have had spectacular results.

Toward a Mexican Pedagogy.—In 1925, the Departamento de Psicopedagogía e Higiene (Department of Pedagogic Psychology and Hygiene) was created, which in 1939 was transformed into the Instituto Nacional de Psicopedagogía (National Institute of Pedagogic Psychology). The institute's mission is that of organizing scientific investigations into Mexican social and scholastic methods. It is proposed eventually to build up a pedagogy that answers to reality and is not merely an exotic importation. In the same spirit, the Instituto de Perfeccionamiento de Maestros de Enseñanza Secundaria (Teacher's Institute of Secondary Instruction), transformed later into the Escuela Normal Superior (Superior Normal School), was founded in 1937 for graduate teachers to improve their work.

Higher Education.—The disputes between radicals and conservatives that made the life of the university so unfortunate in the 19th century were resolved in 1929 by giving legal autonomy to the National University and a substantial subsidy from the government for its maintenance. The course of studies in the humanities and in the formation of the liberal professions of the traditional type has been left to the university. Under these conditions it prospers, and has also been converted into the leader of the network of other universities established in the principal cities of the country.

On the other hand, the aspiration toward a higher education that would place the more advanced scientific knowledge and technique at the service of the industrial development of the country, noted before in the Liberal ideologies of the 19th century, was made a reality with the establishment (1936) of the Instituto Politécnico Nacional (National Polytechnic Institute) in Mexico City during the administration of President Cárdenas. Built upon the same basis as the national institute, but with adaptations to local necessities and resources, local technological institutes exist in various states and others are being set up. Among the most noted of these educational centers are those at Monterrey and Guadalajara.

The education of technicians in the field of agriculture and cattle raising relies upon various agricultural schools of the middle grades, in whose courses more than 5,000 students are enrolled, and upon three schools of the upper levels. The latter are the Escuela Nacional de Agricultura, located in Chapingo, State of Mexico, and the agricultural schools of Narro, Coahuila, and Ciudad Juárez, Chihuahua. The first named dates from 1854; all the others are the work of the educational reforms which grew out of the revolution.

Educational Policies.—The development of the contemporary educational work which has been described does not follow a constant rhythm, either in intensity or in technical organizational efficiency. The economic vicissitudes of the government and the greater or lesser progressivism and interest of the political leaders in office have made the intensity and the effectiveness of the educational endeavor variable. The impulse given to education by presidents Obregón (1920–1924), Calles (1924–1928), and Cárdenas (1934–1940) should be mentioned, since during their administrations education received a generous attention, expressed in the large portions of the general government budgets designated for its use.

The first secretary of public education in the constructive era of the revolution was José Vasconcelos, from 1921–1924, but the credit for orienting and constructing the new Mexican education along definite lines goes to the group of professional teachers who constituted the staff of the Secretaría de Educación Pública during the more fruitful years. Distinguished teachers gathered around Professor Lauro Aguirre (1883–1928), who edited the magazine *Educación.* Among these was Professor Moisés Sáenz (1888–1941), who was

undersecretary of public education (1925–1930), in the administration of General Calles, which, in fact, implied responsibility for the technical direction of the programs. Lauro Aguirre was placed in charge of the preparation of new teachers in the reform of normal-school education, and Alfredo Uruchurtu (1884–1940) became the chief administrator of this program. José María Bonilla (1872–) and later Rafaél Ramírez (1885–) were in charge of organizing rural education. José Guadalupe Nájera (1889–) assumed the office of chief of the cultural missions. Other posts of similar importance were occupied by professors Manuel Barranco (1881–1945), José Arturo Pichardo (1863–1933), and Leopoldo Kiel (1876–1943). This is the team which, from the technical-pedagogical point of view, effected the most skillful, transcendental, and ample work of education in the history of Mexico.

In more recent years, with the start (1940) of the administration of President Ávila Camacho, the vigorous rhythm characteristic of the early years has yielded to a slow decline, as a consequence of the practical exclusion of professional teachers from the direction of educational endeavors. Their successors have not had a clear and deep vision of the meaning of the new educational institutions; thus they did not continue the development of those institutions with the same enthusiasm and ability. Their lack of deep concern for education is shown by the following data.

The financing of education took 6.78 per cent of the general expenses of the federal government in 1950. For this same work, 13.35 per cent of the general budget was applied in 1937, while in 1923 it was 15 per cent. This has necessarily affected the quality and the amplitude of the service. In 1950, for example, the proportion of the population of primary school age being adequately instructed was reduced to 44.6 per cent; contrasting with 54.7 per cent in 1938 and 71.8 per cent in 1939.

There are, nevertheless, reasons for thinking that this period of decline will be transitory and that Mexican education will recover the progressive momentum that was earlier achieved, and which distinguished the Mexican nation.

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15. CHURCH AND STATE. Relations between church and state in Mexico have passed through a multitude of vicissitudes which have oscillated between complete harmony and open war. To understand the situation of those relations in modern times it is necessary to know the historic antecedents. For the purposes of this article, therefore, the study has been divided into six historical periods.

Indian Basis.—The tyrannical and primitive political forms which the Spaniards encountered in that part of the New World which today is the Mexican Republic were of a theocratic and warlike type, with diverse shadings among the different peoples. All of them were idolatrous, but particularly so were the most powerful, the Aztecs, who dominated the Central Plateau, and who practiced a barbaric worship based on human sacrifice and even cannibalism, in which the number of victims came to 100,000 annually. Although they had priests and warriors as different social castes, a real institutional distinction between political method and religious organization did not exist.

Discovery and Conquest.—The Catholic monarchs, Ferdinand and Isabella, and afterwards Charles V and Philip II, as also their successors, took an apostolic view of the discoveries and conquests that, beginning with Christopher Columbus, they made in the New World. Thus, with respect to the conquest, they considered the propagation of the Christian faith in the newly discovered lands as their primary duty.

Hernán Cortés and the other conquerors were nearly always accompanied by missionaries. They not only required of the Indians submission to the king of Spain; they also destroyed temples and idols in order to uproot the sanguinary religion of the Indians and asked them to adopt the Catholic faith. In other words, the Spanish state patronized the conversion of the Indians. It also prescribed wise laws for the incorporation of these Indians into Christian civilization. In spite of this, however, the conquerors and the delegates of the Spanish government committed many real abuses; at the same time, the cause of the natives was continually defended by the missionaries, such as Fray Toribio de Benavente (known as Motolinia), and by bishops like Juan de Zumárraga and Vasco de Quiroga.

In the work of evangelization undertaken in America, the Spanish crown received special privileges from the church, which allowed it to intervene in ecclesiastical discipline. Among these were the concession of tithes, the royal Indian patronage (*patronato real*), and the tribunal of the Inquisition. The tithes—or rather the proportion of the gross products of the fields and herds—that the inhabitants paid to the church for the support of its personnel, its worship, and its pious works were granted to Spain by Pope Alexander VI in 1501. In return the church imposed on the government the obligation of defraying these expenses. The rulers accepted the concession, but retained only two ninths of the collection, leaving the balance to the church.

The Bull *Universalis Ecclesiae* issued by Pope Julian II in 1508, and the wide interpretation that the Spanish monarchs gave to it, allowed them, among other things, the right to present candidates to fill the bishoprics and ecclesiastical offices, to issue royal licenses before churches, monasteries, and hospitals could be built, and to issue governmental permits before the bulls and other papal documents could be published and obeyed in the Indies. Numerous unjustified acts were committed by the kings and their officials in the government of the church in New Spain (Mexico) under the pretext of this royal patronage.

For its share, the government endeavored to prevent people who did not profess the Catholic faith from going to New Spain, with the end of maintaining the unity of the faith. Within this policy Philip II, by royal decree in 1569, established the Holy Office of the Inquisition in

New Spain, with the object of preserving the religious unity of the area, isolating heretics, and punishing their errors with the rigor demanded by the laws of the crown. Many have exaggerated the cruelty of the procedures and the penalties of the Inquisition, which in reality were ordinary for that period. From the solemn foundation of the tribunal until its suppression in 1820, only 36 persons were delivered by that tribunal to the secular arm for capital punishment by burning; this in 11 *autos de fé* from 1574 to 1715. After the latter year no death sentences were imposed.

Colony.—French influence and the organization of Freemasonry drove the Spanish government, in the last third of the 18th century and the beginning of the 19th, to a cooling of religious ardor and to a growing intervention in church affairs, which culminated in the Spanish Constitution of 1812 and in subsequent policy, all of which was reflected clearly in New Spain until that colony gained its independence in 1821. One of the most evident earlier manifestations of this change in religious policy was the dissolution and expulsion of the Jesuits from the Spanish dominions in 1767, during the reign of Charles III, and the occupation by government officials of the property belonging to that order, which was one of the most prosperous and active and was dedicated principally to teaching. Mention should also be made of government obstruction, in Spain and in the colony, to the extension of teaching and welfare work, which until then had been completely in the hands of the church and the religious orders. Some of the latter had to withdraw from New Spain or were deprived of their buildings by the government on the pretext of benefiting the national economy, and were fenced in with obstacles that impeded the discharge of their responsibilities.

Independence.—The people of New Spain and their leaders had remained eminently Catholic. It was very natural, therefore, that the Catholic religion should be the only one permitted and protected by the laws—in the constitutional project elaborated at Apatzingán under the direction of the insurgent José María Morelos in 1814 during the struggle for independence; in the Plan of Iguala, which served as a basis for the effective realization of independence in 1821, and was drawn up principally by Agustín de Iturbide; and even in the republican Constitution of 1824, written after the fall of Iturbide, who had been proclaimed emperor in the interim. The first independent governments sought to preserve privileges, such as the royal patronage which the kings of Spain had enjoyed in matters pertaining to religion, but were not successful.

The attack on the privileges of the Catholic Church was initiated—at first secretly, then in public form—principally because of the influence of Freemasonry established in Mexico. In 1833 the vice president of the republic, Valentín Gómez Farías, acting as president by permission of President Antonio López de Santa Anna, issued a series of expanding decrees to oppress the Catholic Church and to deprive it of its privileges. Among other measures, it dissolved the Royal and Pontifical University of Mexico (founded 1551) in the capital, secularized learning, and above all sought to interfere directly in parish affairs. A general clamor and various armed uprisings obliged President Santa Anna to intervene (1834) and to abandon some of these arrangements. Nevertheless, Gómez Farías, without success, had planned to nationalize the property of the church and to convert the priests into functionaries paid by the government.

Constitution of 1857 and Reform Laws.—There was a short period of harmony on the religious question until, triumphant in the Revolution of Ayutla (1854–1855), the ultraradical Liberals came to power. Under the presidency (1855–1857) of Ignacio Comonfort, plain civil war existed between the Conservatives, friends of the church, and the Liberals, their enemies. In 1855 Benito Juárez, as minister of justice and ecclesiastical matters, put forth a law which disentailed property held in *manos muertas* (mortmain), which obliged corporations, especially religious corporations, to sell their properties. A little later, in 1859, nationalization of all the property belonging to religious corporations was decreed. This, made under the pretext that the church, enormously rich, had abused its power by intrigues in politics, had as its only object the crushing of the church; as a result many politicians and foreigners became rich, buying up many of its lands at low prices. A great number of churches, schools, and hospitals were converted by the government to other uses.

Meanwhile, the Liberal Party in power had promulgated the Constitution of 1857. This established liberty for all religions and freedom of education, to stimulate the rivalry with Catholicism, deprived the priests of civil rights, disregarded the religious orders and gave the federal government the right to intervene in matters of religious procedure and in relations between the clergy and the people. With the civil war newly started again, the government led by Benito Juárez set forth the laws called the Reform Laws (1859–1860), which included the law nationalizing the property of the clergy and carried to an extreme the reprisals against the Catholic Church. After the downfall of the imperial adventure of Maximilian of Austria, whose regime (1861–1867) did not basically alter the religious situation, even though it tempered it notably, the Liberal Party remained definitively the victor, and in 1874 had the Reform Laws included in the constitution.

A long period of peace came in 1876, under the rule of Gen. Porfirio Díaz, the "strong man" who remained in power until 1911, when he was overthrown by the revolution led by Francisco Madero. During the regime of Díaz the laws against the church were maintained with vigor, but the church enjoyed, *de facto*, sufficient liberty, although certain policies of oppression were carried out, such as disregard of the legal status of ecclesiastical corporations, and prohibitions of public religious ceremonies outside the churches and of the use of special dress by priests and religious officials.

Constitution of 1917 and Its Application.—The Revolution of 1910 was not antireligious in origin, but it became so in a series of movements which culminated in the Constitution of 1917. The new constitution carried to the extreme the attacks on the church contained in the previous Constitution of 1857. Nevertheless, its provisions were not forcibly applied until 1926, the year in which President Plutarco Elías Calles let loose a true persecution against every kind of religious manifestation, commencing with limiting the number of priests to a ridiculously small figure, prohibiting foreign priests from performing the sacred offices in Mexico, as well as preventing all religious rites and religious instruction in private schools and even in homes; all under the threat of severe penalties, since all infractions of the laws on religious matters were considered criminal.

The clergy chose to suspend all ceremonies. A popular rebellion (the so-called *Cristero* movement) opposed the law for three years, but did not overthrow the government; because the latter was aided by foreign governments, the *Cristeros* could not obtain arms. Finally, in 1929, President Emilio Portes Gil reached an understanding with the church. Although the persecuting laws were not repealed, they were not applied in large part, or were executed with tolerance.

The church was again attacked in 1934 at the beginning of the administration of President Lázaro Cárdenas, principally in the matter of instruction. The Marxist tendency of the government led it to impose socialistic and antireligious education, and even to amend the constitution in that year.

From 1937, however, the *de facto* situation of the church and of religious matters in general has much improved. Relative liberty is enjoyed, since the antireligious laws that are in effect are in large part not applied, and the legislation relating to Marxist education was abolished in 1942–1946. As of 1952, benevolent, although unofficial, relations exist between church and state. From the constitutional and legal point of view, everyone may profess the religion of his choice in Mexico, but the public religious ceremonies must be held within precincts of the churches, in accordance with regulations that are dictated by and are under the vigilance of the authorities. Ecclesiastical corporations lack legal capacity and are not able to acquire property either directly or indirectly. All buildings dedicated to worship or religious education have been converted into national property. The priests do not have political rights, nor can they dedicate themselves to teaching or charity work. Both public and private religious education in the schools is prohibited.

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16. PRE-HISPANIC ART. Mural Painting.—The great epoch of Indian mural painting, as far as both quantity and quality of output are concerned, coincides with the period which archaeologists label "Classic" (300 A.D. to 900 A.D.). At Teotihuacán, the great metropolis of central Mexico, a large number of murals have been discovered already, and it seems likely that more will come to light in the future. It is possible to distinguish an early style of painting at this site. This is found in a building which may be dated at 200 A.D. Its mural decoration is based on interlocking geometric designs with some symbolic religious motifs. The most recent style (dated roughly from 400 to 800 A.D.) is naturalistic, but not realistic. The content of the paintings is religious: they represent gods, priests, and sacred animals. Plants are also represented and some paintings even contain suggestions of landscapes. One of the most outstanding scenes represents the paradise of the water gods. Its liveliness of composition contrasts with the usual hieratic rigidity of Teotihuacán art.

The style of these paintings is characterized as follows: areas of flat colors delimited by contour lines; absence of modeling; no attempts to suggest space through the use of perspective or by other means. The technique used is partly fresco, partly tempera, on a base of calcium carbonate mixed with finely ground quartz sand. All the colors analyzed are mineral colors. Red was probably produced with hematite; yellow and orange with limonite and goethite; black possibly with magnesite; green with malachite or azurite. Reds were painted directly on the wet surface of the wall; greens were never painted in this fashion, but were applied as tempera over the white surface formed by the dry base. The application of transparent green on this white base results in a particularly brilliant green.

The murals of the big tombs of Monte Albán near Oaxaca (tombs Nos. 103, 104, and 105) belong to the same period. These paintings represent gods and goddesses, or priests dressed in cult ornaments. Here, as in Teotihuacán, the style is hieratic, but lines are drawn with greater freedom. The color scheme includes yellow, red, green, blue, white, gray, and black.

In 1946, ruins belonging to the Classic Maya civilization were discovered at Bonampak, in the Chiapas jungle. Among its buildings is one containing three rooms painted with different scenes. One of these shows richly dressed chiefs; servants dressing other men, perhaps chief priests, in ceremonial costumes; and musicians and dancers. Another gives an impressive picture of a battle and of victorious chiefs, surrounded by their guard, confronting a group of prisoners. The third painting represents another group of chiefs, musicians, and a big dance. Particularly significant is the fact that each of the paintings shows differences in rhythm, composition, and color scheme, according to its special content. The battle scene is characterized by the violent rhythm of broken lines and by somber colors. The scenes in which groups of chiefs appear show a composition of horizontal and vertical lines in equilibrium, and brilliant colors. The dancing scene shows an agitated rhythm of massed colors and undulating lines, which suggest movement. The technique employed in these paintings is also partly fresco, partly tempera. The color scheme includes yellow ocher, Indian red, orange red, burnt sienna, emerald green, dark green, turquoise blue, dark blue, white, and black. The Bonampak paintings are assigned to the 8th century A.D.

To a period after 1000 A.D. belong the paintings of mythological subjects which cover the altars of Tizatlán near Tlaxcala. The figures of gods are painted in the same style as the codices and the polychrome pottery of the Mixtec region of Oaxaca and the Valley of Puebla. This style, therefore, has received the name Mixtec-Puebla. Murals, painted in Mixtec-Puebla style, have also been found at Mitla, near Oaxaca. They represent mythological scenes, painted in red on a white background. An extension of this style toward the north has been found on the altar of Tamuin, in San Luis Potosí, near Valles. This painting, similarly red on white, shows a procession of gods and other figures.

In Yucatán, the murals of the Temple of the

Jaguars and the Temple of the Warriors at Chichén Itzá belong to the period of Toltec influence, from 1000 to 1200 A.D. They depict scenes from the conquest of the country by the Itzá. These pictures definitely show an attempt to depict the landscape realistically, and to convey an impression of spaciousness.

Mural paintings are also found in a number of buildings in the Maya ruins of Tulum, in Quintana Roo. They represent mythological scenes. The Tulum buildings are dated after 1000 A.D.

Another mural, which belongs to the last centuries before the Spanish conquest, decorates one of the rooms in the temples of Malinalco, in the State of Mexico, 25 miles south-southeast of Toluca. It represents a procession of warriors, armed with lances and shields.

Painted Books.—The miniatures contained in the painted books form an important aspect of Indian art; comparable on the one hand to the great art of mural painting, and on the other to some types of decorated pottery. Some of the miniatures show exquisite composition, drawing, movement, and coloring. They were painted on deerskin or on bark paper, dressed with white chalk. They deal with the calendar, ritual, mythology, and history. None of the picture books which have been preserved seem to go back further than 1000 A.D. Nevertheless, remains of similar books, consisting of heaps of alternate layers of thin chalk and powdered paint, have been found in tombs that are several centuries older.

The few pre-Hispanic codices which have survived the ravages of time and men are classified stylistically as follows:

(1) Aztec: The most important of these, from the artistic point of view, are the sections of the *Codex Borbonicus* which deal with the divining calendar and with the ritual of the months.

(2) Historical Mixtec: This group comprises a number of codices, which contain genealogies of Mixtec lords, and depict their acts of prowess.

(3) *Codex Borgia* group: This consists of codices which deal with the calendar, astronomy, divining, and mythology. The codices of groups 2 and 3 are firmly drawn and vividly colored, and differ only slightly in style. According to the art expert Salvador Toscano, this slight difference may be due to their different content.

(4) Maya: These are characterized by freedom of drawing, sensitiveness of line, and by the elegant sophistication of Maya art.

Decorated Pottery and Lacquer Work.—The pre-Hispanic potters did not know the potter's wheel. They usually shaped and modeled pots by hand, but they were also acquainted with the use of molds. A large number of techniques were used to decorate pottery. Due to limitations of space, only three types of decorated pottery will be discussed here: the painted pottery of Tlaxcala, Puebla, and the Mixtec region, produced after 1000 A.D.; the ritual champlevé-decorated pottery of Teotihuacán, produced between about 300 and about 700 A.D.; and stucco-decorated pottery, which is related to lacquer work.

The Mixtec-Puebla style employed in painting polychrome ware is identical with the style used in painting murals and codices in the same regions. The ware is decorated with figures of gods and animals, and with symbolic or simply decorative motifs painted in purple, orange, yellow, blue-gray, white, black, and other colors, and burnished to a high gloss.

The ritual vases of Teotihuacán were often first painted solid deep brown or brownish red, then polished and fired. After firing, the background was scraped away with some sharp instrument, leaving the figures outlined in silhouette and slightly raised above the scraped surface. Details within the silhouettes were shown by incising. The dark colors and brilliant finish of the unscraped portions contrast sharply with the mat background, showing the natural color of the clay or painted with cinnabar. Though not painting, the technique produces the effects of painting in two colors. The figures of gods, priests, religious symbols, and the like used to decorate this Teotihuacán champlevé pottery are the same as those painted in the great murals of the site.

Stucco decoration was applied after the vessels were fired. Two different techniques were in use. The first, called *paint-cloisonné*, was used mainly in western Mexico. A thick coat of paint was first applied over the entire surface of the vessel. This base was scraped to form depressions, and these were filled with the different pigments to be used in the composition. The areas of paint thus imbedded in the base were separated by narrow ridges, in which the base showed through, and which outlined the motifs. In the second technique, successive layers of paint were applied over the vessel. Parts of each layer were cut away to show the portions of the lower layers intended to form the design. Available evidence indicates that this second technique is older than the other. It was used in central and southern Mexico and in Guatemala. It seems certain that some organic adhesive or solvent was used, in both cases, to fix the colors.

These two pre-Hispanic stucco techniques employed to decorate pottery are similar to the lacquer techniques still used in Michoacán and Guerrero to decorate gourds or wood. In Michoacán, the *paint-cloisonné* technique is used, with a varnish made from an insect (*Coccus axin*). In Olinalá, Guerrero, the technique of successive layers is employed, with oil from the lime-leaved sage (*Salvia hispanica*) as the solvent medium. Furthermore, Gordon Ekholm found remains of gourd vessels with *paint-cloisonné* decoration in his excavations in Sinaloa. It cannot be doubted that much lacquer work was done on gourds and wood, but that the perishable nature of the material has made preservation very rare.

Monumental Sculpture.—The majority of pre-Hispanic sculptures were conceived either in terms of compact blocks, or pictorially in two dimensions only. The representation of mass in the three-dimensional terms proper to sculpture is rare in Indian art. The development of a true sense of space in sculpture was inhibited, in some cases, by technical inability to liberate form from the stone. In such cases, the sculptor surrendered to the material. In others, the lack of a true sense of space is due to either conscious aesthetic considerations which conceive form as a closed-in unitary whole, or to functional reasons. A large part of pre-Hispanic stone sculpture was conceived as an integral part of architecture. Therefore flat or low-relief carvings are more frequent than sculpture in the round. However, the same flat conception is found in minor sculpture in baked clay or precious stones; though modeled in the round, these figurines were intended to be seen only from one side.

The so-called *danzantes* (dancers) belonging to the earliest period of Monte Albán are either figures incised on slabs or flat reliefs. In these, the

ngures were made to stand out slightly by carving out the background, though no modeling of any kind was attempted. They represent unusually animated human figures, and are attributed to the beginning of the Christian era or a little before.

The oldest stone sculpture in central Mexico is that of Teotihuacán, dating from about 200 to 500 A.D. Teotihuacán sculpture is wholly conceived in architectural terms; its forms are massive cubes with a minimum of modeling. The reliefs of the Temple of the Plumed Serpent at Xochicalco, Morelos, show greater freedom of form, combined with a more sensual and whimsical style. They are attributed to the 9th century A.D.

The main works of sculpture in the ruins of Tollan (modern Tula), the Toltec capital, are flat reliefs on the fronts of the great pyramid and on the pillars of the portico of the temple. Even the colossal warriors which also supported the portico, though carved in the round, were sculpted following the techniques employed in flat relief. The Toltec period dates are from about 900 to about 1200 A.D.

Only during the last centuries before the Spanish conquest did monumental sculpture reach its zenith in central Mexico, both in quantity and quality. There exist remarkably realistic, austere, and expressive works of this period. Some achieved great economy of form, such as the head of the eagle knight, in the Museo Nacional de Antropología in Mexico City. Others are noteworthy for the sense of movement achieved within a compact block and for their plastic modeling, such as the figure of Quetzalcoatl in the Musée de l'Homme in Paris; or the great Coatlicue, the earth goddess, in the Museo Nacional de Antropología, in which the abundance of detail and the sophistication of execution do not detract from the grandeur of the whole.

There are few examples of the sculpture of the Huastec area of northern Veracruz and of the adjacent zones of San Luis Potosí and Hidalgo. From the Totonac region, north central Veracruz, the reliefs of the site of El Tajín, carved between 600 and 900 A.D., are noteworthy. Sculptured stone yokes, the so-called palmate stones ("palmas"), and flat stone representations of heads or complete figures in profile are also called Totonac, especially when they bear characteristic scroll designs. However, the area of distribution of these objects is much wider than the historic Totonac area.

The Olmec area of southern Veracruz and western Tabasco is famous for its colossal heads, for monolithic altars carved with figures in high relief and for other sculptures from Tres Zapotes, San Lorenzo, and La Venta. Another masterwork of Olmec statuary, and one of the best pieces of ancient Mexican art, is the figure called *The Wrestler*. It represents a man dressed in a loincloth, seated on the ground, apparently stretching his shoulder and arm muscles. The statue is truly three-dimensional in conception and was executed with great mastery of form and movement. It was found in Minatitlán, Veracruz, and belongs to a private collector in Mexico City. The dating of Olmec sculptures remains controversial; nevertheless, there are grounds for dating them between 300 and 600 A.D.

In the part of the Maya area now in Mexico, Palenque, Chiapas, is outstanding for the quality of its stucco reliefs and stone carvings. The stucco decoration is executed in deeply carved relief, with an extraordinary plasticity of forms. The stone carvings are flat relief or slightly modeled low relief. They were painted, and are thus classifiable more as painting than as sculpture. The carvings of the altars of the Temple of the Cross (dated 642 A.D.), the Temple of the Sun, and the Temple of the Foliated Cross (dated 692 A.D.) are well known. During excavations made in 1952 a similar carving was found in a secret chamber in the Temple of the Inscriptions. This stone covered a monolithic sarcophagus in which a great personage was buried. Palenque art is characterized by its naturalistic style, the grace and refinement in the representation of human form and movement, and its decorative splendor. The carvings show an extraordinary sensitiveness of line. Paradoxically, the carvers of Palenque were not sculptors, but excellent draftsmen who, like Hans Holbein the Younger, and Jean Auguste Dominique Ingres, used line to produce the illusion of mass. Many carvings in flat relief or low relief cover the steles, lintels, jambs, and panels of other ruins in the Maya zone of Chiapas, Tabasco, and the Peninsula of Yucatán. These belong to the middle Classic or late Classic periods (about 500 to 900 A.D.). Later, Toltec influence reached Yucatán. This is exemplified by the carvings and sculptures of Chichén Itzá (about 987 to about 1204 A.D.).

The sculpture of Michoacán is known from a few examples only. They tend to be cubic in shape and are schematically and roughly worked.

Ceramic Sculpture.—Sculpture in Mexico begins with the hand-modeled figurines of baked clay belonging to the Archaic period, which lasted to about the time of Christ. The oldest ones seem to be expressions of a fertility cult, involving the symbolic use of female figurines. Many Archaic figurines are conventional in type and seem to have been produced according to standard formulas which did not permit much leeway for the expression of creative impulses. Nevertheless, in others the creative will of the artist is clearly visible, even within the established conventions. The tradition of sculptured clay figurines of religious character lasted in central Mexico up to the Spanish conquest. After the peak period of Teotihuacán, however, they were cast from molds, resulting in a series of conventional types of little artistic value.

In Oaxaca, clay sculpture consists mainly of funerary urns, with different styles corresponding to successive periods. The most abundant of these are of the epoch Monte Albán III (400 to 700 A.D.). These funeral urns of Monte Albán III are heavily structured and covered with ornamentation which had ritual meaning.

In the Maya area, the older figurines of Jaina Island, off the Campeche coast, are small masterworks of realistic art. They are hand-modeled and represent warriors, priests, ballplayers, and women. They are dated at about 600 A.D. The Jaina figurines of a later period (roughly from 700 to 1000 A.D.) are mold-made and conventional in style; nearly all represent women and animals.

In western Mexico (Colima, Jalisco, and Nayarit) baked clay statuary achieved extraordinary development and artistic importance. These western ceramic sculptures are characterized by great economy of form. They portray psychological states with jovial irony. Although intended as funerary art, they faithfully reproduce scenes from everyday life. They may have been inspired by religious ideas, according to which life in the mansion of the dead was thought to be a continuation of life on earth.

Masks.—Masks of stone, wood, baked clay, and bone form an important aspect of pre-Hispanic

art. They were used in magic, and for religious and funerary purposes. During religious ceremonies, the priests covered their faces with masks representing the faces of the gods. In the representations of the gods, their faces are also often seen covered with masks. In funeral ceremonies, the dead body was completely wrapped in cloth, and a mask was placed on top of the bundle. The face of the personage buried in the secret chamber of the Temple of the Inscriptions, mentioned above under *Monumental Sculpture,* was covered with a mask composed of hundreds of jade tesserae pasted on a coat of stucco. The eyes of the mask were made of shell, with obsidian irises.

The use of masks is attested since Archaic times. Aesthetically, the stone masks of the Teotihuacán culture deserve special mention. They show great simplification of the features of the human face, but within a basically naturalistic conception. The absence of individuality is striking, especially since they were probably used to represent the faces of the dead in funeral ceremonies. The art expert Paul Westheim has said that they were not realistic representations, but plastic representations of a concept. There are also Teotihuacán masks of baked clay, painted in many colors, which form the basic element of great incense burners. These are made in the same style as the stone masks. Equally outstanding are the miniature masks carved in Olmec style from semiprecious stones such as jade or jadeite, real masterworks of lapidary art.

A few wooden masks have been preserved. These are covered with mosaics of turquoise, jadeite, shell, mother-of-pearl, and lignite. The British Museum in London and the Prehistoric and Ethnographic Museum in Rome have the best examples. Some are also found in the Museum of the American Indian in New York. There also exist masks made from the frontal portions of the human skull, which are covered with mosaic. The British Museum owns the best specimen.

Lapidary Work and Mosaic.—The pre-Hispanic craftsmen worked jade, jadeite, turquoise, obsidian, rock crystal, and other hard minerals. The most beautiful works of Indian lapidary art are little figures, little masks, and anthropomorphic votive hatchets of Olmec style, worked in jade or jadeite. The most famous work in rock crystal is the human skull in the British Museum. Jadeite, obsidian, rock crystal, and alabaster were also used to make vases. Examples are the jadeite jug in the shape of the water god in the Museo Nacional de Antropología in Mexico City; the obsidian vase in the shape of a monkey in the same museum; the alabaster vase also shaped like a monkey in the Bliss Collection, National Gallery of Art, Washington; and the rock crystal cup from Tomb 7 at Monte Albán, now in the museum at Oaxaca. Ear plugs, breast pendants, and other jewelry were also made from these materials. Turquoise was used in mosaic, together with jade, coral, shell, and other materials. The small mosaic pieces were generally glued on a wood or leather base, occasionally on bone or stone.

A number of the most outstanding mosaic works are mentioned above under *Masks.* To these should be added: the wooden helmet in the British Museum; the handles of the sacrificial knives in the British Museum and in the Prehistoric and Ethnographic Museum in Rome; the wooden vases in the British Museum and at Copenhagen; the discs in the Museum of the American Indian, New York, and those found at Chichén Itzá; and the two-headed serpent in the British Museum.

Wood and Bone Carving and Shell Engraving.—Due to the perishable nature of the material, few wooden carvings have been preserved. Enough are known, however, to give an idea of the remarkable craftsmanship of the pre-Hispanic wood carvers. A number of slit drums (*teponaztlis*) and skin-covered drums (*huehuetls*) have been preserved. These are decorated with mythological scenes. Also preserved are a number of finely carved ceremonial spear throwers. The most remarkable bone objects are the spatulate objects found in Tomb 7 at Monte Albán; they are decorated in Mixtec-Puebla style with calendrical inscriptions and mythological figures. In the Huastec area (the northern part of what is now the State of Veracruz), engraving was used to decorate shell gorgets.

Weaving and Featherwork.—The art of pre-Hispanic weavers is known only from descriptions by ancient authors, and from representations of textiles in painting and sculpture. The chronicles tell us about the types of fabrics produced, and the patterns used are clearly shown in the artistic representations. Cotton was used to make high-quality textiles; agave fiber to make coarse fabrics only. Pre-Hispanic featherwork won high praise from the chroniclers. The lack of feather ornaments in representations of art older than 300 A.D. seems to indicate that this craft developed only after this date. Feather ornaments were in great fashion during the Classic period. At the time of the Spanish conquest, feathers were used for headdresses, fans, and cloaks, and feather mosaic was used to decorate shields. Only a few pre-Hispanic examples of this delicate craft have been preserved. The most beautiful of these are the great quetzal feather headdress of Montezuma II, and a shield, decorated with the figure of a fabled animal, the *ahuitzotl;* both are in the Kaiserliche Schatzkammer in Vienna.

Metalwork.—The tradition of metalwork was of relatively recent development; it does not seem to antedate 900 A.D. The pre-Hispanic metalworkers used gold, silver, copper, and some tin and lead. They alloyed copper with gold, copper with tin, and copper with lead. The technical processes known were: hammering, casting, welding, gilding, plating, and inlaying. Castings were made using the cire-perdue (lost-wax) process, in which the mold is shaped around a wax model of the object to be cast. They employed the *mise-en-couleur* process to gild objects. This produced a gilded surface on copper-gold alloy of low precious-metal content. The surface copper was dissolved by treating it with acids (probably plant juices) and subjecting it to heat. Pieces which are part gold, part silver were produced by welding. Abundant use of filigree characterized the style of Mexican metalwork.

The first rank in technique and artistry was held by the metalworkers of the Mixtec region. The jewels found in Tomb 7 at Monte Albán and presently in the museum at Oaxaca (rings, necklaces, breast pendants, and so forth) are good examples of their excellent work. Copper and silver were both worked in Michoacán, but the artistic quality of this work is low. In Yucatán, during the Toltec period, the local artists used the technique of *repoussé* to represent animated scenes of the conquest of the Maya by the Itzá on discs of imported gold. These scenes have great artistic value.

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17. COLONIAL AND MODERN ART.

Indian painting had very little influence on colonial painting. There were great differences between the two: while the former drew inspiration from Indian mythology and found expression in hieroglyphs and symbols, the latter was devoted predominantly to the Roman Catholic religion and, in common with all European art, favored the use of natural forms.

Mexican colonial art, which could more accurately be described as the art of New Spain, can be divided into four periods: primitive, comprising approximately the 50 years following the conquest of Mexico in 1521; renaissance, a reflection of European Renaissance seen through Spain, lasting a short 25 or 30 years; baroque, developed during the 17th and a great part of the 18th century; and lastly, the period of the neoclassic academicians, during the last years of the 18th century and up to the beginning of the struggle for independence in 1810.

Painting.—*Primitive Period.*—Although pre-Hispanic painting had no direct influence on the art of New Spain, paintings by Indian artists are found in the years following the conquest; however, they used the forms of European art brought over by the Spaniards.

The first school of painting was founded in the capital of New Spain about 1525, only a few years after the conquest, by the Franciscan friar Pedro de Gante; Indian painters like Cuauhtli, Xochitótotl, Xóchmitl, Marcos Cipac and others studied there. Very few of their works have been preserved, but we still have a portrait of Fray Domingo de Betanzos on wood, and the image called the *Virgin of Guadalupe,* probably painted by Cipac shortly before the middle of the 16th century.

The first mural paintings were done about the same time in the cloisters of monasteries, following the fresco technique. The names of the artists are unknown, but it can be safely assumed that in many cases they were Indians, directed by the friars, who found inspiration in European paintings and engravings. The subjects are sometimes simply Italian ornamental themes (so-called grotesque). The most important, however, are usually representations of religious subjects and images of Christ and the saints; although in an exceptional case (at Atotonilco, Hidalgo) the Renaissance influence was so strong as to prompt the reproduction of two great figures, those of Plato and Aristotle, in Renaissance costume. Good examples of this type of work are found in the monasteries of Huejotzingo, Puebla; Acolman, Mexico State; Actopan, Hidalgo; Epazoyucan, Hidalgo; and many others.

Renaissance.—It is perhaps not very accurate to call renaissance painters those who flourished in the last 30 years of the 16th century, but it would be difficult to find another name suitable for them; indeed, their painting is the same as that of the Spanish Renaissance, with its twofold Flemish and Italian influence.

Andrés de Concha, Juan de Arrúe (1565–c.1637), and Simón Pereyns were painters of this period. Pereyns, the most important, was Flemish, and his works belong to the Flemish Renaissance style. He was born before 1550, came to Mexico in 1566, and probably died at the end of the century. His work may still be seen at Huejotzingo; in *La Virgen del Perdón* (*Virgin of Forgiveness*), a good painting in the style of the 16th-century Flemish Madonnas, in the Cathedral of Mexico City; and in many other paintings.

The period which followed can be described as one of transition between renaissance and baroque. The outstanding painter was Baltasar de Echave y Orio, also called Echave el Viejo (the Elder; c.1548–after 1612). He was of Basque origin and came to Mexico at an early age in 1573. Echave's painting was done at the end of the 16th century and in the first quarter of the 17th. He borrowed from both Italians and Flemish, but the two influences never blended adequately. Echave used rich and intense colors. Some of his work is preserved in the Palacio de Bellas Artes in Mexico City. His son, Baltasar de Echave Ibía (1583–1640), has been called "the blue Echave" by Manuel Toussaint because of his marked preference for this color. Several religious paintings of his have been preserved, as well as the portrait of an unknown lady.

Of the same time were Sebastián López de Arteaga (1610–1656), a good portrait painter, and Alonso López de Herrera (d. about 1654), called "the Divine," who achieved great fame. The latter was talented and possessed a remarkable knowledge of his craft. He followed the Italian school; critics have pointed out the influence of Titian. Luis Juárez (fl. 1610–1630), a weaker but very prolific contemporary painter, had leanings towards mysticism. His paintings show certain traits which class him clearly within the baroque tendencies which began at that time.

Baroque.—Mexican baroque architecture is varied and rich, but baroque painting is not. The contrast is all the more remarkable because there is no doubt that baroque painting in New Spain came directly, almost exclusively, from Spanish painting, which reached its highest peak in the 17th century with such masters as Diego Velázquez, Francisco de Zurbarán, and Bartolomé Esteban Murillo. Evidently the distance was too great, and as a consequence painting in Mexico falls well below the Spanish level. The work of Mexican baroque painters was commonplace, a very weak reflection of the Spanish originals, whose excellence made them unattainable.

Baltasar de Echave y Rioja (1632–1682), grandson of Echave el Viejo, was one of the first completely baroque painters. He achieved dramatic effects through the movement which he put in the various elements of his paintings.

Among other painters of the time may be mentioned Juan Correa (c.1649–1738), Cristóbal de Villalpando (c.1649–c.1714), and the brothers Juan Rodríguez Juárez (1675–1728) and Nicolás Rodríguez Juárez (1667–1734), all of whom favored religious subjects, and make good use of color and light effects, with hardly discernible differences. Their painting, in true baroque fashion, is complicated and sumptuous, and they show a marked preference for a purely decorative and spectacular treatment.

The Mexican baroque entered a new phase in the 18th century, when the already few possibilities of expression were further reduced. Inspiration was still found in Spanish painting, which was also in a decadent state, after its great 17th

century. In Spain, the disciples of Murillo had turned his softness of color into a nauseous surfeit of tender pinks and blues. Such an evil example produced in Mexico an art of set formulas which prescribed rose-colored flesh, except in the case of ascetics, who were to be depicted as of yellowish complexion; carelessness in the treatment of robes; pitch-colored backgrounds, the better to show soft colors in the first planes; and several such defective methods, monotonously repeated. Two names should be mentioned in such a panorama, Ibarra and Cabrera. José de Ibarra (1688–1756) possessed good technique, but his use of color followed the trends outlined above. His self-portrait is among his best works. The reputation of Miguel Cabrera (1695–1768) as a good painter has come down almost to our times; the only explanation for this is to be found in a general decadence of taste, since his work was, to begin with, inconsistent—probably owing mainly to the great number of pictures he painted—and then, although his drawing was good, his composition was generally bad. All this apart from his sharing in the generally defective coloring of the aftermath of a great period.

Academicians.—The Royal Academy of San Carlos was opened in 1781 for the purpose of giving instruction in fine arts. It marked the end of a very decadent baroque, and its being replaced by neoclassicism. Two of the important painters that came out of this school before the end of the colonial era are José Luis Rodríguez Alconedo (1749–1815) and Rafael Ximeno y Planes. The former was an excellent silversmith and painter, but his output was small. His self-portrait in pastels is his best work. This is now in the Academia de Bellas Artes at Puebla.

Rafael Ximeno y Planes (1761–1825) was born in Spain, studied in Mexico and Rome, and came back to Mexico in 1795 to direct the academy. He painted many excellent portraits, such as that of the sculptor and architect Manuel Tolsá. He used oil for much of his work and tempera in some murals, like those in the cupola of the cathedral of Mexico City and the chapel of the old Mining College; there Manuel Toussaint found a clear influence of Giovanni Battista Tiepolo.

Sculpture.—*Primitive Period.*—The process is similar to that observed in painting: to begin with, Indians worked on European figures, and managed to leave in them a strong expression of their own sensitivity. The results were primitive and ingenuous pieces of sculpture, now revealing a certain childishness, now a certain ruggedness bordering at times on the monstrous.

There are some crucifixes left from those early times, which are carved in soft wood (patol), and are copies of Spanish originals. Some work was also done in papier-mâché.

We may also consider as sculpture the reliefs executed on the walls of monasteries and churches. These are mostly images of saints, symbols, or even purely ornamental shapes. There are good examples of this type of work in the monasteries of Calpan, Puebla; Tepoztlán, Morelos; Tlalmanalco, Mexico State; Yuriria, Guanajuato; and others. Like the frescoes done at the time, these reliefs seem to have been modeled on copper engravings or woodcuts of various origin.

Renaissance and Baroque.—Again there is a strong parallel with painting. The best of Spain's sculpture was done by Alonso Cano. Pedro de Mena, Juan Martínez Montañes, and others; in Mexico, sculptors filled church exteriors with carved stone figures, and the inside with numerous polychrome or *estofado* wooden sculptures. *Estofado* sculptures are wooden images covered with stucco or plaster, on which gold leaf is applied. Lines are drawn on this with a burin and colors are sometimes applied on top.

Architecture and sculpture blended in wonderful, frequently gigantic reredos which were usually made in three tiers with a finishing motif at the top, a central panel and from two to four panels on each side. They contain oil paintings and sculptures inside niches. Each part was usually executed in a different architectural style. The sculpting work, done by different persons, covered every bit of available space—thousands of columns, friezes, cornices, brackets, all of it carved in wood and lined with gold leaf; here indeed is the glitter and light and shadow play typical of baroque fancy.

The first reredos were in the richly ornamented plateresque style, following the Renaissance influence; among these are the ones at Xochimilco near Mexico City, and, better still, at Huejotzingo, Puebla, executed by Simón Pereyns. But the great period of reredos came later, in the 17th century, when the full influence of the baroque was felt. In all of them we find twisted columns, fewer paintings, and a greater number of sculpted figures; they are full of garlands, angels, symbols, all of them admirably carved and in great profusion. The Churrigueresque type in the 18th century gave sculptors and wood carvers their boldest conceptions, the result being such masterpieces as the reredos of Tepotzotlán, Mexico State; Querétaro; and Salamanca, Guanajuato.

Academicians.—In delivering the *coup de grâce* to baroque art, the Academy of San Carlos put a stop to the development of reredos; but, perhaps as a compensation, it was then that statuary received full attention, just because then each statue began to be considered as an end in itself, not as part of a great mass of a reredos, where each statuette, engulfed in the great mass of decor, lost its identity.

Puebla and Querétaro were the two centers of sculpture in the last years of the viceroys. The names Cora and Villegas became famous in Puebla as those of two families that gave several well-known sculptors; the outstanding ones in Querétaro were Mariano Arce and Mariano Perusquía. A great architect of Celaya, Guanajuato, Francisco Eduardo Tresguerras (1759–1833) also executed a number of sculptures.

The best sculptor of the academic movement in Mexico was Manuel Tolsá (1757–1816), also an architect, whose equestrian statue of the Spanish king Charles IV, in bronze, is preserved in Mexico City as one of its most beautiful and appreciated monuments.

Minor Arts.—Native precursors are of importance in some of the minor arts, such as silverwork and feather mosaic. The decadence of the last dates from early times and it is now almost lost. Otherwise the native element took refuge in popular arts like ceramics, the Michoacán and Guerrero *jícaras* (wooden bowls), and few others. In the majority of cases, however, the European arts became predominant, and even materials and tools were imported.

As was to be expected, the development followed closely the growth of the colonial regime. The increase in population and wealth, the growth

of the cities—above all the capital city—the luxury and pomp of the wealthy classes, the baroque leaning to ostentatiousness and flamboyance, all these favored the development of industrial art in the 17th and 18th centuries. Since such arts vary according to regional and personal characteristics, it is possible to come to know them only through very specialized studies. It is sufficient here to say that they were carefully fostered in New Spain. Jewelry, ornaments, and religious objects of the highest class were made of precious metals, and many Mexican towns still show with pride their iron and bronze grillwork, locks, ancient arms, and other objects. As for woodwork, fine carved furniture and inlaid work in ivory, tortoise shell, bone, and silver were made. Among luxury goods, fine work was done in dyed or gilded leather cordovan and *guadameci* (embossed leather), as well as in weaving and embroidery. Ceramics were also prominent, ranging from that which originated in the pre-Hispanic past to that inherited through Spain from the Arabs, such as the Talavera style of glazed tiles developed at Puebla. The Museo Nacional de Historia and the Museo de Arte Religioso in Mexico City, the Museo José Luis Bello in Puebla and other regional museums, as well as many private collections, have abundant examples of such crafts.

19TH CENTURY ART

Because of the troubled beginnings of independent Mexico, artistic activities were at a very low ebb. The plastic arts lived on the remains of colonial art, creating nothing new. It was not until 1839 that steps were taken to reorganize the Academy of San Carlos. Two Spanish masters, the painter Pelegrín Clavé and the sculptor Manuel Vilar, were engaged to effect a reform in the plan of studies, and arrived shortly after.

Apart from his work as a teacher and director, Pelegrín Clavé (1810–1880) also painted a number of pictures which were well liked. He arrived in Mexico in 1846 to assume the directorship of the Academy of San Carlos, and his influence was instrumental in bringing about a change, indispensable at the time. He did not limit his work to religious paintings, but drew inspiration also from history and fiction. In his portraits he strove for likeness to the model, using gay, brilliantly colored silks and velvets which replaced the monotonous dark shades that obtained in colonial times. In so doing he followed the style whose principal exponent in Europe was then Jean Auguste Dominique Ingres.

The most promising of Clavé's students, Santiago Rebull (1829–1902), Felipe Gutiérrez (1824–1904), and José Salomé Pina (1830–1909), were sent to continue their studies in Rome, and their work was admired in several exhibitions given in Mexico between 1850 and 1865. Ramón Sagredo (1834–1872) and Juan Cordero (1824–1884) are of the same school, though they belong to a later period; also, toward the end of the century, Luis Monroy and Félix Parra (1845–1910). All of them painted portraits, and historical and religious paintings. Their asset was a thorough knowledge of their craft; their handicaps those of the academic movement: limitation, lack of vitality, artificiality, and conventionalism.

It was also a Spanish master, Manuel Vilar, who, coming to Mexico with Clavé in 1846, gave a new impulse to sculpture. His stay in Mexico was shorter than that of Clavé, but during it he endeavoured to teach correct academic sculpture. His most proficient students were Miguel Noreña and Gabriel Guerra (1847–1893), who made several praiseworthy pieces. They worked together on the monument to Cuauhtemoc which is now in the Paseo de la Reforma in Mexico City; Noreña made the hero's statue, and Guerra the four high reliefs adorning the base. The five pieces are in bronze.

Landscape painting in Mexico was begun in the second half of the 18th century, when the Academy of San Carlos arranged for the Italian landscape painter Eugenio Landesio to come to Mexico to teach his specialty; this he did for some 20 years. His most outstanding student was José María Velasco (1840–1912), whose works are mostly landscapes. Velasco always kept to a high standard of achievement and some of his paintings are of the very highest quality; of these are two large canvases of the Valley of Mexico, which are in the Museo de Artes Plásticas.

In 1903 the Catalan painter Antonio Fabrés was appointed to direct the academy. Under him Mexican painting continued along the decadent way it had again fallen into, by following the mistaken road of "photographic" realism, with certain leanings toward the French manner. Two artists are perhaps worth mentioning: Leandro Izaguirre (1867–1941) and Julio Ruelas (1871–1907). The second was an extremely capable but warped draughtsman.

Jesús F. Contreras (1866–1902) should be mentioned among the sculptors of the time. In spite of the loss of an arm, he executed a number of statues for the capital and other cities of Mexico.

Meanwhile, some Mexican artists who were studying in Europe and others who had stayed in their own country were venting their dissatisfaction with the state of the arts. These fostered the awakening of the movement which was to bring far-reaching changes not long after. But very few people then realized that the most important artistic effort was being made in a small printing workshop that was publishing stories, prayers, plays for marionettes, and *corridos* (popular narrative songs) in leaflets and sheets that were sold for two or three centavos. Woodcuts and copper prints had been made in New Spain since the 16th century. The first lithograph press was founded in 1826, shortly after independence had been won, and that type of work was assiduously cultivated during the 19th century.

Manuel Manilla (1830–c.1890) and José Guadalupe Posada (1851–1913) were doing their work for the publisher Antonio Vanegas Arroyo in Mexico City, illustrating with their engravings that genuinely popular literature. Posada's engravings, though showing the influence of Francisco José de Goya and Honoré Daumier, have such a strong Mexican character and such extraordinary strength and emotivity that they are, without a doubt, the best product of Mexican art in the 19th century. They not only announce the following period; they link up with it.

MODERN ART

The last European art movement whose influence was felt in Mexico was the impressionist—very strong in Europe and fully a 19th-century movement; very weak in Mexico and felt rather late. Among Mexican artists, it was best known to Alfredo Ramos Martínez (1875–1946) and Dr.

Atl (1877–), both of whom had lived for many years in Italy and France. They imparted their knowledge to young Mexican painters in 1910, and the result was, not an impressionist movement in Mexico, but rather the desire to seek some reform, something new and different.

Joaquín Clausel (1885–1936), a young landscape painter of great sensitivity, was the best exponent of impressionism in Mexico. Another young painter, Saturnino Herrán (1887–1918), used impressionist trends blended with a national feeling for subject and color, suggesting the discovery of a type of art of his own; unfortunately, he died before he could bring it to fruition.

Meanwhile the revolution had broken out, and during the most active years, 1914–1916, the political struggle and the battlefield demanded everybody's full attention. Some artists were abroad; others, like Dr. Atl and José Clemente Orozco, had embraced the revolutionary cause and were waging their own war, using their art as a weapon through political newspapers. Such an upheaval as the revolution brought about had of necessity to result in something new; it would have been impossible to return to the old ideas and forms of expression.

When peace came in 1921, a cultured and intelligent man, José Vasconcelos (1882–), was appointed minister of public education. Vasconcelos sought above all to create, and in this endeavor he saw fit to offer new opportunities to artists, making available to them public buildings which they could brighten with their artistic imagination.

Diego Rivera had been living in Europe from the first years of the century, having gone there after being awarded a scholarship by the academy, but he had returned to Mexico at the time of Vasconcelos' accession to the ministry. Together with Xavier Guerrero (1896–), Alva de la Canal, Jean Charlot (1898–), David Alfaro Siqueiros, Orozco, and others, he formed the Syndicate of Painters and Sculptors, and prepared to decorate the old and new buildings that the government was making available. They decided to do fresco or encaustic paintings on walls, to make them easily accessible to the common man and to prevent their being shut up in halls, like the oils and watercolors of old. In sculpture, they abandoned bronze and plaster casting, preferring to carve stone in the footsteps of pre-Hispanic sculptors. Thus was born that interesting phenomenon, perhaps the aspect of modern Mexico best known to the non-Spanish-speaking world, its postrevolutionary art.

Each artist followed his own path, all of them different. Some disappeared; others went on, growing in stature. The original group was followed by another, and a third group of artists began its career toward the middle of the 20th century. It is, therefore, inconvenient to follow the process as a whole; to avoid confusion it is best to refer individually to each of the artists that deserve to be mentioned within the strict limits of this short study.

Rivera.—Diego Rivera was born at Guanajuato in 1886. He studied at the academy in Mexico City and went to Europe in 1906, remaining there until 1921, except for a short visit to Mexico at the time the revolution was beginning. He worked in Mexico after 1921, except for visits to the USSR and the United States, where he did some paintings in the cities of San Francisco, Detroit, and New York. He tried various styles and used several techniques in his early days (realism, impressionism, and cubism; oil, tempera, and collage), but his important work began in 1922, and must be studied in two great sections: murals and easel paintings.

Rivera painted his first mural in 1922 in the Anfiteatro Bolívar of the Escuela Nacional Preparatoria in Mexico City, using encaustic paint. It has a vast theme of Man, Nature, and Life. The composition is excellent, but in the subject's treatment one can detect strong Italian and Byzantine influences. A short time later he decorated the ground floor of the Secretaría de Educación Pública (Public Education Department) also in the capital. It is here that social themes and subjects based on the Mexican Revolution of 1910 make their first appearance. In 1927 Rivera painted murals on the walls and vaulting of the former chapel (now the Escuela Nacional de Agricultura) at Chapingo, northeast of Mexico City. The subjects were land and the agrarian reform; the composition as well as the use of design and color are excellent. It can be said without hesitation that the Chapingo frescoes are Rivera's masterpiece, which he has been unable to surpass. After 1929, he devoted his frescoes in the Palacio de Cortés in Cuernavaca and the Palacio Nacional in Mexico City to subjects taken from the history of Mexico and the coming socialist revolution. He repainted, in the Palacio de Bellas Artes in Mexico City, the fresco that he had started—and had been forbidden to finish—for Rockefeller Center, New York. More recently, he has been engaged almost exclusively in trying to make a grand apology for Mexican cultures before the coming of the Spaniards. Through political ideology, he has fallen into practicing the art of propaganda.

His easel paintings, nearly always oil on canvas, show more varied qualities. He has painted popular Mexican types, portrayed with great dignity and devoid of picturesqueness; some landscapes; some life studies; and many portraits. They are in museums and private collections, mainly in Mexico and the United States.

Orozco.—José Clemente Orozco was born at Zapotlán, Jalisco, in 1883, and studied at the academy in Mexico City, where he died in 1949. He made cartoons and illustrations for some of the revolutionary papers, and later held an exhibition of paintings and other small works. Like Rivera and several other Mexican painters, he took to mural painting in 1922 and after that date his important work was in his frescoes, though he also did a great number of works in oil and tempera, as well as drawings and lithographs. His most important murals are found in the following places: Escuela Nacional Preparatoria (1922 and 1926), the Supreme Court building (1940), and the Hospital de Jesús (1942), all in Mexico City; in the United States at Pomona College, California, and Dartmouth College, New Hampshire; the library at Jiquilpan, Michoacán; and the university, Palacio de Gobierno (Government Building), and Hospicio Cabañas (Cabañas Foundling Home) in Guadalajara. The three last were painted in or about 1938 and they are, on the whole, the best. Of special note is the fresco on the cupola of the old chapel of the Hospicio Cabañas. There is, besides, an impressive array of Orozco's oils, drawings, and other easel work, all of a very high quality.

Orozco cultivated a very personal style, which

is in some ways slightly reminiscent of expressionism, but the peculiar characteristics he imparted to it give it a character of his own. It is above all virile, austere, sometimes fierce; there is in it none of the voluptuousness often found in Diego Rivera's work, but on the other hand, it usually has much more strength and movement; it is dynamic in its subjects and treatment, and it moves the observer—just as Diego Rivera's style is static. Some critics have insisted that Orozco is the best Mexican painter of the 20th century. This is difficult to judge, however, when most of the other painters are still living and it cannot be said how or what they will paint in the future. Nevertheless, it can be definitely stated that Orozco was an inspired artist and a great master of the craft of fresco painting.

Siqueiros.—David Alfaro Siqueiros, born at Chihuahua in 1898, has lived a very full life as a Mexican revolutionary, a union leader, and a soldier in the Spanish Civil War, always fighting vehemently for the extreme left. He was one of the pioneers of modern Mexican painting. He has painted in North and South America, and his restless spirit has impelled him to try new materials and methods—undoubtedly in an attempt to modernize art, but it is difficult to see that the results achieved have justified such innovations. He has done murals and easel work, and his political passion has often carried him beyond the realm of art. There is no doubt that he is a good painter; but, so far, only a few portraits and human figures can be said to have lasting qualities.

The painters mentioned, and others who have followed them, are driven mainly by an all-pervading social consciousness: they accuse, they protest, they fight. This is certainly a most important aspect in much of modern Mexican painting, and it is an aspect which the outside observer and the foreign critic, Europeans especially, do not seem to comprehend—perhaps because they are steeped in a pure art tradition which is not part of the Mexican way of life.

Other Painters.—Painters whom we can call independent have worked alongside those who express social or political themes. Among them should be mentioned Francisco Goitia (1884–), who gave pictorial expression to the misery and grief of the poor; in the austerity of his *Tata Jesucristo* he has achieved one of the most dramatic paintings of modern art. Goitia is also a landscape painter. Doctor Atl (pseudonym of Gerardo Murillo; 1877–) is a prolific painter of strong and concise landscapes, using varied techniques. Manuel Rodríguez Lozano (1896–) has, with great intelligence and self-control, followed his own path in paintings of a strong poetic feeling allied to fine drawing and a sensitively quiet use of color. Rufino Tamayo (1899–) is undoubtedly one of the best Mexican painters, but the style he has cultivated since about 1940 has placed him nearer the modern international school and farther from Mexican painting.

There is a later group of painters which has been named the second generation of modern Mexican painting. Of these, the following have done outstanding work: Carlos Orozco Romero (1898–); Julio Castellanos (1905–1947), whose death before he could be said to have reached maturity cut short a highly promising career; Federico Cantú (1908–); Agustín Lazo (1900–); and Jesús Guerrero Galván (1910–).

In the last group, or third generation, are included those painters who are still young, but whose work is sufficient to reveal their talent. Among them should be mentioned Raúl Anguiano (1915–), Juan Soriano (1920–), and Ricardo Martínez de Hoyos (1918–). It is hardly fitting even to try to judge these painters, who are now in their prime and who, because of their age, are still susceptible to change.

Sculpture.—By contrast, modern sculpture, though starting at the same time as modern painting, in 1922, is still very far from achieving the development and fruition that accrued to painting. The experiment of the Escuela de Talla Directa (School of Direct Carving) was very interesting because of the return the school advocated to the straightforward, austere technique that had produced so many masterpieces in pre-Hispanic Mexico. But the results did not come up to expectations, nor was the experiment long continued. Some giant-size statues have been carved —the best example is the statue of José María Morelos on the island of Janitzio in Lake Pátzcuaro—but results have been bad in every case: witness the Pípila Monument in Guanajuato, among others. Mexican sculptors have followed various tendencies, from realism to abstractionism, and they have sometimes created work which is praiseworthy, but never really meaningful or talented. The phenomenon has a parallel in many other places; it seems that our times are not propitious to sculpture. The best known Mexican sculptors are: Ignacio Asúnsolo (1890–), Luis Albarrán, Carlos Bracho (1899–), Manuel Centurión (1865–1948), Federico Canessi, Germán Cueto (1893–), Mardonio Magaña (1866–1947), Luis Ortiz Monasterio (1906–), Juan Olaguíbel (1897–), Guillermo Toussaint, Guillermo Ruiz, and Francisco Zúñiga.

Engraving.—This art, which became so important in prerevolutionary days with José Guadalupe Posada, has continued in its various forms: wood, copper, etchings, and lithographs. It can be said that, like painting, Mexican engraving now holds an important place. The principal places where engraving is carried out are in Mexico City: the Taller de Gráfica Popular (Popular Printing Workshop); the Escuela de Artes del Libro (School of Book Arts); and the two schools dedicated to plastic art, that of the National University and the one supported by the Secretaría de Educación Pública (Public Education Department). Some of the best engravers are: Francisco Díaz de León (1897–), Leopoldo Méndez (1903–), Carlos Alvarado Lang (1905–), Alfredo Zalce (1908–), Abelardo Ávila (1909–), José Julio (1912–), Mariano Paredes (1912–), and Julio Prieto (1912–).

Photography.—Photography has also made a place for itself among the arts. In the first part of the 20th century two photographers did notable work: Lupercio and Guillermo Kahlo (d. 1941). Three great foreign photographers resided in the country between 1920 and 1930, Edward Weston, Tina Modotti, and Serge M. Eisenstein. Their influence stimulated Mexican photography and raised its standards. The most distinguished photographers of recent times have been: Emilio Amero, Manuel Alvarez Bravo and Lola Alvarez Bravo, A. Jiménez, and Luis Márquez.

FOLK ART

The art critic Justino Fernández, in *El arte moderno en México* (Mexico City 1937), has made the following statement which is still valid:

> The general characteristics which can be found in this popular Mexican activity are: a great artistic feeling, especially in so far as decoration is concerned; a high degree of vitality, as can be observed from the number of objects produced and attention to detail; a concern with method to such a degree that it looks like routine; and extraordinary fantasy. It can therefore be said that Mexico holds the third place, after China and Japan, as a producer of folk art.

The only possible classification of folk art, since it follows no school and shows no particular period of development, is according to objects and sometimes to its sources of inspiration. In the following the objects are referred to according to their importance.

Folk painting is found mainly in religious subjects, in small paintings on sheet metal or cloth called *retablos* (another meaning of the word—in English, *retable*—which is used to describe the ornamental pieces of architecture or sculpture covering walls at the back of altars in many churches), showing figures or scenes with great ingenuousness and sometimes with a certain graceful, almost childish clumsiness. A lot of nonreligious painting was done in the decoration of *pulquerías* (taverns where pulque, a popular drink made from the fermented sap of the maguey, is sold). This custom, however, has been almost completely lost.

Folk art finds magnificent expression in weaving. Fabrics are woven in many different ways and for many uses: tablecloths, serapes (woolen blankets to be worn), *rebozos* (scarves of cotton or silk), garments, and ornamental pieces. The techniques are nearly always of Spanish origin, and so are the designs, though in certain regions (Oaxaca, Chiapas, and Michoacán) native influence can be clearly seen in embroidery or colored fabrics. Weaving can be best classified according to regions, since costumes and their ornaments serve best to differentiate popular regional characteristics.

Lacquered goods—vessels, boxes, toys; sometimes furniture and other objects—are also of great interest. The principal centers of production are Olinalá in Guerrero, and Pátzcuaro and Uruapan in Michoacán. The process followed in Olinalá is as follows: scenes and ornaments are painted in color on a black base; or else one single color is applied, on which certain parts are scraped to suggest lacework. In Pátzcuaro it is usual to paint in several colors, nearly always on a black base. The practice of this art had almost disappeared, but it was revived and has become almost as important as it once was in the 18th and 19th centuries. In Uruapan, colors are rubbed into the wood, using black as the background, and the whole is covered with a damp-resisting lacquer.

Leather and iron are worked following the tradition of Spanish arts and crafts. There are slight variations due to the influence of national characteristics. The working of gold and silver, which became so important in vice-regal times, has disappeared in many parts. Gold is being worked following the traditional manner in Oaxaca; and silver in Taxco, Guerrero.

Furniture with regional characteristics, following popular designs and motifs, was being built as late as the 19th century. These designs have been widely used by mechanized industry, and for that reason have changed and lost value.

A great variety of pots have always been made of clay and glass. These continue to be made; as well as toys and other useful and ornamental objects of the same materials. Glass blowing is carried out with great success at Guadalajara and Mexico City. Pottery exists practically everywhere, but as is the case with weaving, takes on distinctive characteristics according to the region. Such peculiarities tend to disappear nowadays, owing to facilities for interchange—whenever a certain type of pot or decoration becomes fashionable, it is immediately imitated by potters whose production ought to have completely different characteristics.

The manufacture of cheap toys has reached into practically the whole country, and offers a very wide variety. Many materials are used—fired clay, wood, wire, rags, paper, cardboard, tin, wax, and even chewing gum—and they are turned out in every kind of animal shape, dolls, and all sorts of objects, most often painted over with strong, contrasting colors.

The human form, apart from being used in clay, rag, wooden, or cardboard puppets, is also borrowed for the manufacture of masks, which may represent comical, awe-inspiring, or grotesque faces, or skulls; sometimes also animal heads. The masks are often children's toys, but in some cases are intended to cover the faces of dancers or actors taking part in dances or religious plays acted during specific celebrations.

The human form is also represented in the so-called Judases, which are small or large cardboard or papier-mâché figures (some being six or more feet tall) to which firecrackers are attached. The "Judases" are burnt publicly on the Saturday of Holy Week.

Piñatas (clay pots covered with colored paper in the shape of animals, ships, stars, and the like) and the crèches or Nativity scenes, with their clay and wax figures made up to represent Biblical scenes or scenes of regional customs, are all expressions of popular art which take place around Advent and Christmas.

Candies are often made or decorated in ways which allow them to be classed as popular art. Perhaps the most remarkable are the small figures made of sugar paste, like *alfeñique* (boiled sugar candy of different colors) and other candies in the shape of animals and objects. Most often they are made to represent skeletons, skulls, and the like, and are made, bought, and eaten around All Souls' Day (November 2), when the so-called *pan de muerto* (bread of the dead) is also eaten in various regional varieties.

All the folk arts are very poor in the northern states and greatly varied in the central and southern ones. They have also tended to disappear, due to several reasons. Sometimes it is because of the mechanization of industry; sometimes because easier means of communication have tended to standardize the formerly different production of each region; sometimes because the growing market for such goods has made manufacturers anxious to please the taste of the majority of buyers, often foreign tourists who prefer picturesqueness and mistaken Mexicanized motifs to genuine decoration, which is usually more austere.

The ornamental motifs in these arts and crafts are usually flowers, birds, and scenes and objects taken from nature, stylized according to the taste peculiar to the region or the artist.

Sometimes they are geometrical shapes of ancient origin. In certain cases short legends are written —"Souvenir Of . . ." or proper names, and so forth. Very seldom is the human figure used, but a very usual subject is death, represented by various symbols or allegories: skulls, skeletons, bones, coffins, funeral processions, tombs, and the like, used in the manufacture of masks, puppets, toys, bread, and candy. The reasons for this—atavism, reminiscence of forgotten cults, the character of the people, their interpretation of life, everything that may have originated and may justify the preference shown for death in folk art—may be studied, perhaps, only through ethnological and historical research. It is sufficient for the present study to record the facts as related to art.

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18. ARCHITECTURE. Pre-Hispanic Architecture.—In discussing pre-Hispanic architecture in Mexico one cannot limit one's field of interest to the present-day boundaries of the Mexican Republic, and hope to understand all the architectural manifestations of that period. This is due to the fact that the culture out of which it arose extended far to the south, while limited narrowly in its extension toward the north. Reference here will therefore be made only to the geographical and cultural area which archaeologists call Meso-America, that is, central and southern Mexico, British Honduras, Guatemala, western Honduras, and El Salvador.

There has been remarkably little excavation, considering the great number of monuments left by pre-Hispanic cultures. Thus only the first phase of architectural investigation has been completed: that of describing and classifying the known material in basic ways. The systematic study of techniques and of the development of forms, as well as the evaluation of styles and aesthetics, awaits the future.

Archaic Culture in Central Mexico.—The first architectural development with which we are acquainted in Meso-America belongs to the level of cultural development characterized by farming and pottery. Its technology, religious ideas, and patterns of urban association are characteristic of a very wide geographical area.

Cuicuilco.—The one well-preserved monument which belongs to this culture and which has been studied sufficiently is found in the Valley of Mexico, south of Mexico City, and is called the Pyramid of Cuicuilco. Shortly after its construction, apparently, the monument was covered over by a layer of basaltic lava, averaging eight meters in thickness. (One meter equals 3.28 feet.) This accounts for its relatively good state of preservation. The monument was excavated by Byron Cummings of the University of Arizona in 1922.

Despite the fact that the building is called a pyramid, it really consists of four superimposed truncated cones. These decrease in size. The first has a diameter of 135 meters, the last a diameter of 70 meters. The layout is oriented almost exactly along a north-south axis, with one end formed by a ramp and stairway leading up to the entrance. This solid construction serves as a platform for an upper construction of wood of which only traces remain. The body of the pyramid is filled with a mixture of clay and rocks, while the outside was faced with stones. Part of this facing is preserved in the upper portions.

The radioactivity of organic remains, analyzed by means of carbon isotope 14 (radiocarbon method) has yielded 600 B.C. as a possible date for the site.

Classic Cultures in Central Mexico.—*Teotihuacán*—The most important material remains of the new cultural horizon in the Valley of Mexico, a horizon which to some degree extended throughout Meso-America, and which is characterized basically by the formation of great urban centers, is the archaeological city called Teotihuacán. It is situated in a small valley, about 25 miles northeast of Mexico City, to the east of the Valley of Mexico and subsidiary to it. The development of the city may be dated very roughly between the 1st century A.D. and the 8th or 9th centuries A.D. Its beginnings tie into the Archaic culture; its terminal phase links up with the Toltec horizon by way of developments at Azcapotzalco, where its culture was carried on. While Teotihuacán has been studied intermittently since the middle of the 19th century, its methodical study by Manuel Gamio, Ignacio Marquina, Sigvald Linné, Pedro Armillas, and others has been under way only since 1922.

The city plan is laid out around a basic north-south axis formed by the Avenue of the Dead (*Miccaotli*), 55 meters wide, which compensates for the unevenness of the terrain by means of ascending tiers. The Avenue of the Dead is about 2,500 meters long, with indefinite limits toward the southern end. The main religious and secular monuments are situated close to the axis and perpendicular to it. Other streets also run parallel or perpendicular to the main axis.

The initial plan determined by these axes was followed rigidly throughout the city's growth. Lines not in harmony with it were avoided. Curved lines are completely absent. Axes also relate the complexes of ceremonial buildings to each other, but these relations do not serve to tie the whole into one aesthetic unit. On the contrary, each building group forms a closed-in unit with scant ties to the other groups.

The main axis, the Avenue of the Dead, is cut off at the extreme northern end by the building called the Pyramid of the Moon. In front of this building the big avenue widens into a rectangular plaza, 150 meters long along the front of the pyramid, and 120 meters wide. West of this axis rise the groups called the Temple of Agriculture and the Group of the Columns; east of it the Pyr-

amid of the Sun and the buildings which surround it. To the south lies the so-called Group of Superimposed Buildings, and, just before the avenue crosses the San Juan River, the one watercourse which traverses the city, is the Viking Fund Group. On the other side of the river, and virtually in line with the prolongation of the axis of the Pyramid of the Sun, lies the complex of the Temple of Quetzalcoatl, also called the Ciudadela (Fortress).

Due both to their location and dimensions, the most important of the buildings mentioned are the Pyramid of the Sun, the Pyramid of the Moon, and the Temple of Quetzalcoatl. The typical plan of these buildings erected for religious purposes consists of a base formed by the superimposed terraces which supported a small temple. None of the small temples have been preserved. The entire complex is surrounded by a platform on three or four sides. The Pyramid of the Sun, 64.46 meters high, with a square base 225 meters on each side, wholly dominates its surrounding platform. This relation has been inverted in the case of the Temple of Quetzalcoatl. The platform, with sides 400 meters long, is vastly larger than the pyramid, which measures only 40 meters at the base.

It has been possible to recognize three distinct periods in the development of these buildings. They are evident primarily in the evolution of the surfaces of the terraces which rise in layers to form the platforms. During the earliest period, the surface is a simple slope. The last step is represented by the architectural form called the "Teotihuacán panel." This consists of a rectangular compartment, outlined by a flat molding, which juts out over a sloping platform one third the size of the whole terrace layer. The inside may or may not be decorated with paintings as well as with sculptured forms. On the Temple of Quetzalcoatl, for example, the heads of two different types of serpents, evidently symbols of water deities, are arranged in strict order within a geometric design.

The system of construction employed in nearly all the buildings at Teotihuacán is very similar. Basically, it consists in heaping up earth, rocks, and adobe, together with retaining walls made of lava, into solid inner bodies for the pyramidal platforms. The retaining walls sometimes form a framework throughout the building. The panels with moldings that jut out are made of whole stone slabs which hold up the weight of the panel, and are faced with ordinary stones and lime stucco. Only the Temple of Quetzalcoatl has facings entirely of cut stones, which protrude into the body of the building.

The layout of buildings used as homes has received less study. It is possible, however, to distinguish buildings near the great temples, which seem to have been used by the priestly class. They show a quite systematic distribution of rooms, with porticos in front, around sunken courts intended for religious purposes. These courts were common to a number of housing units. The habitation area seems to have been very large, so that the large religious buildings formed only the center of an urban aggregate of great proportions.

Later buildings were generally superimposed on earlier ones, following either the vertical or the longitudinal axes of these buildings. The later buildings thus often hid the earlier ones wholly or in part. This custom was followed not only in the case of the great temples but also in the case of human habitations. It constitutes a characteristic common to all Meso-America.

Teotihuacán architecture is important not only in terms of itself, but also because it made its influence felt in such widely different areas as the states of Sinaloa and Tamaulipas in the north of Mexico and the highlands of the Republic of Guatemala to the south.

Cholula.—In pre-Hispanic times this city, now eight miles west of Puebla, was the most important religious and urban center in the Valley of Puebla. Few remains exist, since the colonial city was built over the ruins of the pre-Hispanic city. The most important monument, the main pyramid, was excavated systematically after 1931. As a result, five different architectural periods are known. Each period is characterized by a pyramidal structure of different size, each of which incorporated the pyramid of the preceding epoch.

The phases which stand out most clearly are I, II and IV. One must remember that I is the oldest and that at the time of the conquest the Spaniards found the pyramid unused and in ruins, during the last phase (V).

The structure belonging to phase I resembles in shape the Pyramid of the Sun at Teotihuacán, although its dimensions are obviously smaller. It measures 113 meters by 107 and is typically oriented toward the west, with a deviation of 17°. Five stepped terraces of structured pyramidal shape lead up to the topmost platform, which lies 17 or 18 meters above the surrounding terrain. Each stepped terrace is thus roughly 2.5 meters high.

The most outstanding characteristic of this structure is perhaps the special decoration of the panels which were later added to the slopes. These include polychrome paintings of greatly enlarged insect heads. In style and technique, they seem to be contemporary with the two earliest periods at Teotihuacán.

During phase II the building was completely covered over and its dimensions greatly enlarged. A side of its square base came to measure 190 meters. Its height of 34 meters was distributed among nine terraces, each shaped like a truncated pyramid, but each subdivided into 12 steps 0.30 meters high. The whole edifice thus came to represent a platform with stairways running up each one of its four sides. This continuity, which so strongly emphasized horizontal lines, is interrupted at only four points on each side where open-air drains from the platform above project vertically.

This monument is unique in Mexico, due both to the originality of its conception and to the maximum of emphasis on horizontal lines in its construction. No other building is known in which the same arrangement has been employed.

The works belonging to phase IV, the last phase of importance, cover the preceding ones and lend the edifice its present character. They are sadly ruined on the outside, but seem to have comprised two enormous terraces with sloping surfaces, separated by a wide passage on three sides, while on the fourth side one surface led into another and formed a single slope.

The dimensions of this pyramid are the largest found in any monument built in Mexico. It has a square base with sides 400 meters long and a height of 62 meters, nearly the height of the Pyramid of the Sun.

Transition Period in Central Mexico.—*Xochicalco.*—The ruins of Xochicalco are located 17 miles southwest of the city of Cuernavaca in the Valley of Morelos. From the cultural and architectural point of view, they seem to represent a point of transition between the Classic cultures and the Toltec period, both in terms of time, and in terms of their geographical location as a link between the cultures of the south and the Valley of Mexico.

In contrast to Teotihuacán and Cholula, the ruins are situated on the lateral spur of a mountain, the natural shape of which has been modified by five stepped terraces which tend to organize the terrain into horizontal levels and a surrounding area. The general layout of the terraced area follows a north-south axis 1,200 meters long and an east-west axis 700 meters long.

The top platform is reached by means of two walks formed by staircases which begin in the south and west. It measures roughly 300 meters by 200 meters, and supports the chief buildings of the city. The most important of these buildings in terms of location, state of preservation, and architectural style is located where the general axes of the city cross. It consists of one body, the profile of which is formed by a slope that covers two thirds of its total height, and of an unbroken floor which juts out over the slope and rises on a beveled cornice. The temple which rose on this platform seems to have had a similar silhouette, though only the part belonging to the slope has been preserved. The outside of the whole construction is finished with reliefs of cut and worked stone. These represent the undulating figure of a plumed serpent, which shelters seated human figures and the symbol of the new fire in its curves. A number of authors have called attention to the stylistic similarity of the human figures to Maya representations. Remains of polychrome stucco, which once completely covered architecture and sculpture, are found in different parts of the whole monument.

There are other monuments adjoining the terraces, which form true esplanades. The most interesting of these is the ball court, which in layout and front elevations shows similarities to the ball courts of Copán and Piedras Negras in the Maya area, and to the ball court of the Toltec city of Tollan (Tula).

In contrast to the metropolis of Teotihuacán, Xochicalco seen as a whole gives the impression that the planner, in striving to attain the shapes of stepped pyramids, has attempted to erect one gigantic pyramid. Its body is formed by the natural prominence of the hill of Xochicalco; its stepped tiers are defined by the surrounding terraces.

Toltec Period in Central Mexico.—The fall of Teotihuacán as a cultural center marks a profound break in the development of architecture on the plateau, though it does not imply a complete abandonment of the architectural forms and arrangements produced during the city's period.

Pottery shows a cultural continuation of the Teotihuacán period; in architecture this is represented by decorative elements which appear at Tollan and which were developed during the preceding period. Among the latter elements may be mentioned the special type of panel employed at Tollan (this represents the last step in the evolution of the panel of Teotihuacán and is described below); the merlons of battlements in the shape of a transversal section of a snail; the representations of Tlaloc, god of the rain; the general arrangement of the pyramidal platforms in religious structures; and the layout of courts surrounded by rooms in structures used as homes.

Tollan.—The city of Tollan, the modern Tula, located in the Valley of Tula in Hidalgo, was the center of the new cultural horizon. Excavations were carried on there sporadically after 1873, but systematic excavations were made only from 1940 to 1945. As a result a number of buildings of artistic and archaeological value are known, and proof has been obtained that this city was the capital of the Toltec Empire mentioned in the Indian chronicles before the Spanish conquest.

The building which gives the clearest idea of Toltec architecture is Temple B or Temple of Tlahuizcalpantecuhtli, which forms part of the northern side of the main plaza of the city. It consists of five superimposed terraces decorated with unusually shaped panels, which are divided into three horizontal strips. The lowest forms a slope roughly one third of the total height; the top one consists of a continuous frieze delimited by two smooth moldings with alternating figures of jaguars and coyotes. In the middle strip, panels which stand out alternate with sunken ones. These show eagles devouring human hearts, and a figure which combines human features with those of bird and serpent. A stairway on the southern side facing the plaza ascends to an upper platform where there are remains of columns in the form of anthropomorphic "atlases," eight of which held up the flat roof of a temple. The entrance to the temple was divided into three spaces by columns in the shape of serpents. The tail of each serpent formed a kind of capital, while the head formed the base. Three corridors of pillars, with square sections and decorated with the images of warriors, stood in front of this temple and connected it with the plaza.

All the decorative elements mentioned are repeated with remarkable exactness on the buildings at Chichén Itzá in northern Yucatán which belong to the period of Toltec influence. This supports the supposition that Temple B is older than the Toltec emigration to the south and Yucatán, which took place during the reign of Ce Acatl Topiltzin Quetzalcoatl, in the katun 2 Ahau (987–1007 A.D.), according to the Maya chronicles.

There are a number of other buildings, apart from the one just described. Among these are Mound A, remarkable for its size, but little known, and two ball courts, one on the western end of the main plaza, and the other north of Temple B. These ball courts are of undoubted importance within the general plan of the city and exhibit close similarities to the one at Xochicalco.

Other known buildings are the ones surrounding Temple B and the so-called Palace of Cielito which show the development of porticos around courts, with a layout similar to the buildings of Teotihuacán, but with greater use of isolated supports and more control over them.

Generally it may be said that Tollan lacks the monumental conception evident at Teotihuacán and Xochicalco. The principle of axes of a city has been lost, while the general orientation of buildings along a 17° deviation has been preserved. Religious architecture still dominates, but secular architecture has certainly gained in impulse and has come to use more differentiated elements, such as the pillar and the atlas-type

column. These are used to further a tendency toward relating architecture to the needs of interior structure and decoration, stripping it of the wholly external character typical of Teotihuacán.

The decorative sculpture on the buildings lends them an air of greater luxury and ostentation, retreating from the tendency of the preceding period towards the schematic and geometric. Yet the abundance of new decorative elements gives rise to the impression that there existed a creative tendency to produce new forms, without the refinement and control over aesthetic and technical expressions needed to carry these motifs to a high level of maturity.

Post-Toltec Period in Central Mexico.—*Tenayuca.*—In this small present-day village, eight miles north-northwest of Mexico City, and once of great importance as the center of Chichimec power after the eclipse of Toltec rule, there are some remains which have been well studied in excavations carried on by the Instituto Nacional de Antropología e Historia.

A series of successively superimposed architectural structures belong to an equivalent number of periods. From the earliest period to the latest, the layout used is always the same. It is characterized by three or four stepped terraces with more or less sloping surfaces, which support an upper platform with twin temples. These can be reached by way of a staircase divided in the middle by a double ramp.

Mention may be made of a type of low wall formed by closely spaced serpents which coil back upon themselves and surround the pyramid on the three sides of lesser importance.

The decorative and architectural poverty of these monuments and the repetition of the same arrangements seem to indicate a standstill in the evolution of styles during the three centuries preceding the Spanish conquest.

The known remains of the great temple of the old Aztec city of Tenochtitlán in Mexico City and of the temple there in the barrio (quarter) of Tlaltelolco resemble the Tenayuca pyramid in style.

Valley of Oaxaca.—*Monte Albán.*—This ancient city, six miles west of the modern city of Oaxaca, is primarily interesting for its overall plan in which the highest portion of a hill rising 400 meters above the valley has been used for its buildings. The main center includes a rectangular plaza surrounded by buildings on its two larger sides and delimited on the two shorter sides by two great platforms. The main axis of the plaza is marked by four low structures which stand in line. The principle of organization in terms of parallel or perpendicular axes is absent in this arrangement, which is characterized, however, by a series of relations set up by visual perspective which have determined the position and dimension of each monument.

The central part represents a great center of monumental buildings. The spurs of the mountain have been absorbed by means of stepped terraces, containing a large number of tombs. The whole complex is thus one great necropolis. Four periods of architectural development are recognizable in the form and system of construction of the tombs; these periods are also evident in the development of ceramics. The city flourished during the Classical period in central Mexico, and was abandoned about the end of the 8th century A.D., though it was used later as a burial ground.

The slopes of the stepped terraces of the main buildings are decorated with a special type of panel, called *escapulario,* used principally on ramps. It consists of alternating lower vertical elements and horizontal top ornaments of varying height.

Mitla.—This city, 26 miles southeast of Oaxaca, flourished during the Toltec period in central Mexico, after the decline of Monte Albán. The monuments of Mitla were known throughout the colonial period. They are preserved in part due to their stone construction which is, technically speaking, perhaps the best in Meso-America.

The city consists of five groups of buildings, clearly the same in layout. Each is made up of three extended constructions on top of platforms which surround a plaza on three sides, leaving the fourth open. These buildings bear decorations unique in Meso-American architecture. The decorations consist of three strips of panels similar to those found at Monte Albán, with square compartments containing Greek frets of great variety, which were produced by a type of stone mosaic. These buildings are also outstanding from the architectural point of view due to the use of great stone lintels on the doorways, and due to the division of halls by monolithic columns which held up the roof. The lintels are up to seven meters long and 1.20 meters wide.

Gulf Coast.—*El Tajín.*—This city, which flourished near modern Papantla in northern Veracruz during the Classical period in central Mexico, is not sufficiently known; but special mention should be made of its best preserved building, the so-called Pyramid of the Niches. The pyramid consists of six stepped terraces. Square niches, formed by laying flagstones vertically and horizontally, are crowned by a wide cornice. The effect of lights and shadows in the niches gives the onlooker an impression of great height and the total effect is very picturesque. The number of niches appears to equal the number of days in the solar year and there has been much speculation about their use. The general silhouette of the building has a slope of close to 45°.

Maya Area.—Maya architecture represents the most differentiated type of architecture within the entire cultural complex of Meso-America. Its stylistic development leads almost without interruptions from the beginnings of the 4th century A.D. to the middle of the 15th century. In terms of modern political geography, the monuments of Maya culture are scattered through Guatemala, particularly in Petén Department; British Honduras; the west of the Republic of Honduras; and the southeast of the Mexican Republic, which includes the Peninsula of Yucatán and the states of Chiapas and Tabasco. For methodological considerations, however, archaeologists divide the Maya area into the regions used below.

Petén Region.—According to the opinion of Sylvanus Griswold Morley (1883–1946), which is generally accepted, the first Maya cities to develop were Uaxactún and Tikal.

At Uaxactún, 37 miles north-northeast of the modern city of Flores, probably the oldest monument is the substructure E-VIII, excavated by the Carnegie Institution of Washington. It consists of a low stepped base with four stairs and ramps decorated with grotesque faces. The whole monument is covered over with a thick layer of stucco. Its construction is dated at earlier than

the Maya date 8.14.0.0.0. (317 A.D.), due to its association with Chicanel-type pottery. The construction above this base was of wood only.

One of the characteristic elements of Maya architecture, the corbeled arch, is found for the first time in Group A-V, dated a little later than 328 A.D. From this date on, it is used with variations in forms and materials throughout Maya architecture.

The prototype of the temple in the shape of a pyramid reaches its greatest development in the Maya city of Tikal, 27 miles northeast of Flores. There, five great structures were built, with the highest 70 meters high. The latter, Temple IV, consists of a stepped base of nine terraces and an upper construction of three chambers parallel to the façade, and walls up to seven meters thick, which support a cresting, 14 meters high, in the rear portion.

Copán and Quiriguá.—Due to the custom of setting up dated memorial steles observed in all the Maya cities, we know that Copán, 35 miles west of Santa Rosa in western Honduras, thrived from 450 A.D. to 800.

The architectural monuments show a more perfect type of construction, involving the use of cut stone and less use of stucco. Decorative sculpture made great use of human and animal forms, as well as of plant themes, and is found concentrated around doors and along the façades around archways.

The most important monuments are Temple 22, Temple 11, and the Stair of the Hieroglyphics. The first of these rises on a base formed by a single terrace and consists of two halls parallel to the façade, and two others perpendicular to the ends of the first two. The entrance leading from the outside into the first hall is formed by the mouth of a grotesque face; the communicating door between the first and the second hall is ornamented with human figures in high relief, which surround the door on all sides. A high step of the stairs is similarly decorated.

The Stairway of the Hieroglyphics begins at the east end of the main plaza. The fronts of its 63 steps are decorated with more than 2,500 hieroglyphics, and at every section sculptured figures rise from the center of the ramp.

The layout and the orientation of the buildings at Copán show some points of contact between this city and the cities of central Mexico. The Maya city of Quiriguá, in Izabal Department, eastern Guatemala, has little importance from the architectural point of view; its few buildings are patterned on those found at Copán.

Usumacinta River Drainage, Tabasco, and Chiapas.—Three of the most important cities of the Maya area are located in this region: Yaxchilán, Piedras Negras, and Palenque. Their general plan has been adapted to mountainous terrain; their urban pattern does not follow a clearly defined plan. The pattern consists of unequal terraces and steps, which tend to organize the terrain, and which create groups around plazas and courts.

Piedras Negras, in Petén Department, Guatemala, 90 miles west-northwest of Flores, is at one and the same time the most ruined of these cities and the richest of the three in the sculptured decoration of its steles, lintels, and thrones.

Yaxchilán, in Chiapas, possesses well-preserved buildings such as Structure 33. These consist of only one hall, which runs parallel to the main front, and transversal buttresses which support a large cresting formed by two wedged and leaning walls and which come together at the center of the building. The lintels of all of the buildings are stone and most of them are sculptured.

The Temple of the Sun at Palenque, State of Chiapas, Mexico, is its most representative structure. It is constructed of flat stones or flagstones and is thickly decorated with stucco. It has a double hall, and in the rear a small sanctuary with a corbeled arch which covers a panel sculptured in low relief. This panel shows human figures flanking a representation of the sun and four columns of hieroglyphics around the edges.

Southern and Northern Campeche.—These two regions are usually called Río Bec and Chenes respectively. They seem to represent an intermediate step between the architecture of the Petén region and the architecture of northern Yucatán.

The decorative forms of both groups are very similar. They make great use of the grotesque face. In the first of these zones there are simulated temples which do not contain any interior rooms whatsoever.

The most important cities of the first group are Río Bec and Xpuhil; of the second, Hochob, Tabasqueño, and Dzibilnocac.

Puuc in Yucatán.—In the north of the Peninsula of Yucatán there exist small complexes of cities and building groups which are notable for exact and careful stonework, for special types of decoration, among which geometric elements predominate, and for their stress of the horizontal lines in the buildings. It is possible that these buildings are coeval with Toltec influence, which is clearly evident from 1000 A.D. on, and which possibly began before that date.

The most important city for its size in puuc (Maya renaissance) style is Uxmal, 40 miles south of Mérida. Its general layout does not obey a strictly preconceived plan, but is clearer than that of most Maya cities.

The most important buildings extend horizontally and consist of corridors of rooms, raised on low platforms. Yet some also show considerable development into pyramidal structures, such as the chief pyramid, called the House of the Wizard, and also the structure called the House of the Old Woman.

Buildings with many rooms are almost always grouped in rectangular fashion: four buildings, the sides of which do not touch, around a court. To this type belong the so-called Nunnery Quadrangle, the House of the Doves, the Cemetery, and some others that are less well preserved.

The most outstanding building of puuc style is called the Governor's House. It is constructed on top of a platform with sides 150 meters long, and directly on a base seven meters high. The building proper consists of twin corridors of rooms with a front of 98 meters. The façade is divided into component parts. The middle one is the biggest. It consists of a flat area formed by the walls and a much-decorated higher area which belongs to the arches. Along this decorated higher surface geometric motifs, grotesque faces, and lattice work alternate along diagonal lines.

Remains of a ball court excavated by the Carnegie Institution's archaeologist, S. G. Morley, have also been preserved.

Toltec Influence in Yucatán.—The similarities between Toltec and Maya architecture became

known when systematic excavations were begun in 1940 in the Toltec city of Tollan (now Tula). According to Indian chronicles, corroborated by archaeology, this cultural current originated in central Mexico in the beginning of the second millennium A.D., although it seems certain that less profound contacts existed before.

The following architectural and urban elements are characteristic of this influence: layout of the entire city according to one plan, and more or less exact relationship of the axes of different buildings to each other; columns in the shape of plumed serpents; slopes at the base of walls; creation of great roofed-in spaces with corridors of pillars and columns; atlas-type figures; and use of merlons.

The buildings most representative of this influence are the Temple of Kukulkán (or El Castillo), the Temple of the Warriors, and the ball court at Chichén Itzá, 72 miles east-southeast of Mérida. The first two buildings have substructures which belong to an earlier period, but which also reveal Toltec influence.

In the same city there are other buildings which certainly belong to a previous period. These show more Maya style in their architecture, with grotesque faces as decoration, as is evident in the group of the Nunnery. These Maya elements continue in the buildings of the period of Toltec influence, together with the system of construction based on the corbeled arch.

Toltec influence is also visible in the much ruined cities of Mayapán, 24 miles south-southeast of Mérida, and Tulum, on the coast of Quintana Roo.

COLONIAL ARCHITECTURE

The architectural development of the colony shows various phases which are related in part to local conditions, both political and social, and in part to the development of styles in Europe. The first phase comprises the years from 1521 to 1550, a period which corresponds to the conquest of New Spain (Mexico). In the second half of the 16th century and at the beginning of the 17th century, Renaissance influences are felt; just as in the following years and during all of the 18th century the baroque style is developed to its ultimate consequences. The last 30 years of the colonial period reflect in Mexico the neoclassical tendencies current in Europe.

From 1521 to 1550.—Immediately after the conquest of the Aztec capital, Tenochtitlan, on the site of Mexico City, feverish activity was displayed to furnish the conquerors with churches and dwellings. In building the churches, the basilica type was adopted, as in the original cathedral of Mexico City. Another characteristic type was the so-called open chapel, which could accommodate the immense congregations of newly converted Indians, and which has certain analogies with the architecture of the natives. An example of this type of chapel open to the sky is that attached to the Monastery of Tlalmanalco, State of Mexico, which is arcaded; the arcades being profusely ornamented with sculptured archivolts in the plateresque style. Other examples are the churches at Actopan, Hidalgo; Yautepec, Morelos; and the Royal Chapel at Cholula, Puebla.

From 1550 to 1630.—During this period the building of great "fortress monasteries" belonging to the Franciscan, Augustinian, and Dominican orders was carried out. These edifices, springing up all over the country, served as active centers for the Christianization of the natives.

The general disposition of the monasteries is almost always the same. A thick-walled masonry church with a single nave, and rib vaulting supporting an arched stone roof was prevalent. Its exterior was generally undecorated except for the area around the entrance, above which there might be a small rose window. To the right of the church the monastery proper is found, together with one or two large patios around which are placed various dependencies. These constructions are surrounded by a great uncovered courtyard or atrium, which is enclosed by chapels and a battlemented wall.

It is easy to perceive in these monasteries the Romanesque, Gothic, and plateresque influences. The outstanding examples of this architectural type are found in the monasteries at Huejotzingo and Tepeaca, in Puebla; Acolman, Mexico State; Actopan, Hidalgo; and Atlatlahucan, Morelos.

In this same period the construction of great cathedrals, such as those of Mexico City and Puebla, was undertaken. These two edifices were not completed until the middle of the 17th century, however, and are predominantly neoclassical, although they incorporate many styles inside and out.

Baroque.—The monastic orders followed the expanding frontier of Hispanic civilization and were replaced in the rapidly growing cities by the secular clergy. The baroque style, which makes its appearance in Mexico after the first 25 years of the 17th century, coincides with the most flourishing economic period in New Spain and, due to its characteristics of form, it developed as the most suitable manner of expressing the amalgamated feelings of Spaniard and native. As a result the baroque style crystallized in Mexico into a group of works which, because of their number and quality, form the most genuine artistic manifestation of the colonial period, and at the same time constitute the most differentiated style when compared with the art of the mother country, Spain.

Within the baroque period, which maintained its output for more than 150 years, a line of evolution can be traced, which, starting from the forms of the Renaissance, began to develop a new style guided by the premises of expression and movement at all costs, until it reached the ultimate consequences of these principles.

The development of baroque style in Mexico is usually divided into two phases, the first of which is known as baroque proper and the second as Churrigueresque. Certain examples which show the proportions and regularities of the Renaissance combined with baroque principles are the churches of Jesús María, completed in 1621, and of San Lorenzo, completed in 1650, both in Mexico City. Toward the end of the century there appeared the ornamentation of the body of the columns, and finally the twisted or spiral column which forms the most typical element of this first phase. Church portals were heavily ornamented with carvings and a profusion of sculptured figures placed in niches. The interiors were also exuberantly decorated. Brightly painted, carved stucco covered walls and sections of ceilings with innumerable heads, figures, and varieties of decorative motifs. The baroque style was also adapted to large residences and colleges. Besides certain buildings erected in the capital, mention should be made of other groups

having definite local traits, such as the churches of the valleys of Oaxaca and Puebla, among which the churches of Santo Domingo in Oaxaca, San Francisco Acatepec and the Chapel of the Rosary in Puebla are outstanding.

Churrigueresque.—The second phase, typified by the almost exclusive use of the reversed pyramid as an ornamental support in façades and altars, appears for the first time in the Altar of the Kings of the cathedral of Mexico City. This altar, begun in 1718, is the work of Jerónimo de Balbos.

A great number of churches in Mexico City were built in the new fashion, which carried the baroque to its limits in fantasy and inventiveness and created even more elaborate church façades, and *retablos* (decorative altar pieces) of richly carved, gilded wood as a background to an array of small polychromed statues. Among such churches are the Sagrario Metropolitano and the Church of La Santísima Trinidad (both the work of Lorenzo Rodríguez), the Balvanera Chapel in the Church of San Francisco, the Church of La Santa Veracruz, and the Church of La Enseñanza. Churrigueresque extended itself to all corners of the colony and formed local focuses, the most important of which rose among the cities of the central regions. The finest examples of this style are the churches of Santa Rosa and Santa Clara in Querétaro, La Valenciana in Guanajuato, San Agustín in Salamanca, and the Del Carmen Church in San Luis Potosí, among others that might be mentioned.

In the final manifestations of baroque style the concept of architectural elements was lost; ornamental moldings, and animal, vegetable, and anthropomorphous leitmotifs being substituted for it. (See also the section *Colonial and Modern Art.*)

Neoclassicalism.—During the last quarter of the 18th century, in partial juxtaposition to baroque, there appeared the neoclassical style, imported directly from Spain with the arrival in Mexico of architects such as Manuel Tolsá, Antonio González Velázquez, Jerónimo Gil, and others. Tolsá, an architect and sculptor, and a native of Valencia, completed the cathedral of Mexico City and built the Real Seminario de Minería there. Of native architects, mention should be made of Ignacio Costera, Francisco Eduardo Tresguerras, designer of the Church of Nuestra Señora del Carmen in Celaya and the Palacio Real in Guanajuato, and José Manzo who worked mainly in Puebla. The neoclassical style did not terminate with the end of the colonial era, but lasted until the middle of the 19th century.

Domestic Urban Architecture.—This architecture, which showed far less variation than that of churches and public buildings, generally arranged rooms around a paved patio which was enclosed on four sides and contained the family garden, the rooms opening directly onto the patio. Most public buildings, of one or two stories, also incorporated the patio in their design. The houses, built of stone, stuccoed brick, or adobe, were usually severely plain outside. There were some notable exceptions to this, however, such as the Casa de Alfeñique ("Sugar-paste House"), built in Puebla in 1790, whose walls are faced with unglazed red and glazed blue tiles and a lavish white stucco trim, the latter giving the mansion its nickname.

MODERN ARCHITECTURE

To understand fully the development of modern architecture in Mexico, it is necessary to bear in mind its immediate antecedents in Europe, where its first manifestations occurred. These first manifestations appeared in Mexico in the middle of the 19th century, although they did not crystallize into a true artistic style until much later.

The 19th and Early 20th Centuries.—Whether one turns to the Europe of this period, or to Spanish America—in this case particularly to Mexico, where remarkable works of architecture were produced during the colonial period—a deep fracture becomes evident in a Western artistic tradition, which for an uninterrupted period of 5,000 years had produced an architecture in stone. The new architect, allowing himself to be carried away by a completely subjective taste, and utterly disdaining the deepest roots of style, turned to the latest artistic novelties exhumed by archaeologists and historians to find a repertory of anachronous forms which he applied with scientific coldness to the ornamentation of his façades. Thus an architecture was developed that copied the Gothic cathedral in building its churches, Greek temples in its banking buildings, and which even reproduced architectural forms alien to Western culture, such as Arabian patios and Mayan temples.

In this process of copying the forms of other arts, toward the end of the 19th century architecture reached a new phase characterized by the copying of nature itself; executing this copy not as a means of expression, but rather as a finality in itself. This is the artistic mode known as *art nouveau* (new art). The noble art of architecture, which fundamentally had expressed itself through the severe forms of geometry, now found itself transformed into an art of naturalistic ornamentation.

The situation in which architecture found itself was typified in Mexico by the arrival of two architects, Lorenzo de la Hidalga, a Spaniard who arrived in 1838, and Xavier Caballari, an Italian who reached Mexico in 1856. It must be noted that the period immediately following Mexican independence (1821) had marked a critical moment for the Academy of Architecture, which for a time was forced to close its doors and only regained impetus through the efforts of Javier Echeverría and José Bernardo Couto, chairmen of its Board of Trustees. It was they who decided to avail the academy of the services of de la Hidalga and Caballari.

Within the eclectic tendencies referred to above were executed the baldachin of the cathedral of Mexico City, which replaced the original one in Churrigueresque style, the Teatro Nacional (National Theater) inaugurated in 1844, and the dome of the Sanctuary of Santa Teresa. All three of these structures in the capital were the work of de la Hidalga and may be characterized as the last germination of that neoclassicalism which took hold in Mexico in the final years of its colonial period.

The Italian Caballari is important not so much for his personal output as because of the impulse he brought to the Academy of Architecture, modifying its curricula by fusing architectural and engineering studies into a single course.

The second half of the 19th century was dominated by influences emanating from France,

whence radiated the prevalent fashions and taste, not only in architecture but in other fields of life as well. The principal Mexican architects of the period were trained in the École des Beaux-Arts in Paris, bringing its teachings back to the academy in Mexico.

The architect Emilio Dondé (d. 1905) designed luxurious mansions and built the Church of San Felipe de Jesús in Mexico City in a style somewhat similar to Romanesque-Byzantine. Antonio Rivas Mercado, counted among the finest architects of his time, erected the Independence Monument in the Paseo de la Reforma in the capital. This not only ranks among the noblest architectural works of its period, but also served to introduce technical innovations, such as the use of supporting piles driven to great depths. These were introduced to offset the sponginess of the subsoil.

At the dawn of the 20th century another work of colossal dimensions was begun in Mexico City, the Palacio de Bellas Artes (Palace of Fine Arts). This was entrusted to the Italian architect Adamo Boari, who applied to it the forms of *art nouveau,* giving Mexico what is possibly the finest example of that architectural style in all the world; certainly the most finished. Boari's general layout is clear and well-ordered, and fineness of design and good proportions are notable in the details.

Other buildings of less importance were constructed in the capital in the most varied styles: the Edificio de Correos (Post Office Building), also by Boari, in Gothic; the pavilion of the Alameda de Santa María, in Spanish Moorish; and the Secretaría de Gobernación (Department of the Interior) in the style of the Renaissance.

In all these constructions, as in their counterparts in Europe, two new structural materials are made use of—steel and concrete. Nevertheless, the use of these did not yield, at the time, any apparent changes in the conception of architectural forms.

Contemporary Architecture.—Having examined the architectural production of the second half of the 19th century and the beginning of the 20th, one is able to investigate the architecture usually called modern or contemporary. A very brief reference to the aesthetic ideas which preceded it and which served to form the intellectual atmosphere in which it began will first be made.

The purely objective consideration of an artistic work is a tendency, based on certain of Immanuel Kant's philosophical considerations, which gained great momentum during the last third of the 19th century. In its historical application to the field of architecture it was championed by the German art theorist Konrad Fiedler, who saw the specific values of architecture as exclusively formal and spatial, the spatial ones deriving from the formal. Fiedler likewise maintained in his writings the basic predicate that the prime factor in architecture is "functionalism," considered as the need of covering an enclosed space. Similar ideas and even more radical ones were upheld by the eminent German architect Gottfried Semper, who proclaimed the technogenetic roots of architectural art.

Modern architecture rose out of the activity generated by these ideas, in the first decade of this century, some 15 years prior to its appearance in Mexico. It is necessary to refer to these ideas because of their widespread influence in contemporary Mexican architecture.

The first productions of modern architecture in Mexico were produced in the first interval of social stability following the Revolution of 1910. The head of the new architectural movement was a young architect, José Villagrán García, who attained the professorship of architectural theory in the National University in Mexico City and formed a small but integrated group with Mauricio R. Campos, Enrique del Moral, Juan O'Gorman, Juan Legarreta, and others, who soon became the stalwarts of the new architecture. This group contended against the Academy of Fine Arts, which they regarded as simply a follower of architectures of the past. According to the new ideals, architecture was to be eminently "functional" and was to solve the needs of man considered as a whole, in all his psychic and physical complexity.

Faithful to these ideas and in collaboration with his students, Villagrán García in 1925 brought to completion the laboratories of the Instituto de Higiene (Institute of Hygiene) in Popotla, a suburb of Mexico City, this being the first accomplishment of the new architecture in the republic.

The various blendings of ideas and a greater radicalism in their creative thought, together with the influence of the Swiss architect Le Corbusier, which was immediately felt by the pioneering group, moved O'Gorman and Legarreta toward a solution of the problems created by what were called "popular" dwellings of the masses. Together they began the construction of groups of "popular" homes and schools between the years 1931 and 1934. This architectural tendency, combined with ideas of a social and political nature, led to the creation of the so-called advanced school of construction by O'Gorman and the engineer José A. Cuevas in 1932.

Nevertheless, this appearance of modern architecture did not in the least suppress the great profusion of works representative of opposite ideas, among which mention should be made of the conceptions determined by the influence of the Paris Salon of Decorative Arts, and also of the various attempts to originate a "national" architecture. Among the first group mentioned one finds the works of Juan Segura, such as the Ermita Building in Tacubaya, a suburb of Mexico City, the open-air theater in Colonia Hipódromo, a residential section of the capital, and some of the works of Carlos Obregón Santacilia (1898–), such as the interior of the Bank of Mexico, also in Mexico City. In all these works may be noted the geometric stylizations of classical forms intermixed with surviving elements of *art nouveau.*

The attempts to form a "national" architecture have been of much greater importance, owing to the number of works those attempts have produced. The system followed in each case has always been to take forms or conceptions belonging to past periods of Mexican history and to adapt them to present needs and problems. In this fashion, the architect Amabilis brought to his constructions decorative elements of Mayan architecture from the Yucatán Peninsula. Obregón Santacilia adapted the typical dwellings of the 19th century, called *viviendas,* furnishing them with ventilation, illumination, hygienic conditions, and other modern improvements. In the reconstruction (1930–1934) of the Palacio de Bellas Artes, carried out by Federico

Mariscal (1881–), discreet use was made of pre-Hispanic themes, as in other constructions of the same architect.

In addition to these attempts, carried out by trained architects within the limits of discretion and archaeological knowledge, there have been other very numerous productions of private architecture and sometimes even of public buildings, executed generally by engineers and contractors devoid of professional skill. These productions, which have given a special countenance to certain entire residential sections of Mexico City, can be classified within the generic and derogatory denomination of Californian-colonial. In these productions one finds elements grotesquely copied from colonial architecture, profusely decorated with fireplaces, coats of arms, rustic touches, and the like. The most deplorable technical and structural qualities are combined with a taste that can only be described as ridiculous and anachronous.

Leaving aside those tendencies, which may be called heterodox, and once more taking up the new movement, it should be said that the most important fruits of modern Mexican architecture appeared during the decade of 1940–1950, brought into being in the large edifices built along the important avenues of Mexico City and in the great collective projects sponsored by various government agencies.

The first of the great privately owned buildings in the capital was that of the La Nacional Insurance Company, its design and constructions deftly carried out by the architect Manuel Ortiz Monasterio and the engineer Calderón. This type of building, similar in general outline to the skyscraper of the United States, has been also used in the constructions of the brothers Francisco (1894–) and Luis (1908–) Martínez Negrete who erected the San Antonio Building and the Seguros de México Building. Other great buildings have sprung up along the famous Paseo de la Reforma, giving this boulevard the definite quality of a commercial avenue. Among these the following should be mentioned: the building at Number 1 Reforma, designed by the brothers Martínez Negrete; the La Fragua Building by Mario Pani (1911–); and the vast central building of the Instituto del Seguro Social (Social Security Institute) by Obregón Santacilia.

Among the great groups of buildings designed for government agencies is the Hospital City in the capital, which is part of the general plan for the construction of hospitals in all parts of Mexico sponsored by Gustavo Baz while he was secretary of public health and social assistance, and which has been only partially completed. The design and construction of public schools throughout Mexico is also worthy of mention. This work is being carried out by the Committee for the Construction of Schools and by the Buildings Division of the Department of Public Instruction, under the direction of the architects José Luis Cuevas and Pedro Ramírez Vásquez.

Special mention should be made of the University City in the capital, begun in 1950 and dedicated in 1952. This work, of great transcendency from an architectural point of view, is the fruitful result of the collaboration of the best Mexican architects, headed by Enrique del Moral and Mario Pani, who are the directors of the project.

The formal characteristics of modern architecture in Mexico are very similar to the corresponding ones in Europe and the United States: elementary combination of geometrical volumes, a marked tendency towards a horizontal line, and an almost absolute exclusion of the curved line. When the latter is used, it is expressed mainly in the form of parabolas and ellipses.

Special attention is paid to the function which is to be fulfilled by the building, rationalist logic is applied to the use of materials and technique, and there is a growing interest in expressing a definite aesthetic idea. Any element that tends to obscure the expression of form is eliminated. Interior and exterior space is fused, not limited. All these are significant traits of modern Mexican architecture. Particular mention should be made of the importance granted by the Mexican architect to the use of colors as an element of ornamentation which underscores and gives added clarity to architectural form.

RICARDO ROBINA,
Architect.

19. LITERATURE. Mexican literature, like every other aspect of what we understand as Mexican culture, is not of a wholly indigenous nature. The roots of Mexico are found both in the native pre-Hispanic culture and in the Spanish culture. These two aspects have blended in varying proportions to form present-day Mexico.

Pre-Hispanic Period.—The most important pre-Hispanic peoples—the Maya, Tarascans, Otomís, Mixtecs, Zapotecs, and Nahuas; mainly the Aztecs among the last—all created important literary works, which undoubtedly were numerous. Unfortunately, these were almost completely lost when European civilization was superimposed on Indian cultures, for the native literatures were all oral and their creators had not yet perfected literary texts. Their hieroglyphs could express only concrete facts or symbols of concepts—thus all codices were records of history, taxes, or mythology—and they were useless to communicate that beauty of expression which is indispensable in literature.

Very few works were saved from the upheaval caused by the conquest, to be later transcribed into European writing; some books were, however, saved in this way, such as the Maya *Popol Vuh* and a few epic and lyric poems, mainly Otomí and Nahua, all of them relating to a period immediately before the conquest and all anonymous, with the exception of a few songs attributed to Nezahualcoyotl. Many modern scholars, however, doubt that this 15th-century king of Texcoco was the real author of these poems. In any case, these few monuments of a lost literature have exerted no direct influence in the awakening of what must now be considered as Mexican literature.

The true roots of the literature of Mexico are to be found in Spanish literature, in which at the time of the conquest (1521) one could already find outstanding examples of every literary genre, and which was soon to embark on its golden century, so amazingly rich.

The 16th Century.—The first type of work—not strictly literary—produced in New Spain (Mexico) was the chronicle. The best examples are found among the chronicles of the conquest, such as the *Cartas de relación* of Hernán Cortés and the *Historia de la conquista* (published 1632) of Bernal Díaz del Castillo, and among the religious chronicles—in those of the friars Toribio

Motolinía, and Jerónimo de Mendieta, whose *Historia eclesiástica indiana* (published 1870) is an account of the conversion of the Indian peoples to Christianity, and in the remarkable research work of Friar Bernardino de Sahagún, who wrote the *Historia general de las cosas de Nueva España* (first published 1829–1830).

Another primitive genre was the drama used for the evangelization of the Indians, which consisted of adaptions in the native tongues of the religious drama of medieval Europe. Its very purpose made it a short-lived phenomenon, to which many references are found but of which very few works are left.

A dramatic movement equivalent to that called *prelopista* (before Lope de Vega, 1562–1635) in Spanish literature soon made itself felt in the towns of New Spain where Spaniards lived, mainly in the capital. The year 1574 saw the performance, in honor of Pedro Moya de Contreras on his investiture as archbishop of Mexico, of the allegorical work *Desposorio espiritual del pastor Pedro y la iglesia mexicana* by the presbyter Juan Pérez Ramírez, the first writer born in Mexico (1543–?) and perhaps the first in the whole of the American continent. A short time later the *Tragedia del triunfo de los santos* was played. The author of this verse play with a medieval theme is unknown, but he was probably a Jesuit, and he shows a marked Renaissance influence. The most important writer of this time was Hernán González de Eslava (1534–1600?), of whom we have 16 *Coloquios espirituales y sacramentales,* religious and allegorical plays similar to the medieval mystery plays. They are uneven works, but the fact that some of them deal with local Mexican themes is of special interest.

Epic and lyric poetry were also cultivated from very early times. Francisco de Terrazas (c.1525–1600) was a good poet following in the steps of the school of Seville. Also important were Pedro de Trejo (c.1534–c.1600) and Fernando de Córdova y Bocanegra (1565–1589); but the outstanding writer of the period was Bernardo de Balbuena (c.1567–1627), who wrote three long poetic works: *La grandeza mexicana,* a eulogy of Mexico (1604); *El siglo de oro* (1608), a pastoral novel in imitation of Jacopo Sannazaro; and *Bernardo* (1624). The last, dealing with the semilegendary hero Bernardo del Carpio, is one of the best epic poems of its time.

Besides literary works in the Spanish language there were writings in the native tongues, decreasing in number as the years advanced; also works in Latin, of which the most important in the 16th century are some *Dialogues* (1554), descriptions of social and intellectual life by Francisco Cervantes de Salazar (c.1514–1575), a distinguished professor of the Royal University of Mexico (founded in 1551). Other prominent, though not so literary, writers are found among historians, jurists, physicians, mathematicians, and above all theologians, among whom the most important is the Augustinian friar Alonso de la Veracruz (1504–1584).

Baroque.—The great baroque period, the richest and most fruitful in New Spain, begins at the end of the 16th century and continues to the second half of the 18th. The literary genres already initiated were continued and developed in accordance with the basic characteristics of the Spanish baroque—superabundance, flamboyance, and dynamism.

After Balbuena, epic poems tend to disappear and none of them are really important; but the name of Arias de Villalobos, whose poem *Canto intitulado Mercurio* (1623) concerns the arrival of one of the viceroys, should be mentioned in passing.

Of special note is the case of Carlos de Sigüenza y Góngora (1645–1700), a remarkable author who wrote successfully in such varied fields as narrative (*Aventuras de Alonso Ramírez,* 1690); lyric poetry, of which he left many examples; history; geography; mathematics; and astronomy, with his bombastic explanation of a comet. But his most important work is a chronicle and compilation which he made on the occasion of two poetic competitions, and which he entitled *Triunfo parthénico* (1683).

The first important name in the baroque theater is that of Juan Ruiz de Alarcón y Mendoza. He was born about 1576 and studied in the Royal University of Mexico. He then went to Spain, where his dramas were played with those of Lope de Vega, Tirso de Molina, and other authors of the Spanish golden century. He was appointed to the Consejo de Indias (Council of the Indies) in 1626 and died in Madrid in 1639. Some of the most important among his plays are *Los favores del mundo, La verdad sospechosa, Los pechos privilegiados,* and *El examen de maridos.* Ruiz de Alarcón belonged to Lope de Vega's dramatic cycle in the Spanish theater, but had certain personal values, paying particular attention to form and the psychology of his characters. His influence was felt directly in the French classical theater, and he is surely, as Alfonso Reyes states, the foremost Mexican writer of international renown.

The remaining playwrights of the baroque period were much less important, but Eusebio Vela (1688–1737), a mixture of author, producer, and actor, should be mentioned. He did a great deal of work in Mexico and it is known that he wrote some 14 plays, of which only three remain. The influence of the Spanish dramatist Pedro Calderón de la Barca toward the end of the period is incontestable.

Lyric poetry was written profusely during the baroque period; a competition held about 1680 brought forth over 500 poems. Among poets of note were Luis de Sandoval y Zapata, Alonso Ramírez de Vargas, and Matías de Bocanegra (1612–1668). Sandoval and Ramírez were more Gongoristic in their metaphors; Bocanegra's style was sweeter, but less coloristic. His claim to fame is based on his *Canción a la vista de un desengaño* (c.1650), a sort of precursor of neoclassicism which breaks away from the two great baroque tendencies holding absolute sway over the literary production of the times, the pompous *culteranismo* and the deliberately ambiguous metaphors and puns of conceptism. Nor must one omit Friar Miguel de Guevara (c.1585–c.1646), who is credited with the sonnet *No me mueve mi Dios para quererte,* one of the best in the Spanish language.

But before all these must be placed the name of Juana Inés de la Cruz, born near Mexico City in 1648 (or perhaps, according to older documentation, in 1651). Precocious and intelligent, she was for a time at the viceroy's court; but later entered the Convent of San Jerónimo, where she died in 1695. She was a woman of great talent and very wide culture, the author of religious works, a musical treatise now lost, some religious

and some secular plays, like *Los empeños de una casa* and *El divino Narciso,* and a great number of poems, many of them first rate, especially *Primer sueño.* This poem, nearly 1,000 lines in length, deals with a broad and universal subject in a continuous succession of extremely lyrical baroque metaphors, and is a poetic interpretation of a dream—in the human body, in nature, in the cosmos—followed by the awakening and the return to life and to conscious being. Within the baroque style is a forerunner of modern literature based on the experiences of the subconscious. Such extensive writings place their author not only in the first rank in her time but among the best writers in the Spanish language.

Literary production shows a very definite decadence in every branch in the first half of the 18th century, reaching extremes of exaggeration, confusion, senselessness, and bad taste. The baroque had exhausted its possibilities; new trends were in the making. One of the effects was a drifting of intellectual interest mainly to the sciences, as far removed as possible from the exclusively literary activity of the previous period.

The most remarkable product of this new trend in New Spain was the writings of the group of Jesuits exiled from Spain and her colonies in 1767 by order of the king. They published their work in Italy, and although circumstances forced them to write in Italian or in Latin, as a group they caused the first awakening of the consciousness of Mexico, now fully distinguished from its Spanish origin. The most important were Francisco Xavier (or Javier) Clavijero, author of a comprehensive history of pre-Hispanic Mexico, *Storia antica del Messico* (Cesena 1780–1781); Rafael Landívar, author of *Rusticatio Mexicana* (Bologna 1782), in which he described the beauty of the Mexican countryside and customs; the historians Francisco Xavier Alegre and Andrés Cavo; and the aesthetician José Márquez.

Neoclassicism.—In ousting the baroque, neoclassicism gave rise to a type of formally correct lyric poetry, but showed a marked preference for minor themes and a certain weakening sweetness. Examples of this type of writing are found in the work of Father José Manuel Sartorio (1746–1828) and Friar Manuel Navarrete (1768–1809).

During the struggle for independence (1810–1821), as was to be expected, writers concentrated on the political conflict, and it is this trend that the scanty production of the times followed. The most important name was that of José Joaquín Fernández de Lizardi (1776–1827) who wrote many political works under the pseudonym El Pensador Mexicano (The Mexican Thinker). His novels *El Periquillo Sarniento, La Quijotita y su prima,* and *Don Catrín de la Fachenda,* in which he criticizes the customs of the times, are far more important to us nowadays. These were the first novels to be written in Spanish America. The picaresque *El Periquillo Sarniento* (1816) was translated into English by Katherine Anne Porter, as *The Itching Parrot,* in 1941.

The 19th Century.—Men of letters of the first few years of independent Mexico fall into two groups: neoclassicists and romanticists. Of note among the former were: Manuel Sánchez de Tagle (1782–1860), José María Heredia (1803–1839), Manuel Carpio (1791–1860), José Joaquín Pesado (1801–1861), and the playwright Manuel Eduardo de Gorostiza (1789–1851), who is best remembered for his plays *Contigo pan y cebolla, Indulgencia para todos,* and *Don Dieguito.*

Romanticism came to Mexico shortly after the country's independence, as a French influence. Young writers took to it with devoted zeal. Of these were José Ignacio Rodríguez Galván (1812–1842), a prolific but inaccurate poet, author of two romantic dramas, *El privado del virrey* and *Muñoz, visitador de México;* and Fernando Calderón (1809–1845), also a poet, and author of the plays *Herman, o la vuelta del cruzado* and *Ana Bolena,* among others, as well as a play in which he criticizes the customs of the times, *A ninguna de las tres.* Among the early romantic novelists were Florencio María del Castillo (1828–1863), Juan Díaz Covarrubias (1837–1859), and Justo Sierra O'Reilly (1814–1861). The last leaned toward the historical novel, as did Eligio Ancona (1830–1893), and Vicente Riva Palacio (1832–1896). Manuel Payno (1870–1894) preferred the novel of adventure.

About the middle of the century there was an almost uninterrupted 20 years of wars and civil wars (1847–1867)—including the invasion from the United States, which wrested from the nation half its territory, the Liberal reform movement, which succeeded in breaking the power of the Roman Catholic Church, and the French invasion and the country's struggle against Maximilian's empire. All these factors encouraged the development of new literary forms: oratory, political essays, and history. Prominent in these fields were Francisco Zarco (1829–1869), Ignacio Ramírez (1818–1879), Clemente de Jesús Munguía (1810–1868), and others. José María Luis Mora (1794–1850), Lucas Alamán (1792–1853) and Manuel Orozco y Berra (1818–1881) dealt with political history.

When peace came, a second and last romantic flowering took place, with the poets Manuel Acuña (1849–1873), Manuel M. Flores (1840–1885), Agustín F. Cuenca (1850–1884); the playwright José Peón Contreras (1843–1907); and the novelist Pedro Castera (1838–1906).

The trend of the last genre was toward the novel of manners, with such authors as Guillermo Prieto (1818–1897) and José T. de Cuéllar (1830–1894); but it soon drifted toward realism, whose first adherent was Luis G. Inclán (1846–1875), followed by Ignacio Altamirano (1834–1893), Rafael Delgado (1853–1914), José López Portillo y Rojas (1850–1923), and Federico Gamboa (1864–1939). The novel of the turn of the century was inspired by the French and Spanish realistic novel, but by its very nature—because of its method, which was based on the observation of surrounding reality, in taking note and making use of it—it gave rise to novels which differed more and more consciously from their European models and which took on more of the country, the people, and the color of Mexico; in other words, the true Mexican novel was being created.

Poetry, which has always been a most important literary activity in Mexico, as well as in the whole of Spanish America, also experienced a considerable change, influenced by French Parnassianism and symbolism, in those years of transition between romanticism and modernism.

Histories of Spanish American literature also mention the premodernistic poets of the transition period; first place always being given to Manuel Gutiérrez Nájera (1859–1895), who was

also an extremely fine and nimble prose writer.

The triumph of modernism dates from about 1890, and the movement lasted for more than 20 years. The poets of modernism were Efrén Rebolledo (1877–1929), erotic and curt; José Juan Tablada (1871–1945), who made use of Japanese exoticism, and became a brilliant newspaperman; and Amado Nervo (1870–1919), who started from modernism and went on to achieve a more personal style. The latter achieved international renown in the Spanish-speaking world and great honors were bestowed on him at his death.

Though modernism was predominant, there were also other types of poets. Manuel José Othón (1858–1906) was classical by education and style. He was perhaps the poet who wrote best about the Mexican landscape. Salvador Díaz Mirón (1853–1928) sought perfection in form, and left a relatively small but magnificent production. Luis G. Urbina (1868–1934), always faithful to romanticism, was also a good critic and a fine prose writer.

The names of a few humanists must be added, men of profound classical culture, translators of the Greek and Latin classics and themselves careful writers in their own tongue, though often writing in Latin. Among these are Ignacio Montes de Oca y Obregón (1890–1921), Joaquín Arcadio Pagaza (1839–1919), Federico Escobedo (1874–1949), Francisco de P. Herrasti (1879–1940), the brothers Gabriel (1905–1949) and Alfonso (1909–) Méndez Plancarte, and Octaviano Valdés (1901–).

The 20th Century.—The Mexican Revolution of 1910 brought about a profound and all-embracing political and social upheaval. Mexican literature could not escape its impact, though its effect was felt late.

Novels.—The realistic novel mentioned above welcomed the warm echo of the revolution and a new branch sprang forth. This has been called by some "the novel of the revolution"; but the name is inexact, for much of the production did not, properly speaking, consist of novels, but rather of tales or anecdotes, sometimes memoirs, and short stories were abundantly written.

The general opinion is that the novel of the revolution began with *Los de abajo* (1916) of Mariano Azuela (1873–1952), author of some short biographies and a long series of novels, the best of which are *Malayerba, Sin amor,* and *La luciérnaga.* His best known work, *Los de abajo,* translated by Enrique Munguía as *The Underdogs* (1929), is no doubt a good novel, mainly because of its background and its characters. The structure leaves much to be desired, but this is a common occurrence in this author and, indeed, in most of the Mexican fiction writers of the present century. Generally speaking, Martín Luis Guzmán (1887–) is a better writer. Novelist, essayist, newspaperman, and politician, he is the author of a book of tales, *El águila y la serpiente* (1928), without doubt the best of its kind that has been written about the Mexican Revolution. This work was translated by Harriet de Onís as *The Eagle and the Serpent* (1930). There are other, not so successful, writers of this type of novel, such as José Rubén Romero (1890–1952), Rafael Muñoz (1899–), and others.

Some authors, like Ermilo Abreu Gómez (1895–), Francisco Monterde (1894–), and Julio Jiménez Rueda (1896–), followed a trend which started in the third decade of the century and which sought inspiration in the times of the viceroys; hence it was called *colonialismo.* The authors mentioned have written excellent short stories, novels, dramas, and works of criticism; but realizing the mistake of finding inspiration exclusively in dead forms, they made a timely departure from their original aims. Artemio de Valle-Arizpe (1888–) alone has kept up the error.

The appraisal of Mexican social problems and the revision of certain historical opinions in favor of the Indian, as against the Spanish, roots of Mexican culture—so-called *indigenismo*—inspired many of the more recent short story and novel writers, most of whom are enjoying the fullness of their creative powers. Among these should be mentioned: Andrés Henestrosa (1908–), José Mancisidor (1894–), Mauricio Magdaleno (1906–), José Revueltas (1914–), Alberto Quiroz (1909–), Efrén Hernández (1903–), and Agustín Yáñez (1904–).

Poetry.—This art, meanwhile, had been following varied paths. Shortly before the outbreak of the revolution, the more sensitive writers foresaw the exhaustion of modernism and the need for a poetic revival. Beginning in 1909, this revival was led by Enrique González Martínez (1871–1952), physician and diplomat, who throughout his long life created works of such importance as to place him in the lead in Mexican literature. Also very important is Ramón López Velarde (1881–1921). His contribution was to make a place in poetry for provincial and familiar things, in a language full of tender sensitivity and unexpected imagery.

A group of young writers conceived the idea, imperfectly understood by most people, of strengthening the bonds, at that time not very solid, between the literature of Mexico and that of other countries. They published a literary review, *Contemporáneos* (1928–1931), from which the group of its contributors was named. Their writings were usually accessible only to an intellectual minority, but usually kept to very high standards of achievement. They wrote a great deal of poetry, some prose fiction, and some drama. Of this group were Jaime Torres Bodet (1902–), Xavier Villaurrutia (1903–1950), the brothers José (1901–) and Celestino Gorostiza (1904–), Gilberto Owen (1905–1952), Jorge Cuesta (1903–1942), and Bernardo Ortiz de Montellano (1899–1949), among others.

Lyric poetry has always been favored by women writers in Mexico. The number of women poets has grown and their standards have improved considerably in modern times. Important work has been done since about 1930 by Concha Urquiza, Margarita Michelena, and Guadalupe Amor.

Drama.—The first of the literary genres to be cultivated in Mexico, from the days immediately following the conquest in the 16th century, entered a period of decadence after the baroque era. The decline continued during the following two centuries, and with ever-quickening tempo after independence. After the turn of the century, psychological drama replaced moral plays in the European theater; the romantic theater was followed by realism, under the strong influence of the Scandinavians through the Théâtre Libre of André Antoine in Paris. Whatever drama was written in those days in Mexico has only an historical interest for us. The only

name worth mentioning is that of Marcelino Dávalos (1871–1923), a facile poet and author of several well-constructed plays; but their subjects were romantic and their characters distorted by an excessively realistic point of view.

Before the revolution every theater was kept busy showing various kinds of the Spanish type of operetta called zarzuelas. The revolution, however, caused a very specific change and innovation, the Mexican review, in which criticism and politics carried the day. Unfortunately, it never reached a really artistic or literary level.

Tentative efforts made after 1920 later turned into an open and decided attempt at creating a Mexican theater movement, which would blaze a trail for the artistic expression of the country. José Joaquín Gamboa (1878–1931) and Víctor Manuel Díez Barroso (1890–1936) are the outstanding writers of those years. Taken together, their works clearly reflect the evolution of the theater, similar to that of Europe, from the naturalistic drama to the drama subsequent to the influence of Henrik Ibsen. But it is perhaps more important to point out the struggle toward the achievement of a national drama movement, which was being conducted both by individuals and by experimental groups like the Comedia Mexicana, the Teatro de Ulises, and the Teatro de Orientación. These struggled on, partially encouraged by insufficient and sporadic government grants. It has been only comparatively recently, really since 1946, that the government has seriously undertaken to encourage authors and actors working exclusively in Mexican media. It is fitting to mention among contemporary authors Xavier Villaurrutia (1903–1950), and above all Rodolfo Usigli (1905–), author of first-rate plays like *Otra primavera, Media tono,* and *El gesticulador.* Usigli's best qualities are in the precision and psychological vigor of his characters, in the construction of his plays, and in the powerful social and political criticism which they contain.

Essays.—Very few essays have been written by Mexican authors. They are first found with the introduction of modernism, mixed and confused with newspaper articles and critical reviews. This form later gained new importance with the impulse given to it by the group that was called Ateneo de la Juventud (Athenaeum of Youth), later renamed Ateneo de México, toward 1910. It was a splendid group of people, highly productive under the guidance of the eminent Santo Dominican intellectual Pedro Henríquez Ureña. Of this group were the essayists, and also philosophers, Antonio Caso (1883–1946), José Vasconcelos (1882–), Julio Torri (1889–), and Alfonso Reyes (1889–). Essay writing was also taken up later by Xavier Villaurrutia, Andrés Iduarte (1905–), Octavio Paz (1914–), and various others; but above them all stands Alfonso Reyes, a native of Monterrey, who apart from being a diplomat for 30 years, has successfully written short stories and dramas, and has done extensive research and literary criticism. His works are legion. A few of the most important are: *Cuestiones estéticas* (1911); *Visión de Anáhuac* (1917); *Huellas* (poetry, 1922); *Ifigenia cruel* (poetry, 1924); *Capítulos de literatura española* (1939); *La crítica en la edad ateniense* (1941); *La experiencia literaria* (1942); *El deslinde* (1944); and his version of the *Iliad* (1952). Alfonso Reyes is, without a doubt, the most important, of greater literary knowledge, and the most devoted and most careful writer that Mexico has ever produced. See also LATIN AMERICA—*Spanish American Literature.*

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20. MUSIC. Pre-Hispanic.—Of the music of prehistoric Mexico, only instruments (clay whistles), found under the lava that forms the Pedregal de San Ángel on the southern outskirts of the capital, have been preserved.

In the 4th to 10th centuries the Maya culture flourished in southern Mexico, Guatemala, and western Honduras. The large monuments of the region—temples, palaces, and pyramids—as well as their reliefs and statues, are proofs of the refinement attained by Maya culture. After a short period of decadence this culture sprang up again on the Yucatán Peninsula in the 10th century.

In reality very little is known concerning the customs of the Mayas. With regard to music, we know that they had a singer and a principal director in charge of the instruments that accompanied the dances with which they celebrated their religious festivals. These instruments, which are well known through the frescoes discovered in 1946 at Bonampak, Chiapas, were: conchs used as horns, of raucous sound; large trumpets, probably of wood; turtle shells struck with the horns of deer; wooden oboes; whistles and flutes of cane and deer bones; drums; and the *tunkul,* which the Aztecs called the *teponaztli.* Conchs and the *tunkul* served particularly to call the people to the temples.

The *tunkul,* or two-tone slit drum, made from the trunk or limb of a hardwood tree such as the sapodilla, is an instrument without equal in the ancient world. It consists of a wooden cylinder placed on its side, generally from two to three feet long and about a foot in diameter, which has been hollowed out through the base. The latter is left open, except for a "pillow" at each end to support the instrument. In the center of the upper part are two small tongues produced by two parallel longitudinal slits connected by another, in the form of an H. These tongues are struck with rubber-tipped sticks and produce the two tones, the musical interval varying with such factors as the length and mass of each tongue.

Music and dance played a very important role in Maya worship and in that of the Mixtecs and Zapotecs of Oaxaca and the Tarascans of Michoacán.

The Texcocans, who in the reign of Nezahualcoyotl (15th century) were the most civilized of the peoples in the Nahua confederation, had schools and fraternities similar to academies for the cultivation of poetry and music.

The musical life of the Aztecs has come to us in more detail. The wealthy class had its own group of singers, and generally composers

also. The great lords and the temples had for their exclusive service chanters, or composers of songs. In a like manner, the king had his musicians, perhaps poets also, who extolled in their songs the warlike deeds of the king, his lineage, and his great wealth.

In each of the 18 months of the Aztec year there was at least one important celebration, for each of which the dances, songs, and the dress were distinct. In the large festivals, in which there were up to 8,000 dancers, the first two or three circles of people were formed by the older lords and priests; the others, after leaving a space for the jesters who rambled about performing as buffoons, were formed by the youths. The Aztecs, however, danced as much in private festivals as in public ceremonies.

Dance and song were carefully taught not only in the *calmecac,* where the sons of the nobles were educated, but also in the great temple, where the young girls of the noblest houses lived, and in the *telpochcalli,* where the plebeian youths were educated.

The sounding of the alarm in the city of Tenochtitlan was given with the terrible *huehuetl* of the great temple. This was a "drum" about three feet high and 1.5 feet in diameter, made of a hollowed tree trunk, over the top of which was stretched a deer or jaguar skin, while the bottom was supported by feet. It was beaten with the hands, fingers, or sticks as various usages required.

The instrument of warfare, to communicate orders, was the conch, of frightful sound. The signal for combat was communicated by *teponaztlis* which the chiefs carried at their sides, that of the supreme chief being made of gold.

Colonial.—Together with the rest of the culture of the Indians, their music fell victim to the implacable persecution of the friars. To the peremptory prohibitions placed on the music and dances of the Indians, one must add, as the cause of the absolute extermination of Indian music, the early opening of schools of religious music in the churches and convents. In fact, scarcely had the final capture of Tenochtitlan (now Mexico City) taken place, when Fray Pedro de Gante in 1524 founded the first music school, at Texcoco, to teach the Indians the musical essentials for the religious services, and the making of instruments. This school was moved to Mexico City in 1527, and in a short time there was scarcely a church or convent without a music school, or a town without Indian singers. Their teachers found great talent for music and declared that "they advance in months what in Spain the Spaniards do in two years."

Thus, in the hands of the conquerors, ended the great Indian music—the music that had been composed for the Indian lords and that which had accompanied the temple ceremonies. Only rural and pastoral music remained, defended by the jungle or the rugged mountains. Its pure remains are now to be found principally among the Seri Indians of Tiburón Island, Sonora; the Yaqui of southern Sonora; the Tarahumara of Chihuahua; the Huichol of Nayarit; the Cora of Jalisco; the Lacandon of Chiapas; and the Maya of the Yucatán Peninsula.

Very little of the dazzling sparkle of the Renaissance came to New Spain. Musical life in the colony remained as if in a state of sleep. In the theaters, there were only frivolous little songs and immodest little dances, done by assembled companies of castoffs from Spain. The devout, however, had the occasion to hear in their vespers, their matins, their tierces, and solemn masses something of what the great mystic composers of Europe produced.

Four colonial composers are worthy of note because of the high quality of their works. José de Lienas, whose style shows that he lived in the second half of the 16th century, was an able polyphonic composer. Hernando (or Fernando) Franco reached Mexico City in 1575 and died in 1585. He was choirmaster of the cathedral and his compositions consist of religious works in the best style of the Roman school. Antonio de Salazar is known to have been choirmaster in the cathedral between 1685 and 1715. His works are religious: motets, masses, hymns, and a great number of *villancicos.* José María Aldana, who died in 1810, was a violinist in the cathedral and the composer of numerous religious works, including a *Te Deum* and a Mass in D Major.

The people showed an extraordinary musical activity. *Jarabes, sones,* and *huapangos* of a thousand suggestive names are touched upon in the reports of the epoch—and the archives of the Inquisition. Everywhere they were spoken of as diabolical inventions; on all sides there arose a clamor which called these popular songs shameful, indecent, and sinful.

The folk music of Mexico is the result of three currents: the Indian, the European, and that of the Negroes brought as slaves by the conquerors. The *corrido,* a narrative ballad which derives from the Spanish *romance,* and the *canción* are two song types found all over Mexico. The most characteristic dance forms, generally accompanied by singing, are: the *son,* found almost everywhere; the *chilena* of Guerrero; the *jarana* of the Yucatán Peninsula; the *huapango* of the Gulf coast, principally in Veracruz and Tamaulipas; and the *jarabe,* of which the most popular types are those of Jalisco and Michoacán and the *jarabe largo* of Veracruz. *Jarabes* are suites of *sones* danced by couples without embracing. The three types differ from one another in the *sones* which make them up and in the steps by which they are danced.

The 19th Century.—The musical geography of the country was defined during this century. The *jarabe* divided into the Jalisco and Michoacán types; the *canción* of the Bajío and that of the Central Plateau established a style full of Italian influence; African influence fastened itself along the Gulf coast; and the Viennese waltz found shelter among the islanders of Lake Pátzcuaro in Michoacán.

The 19th century, with the independence of Mexico (1821), also brought the first effective importation to the musical life of the country. For the first time, musicians of merit arrived and Mexico heard Italian music sung by large opera companies.

Three main impulses initiated the musical movement in the country: the founding in Mexico City of the Sociedad Filarmónica by Mariano Elizaga in 1825, and of the Gran Sociedad Filarmónica by José Antonio Gómez in 1839, and the establishment of the Sociedad Filarmónica Mexicana by Agustín Caballero in 1866. From these three were born the Conservatorio Nacional (founded 1877), symphonic and solo concerts, and choral organizations and concerts.

Ricardo Castro (1864–1907) and Julio Ituarte (1845–1905) composed fantasies dealing with Mexican themes. Castro's principal works are a piano

concerto and the operas *La Leyenda de Rudel* and *Atzimba.* Aniceto Ortega (1823–1875) composed the opera *Guatimotzin* (another name for Cuauhtemoc, the last Aztec emperor), which was presented in 1871 and had an extraordinary success. Two other composers, Felipe Villanueva (1862–1893) and Juventino Rosas (1868–1894), succeeded in gaining universal renown with two waltzes: Villanueva with the *Vals Poético;* Rosas with *Sobre las Olas.* Villanueva was also the composer of the opera *Keofar,* presented in 1893.

The first artist to make the name of Mexico known to the European continent was Angela Peralta (1854–1883), a soprano with a prodigious voice and great talent that aroused tremendous enthusiasm during a tour of the principal cities of Italy and France.

At the end of the 19th century, Carlos J. Meneses (1863–1929) started the symphonic movement in Mexico, formed a true symphonic orchestra, and made known the most important works of that class of music.

Modern.—Music in the 20th century follows the paths of nationalism, timidly aimed at by Castro and Ituarte. The latest European currents are represented: the German by the violinist and composer Julián Carrillo (1875–), author of numerous treatises and of the theory of Sound 13, based on the subdivision of the semitone; and the French by Gustavo E. Campa (1863–1934). The latter's most important work is the opera *El Rey Poeta,* based on the life of Nezahualcoyotl, the 15th century poet-king of Texcoco.

During the Revolution of 1910 the great composer and pianist Manuel M. Ponce (1882–1948) brought the music of the people into aristocratic salons with his stylizations of Mexican folk songs. After the revolution had ended, the interest of Mexican musicians and musicographers was oriented toward folk music, led by Ponce. The latter, José Rolón (1883–1945), Candelario Huizar (1888–), the pianist and composer Silvestre Revueltas (1899–1940), and Carlos Chávez (1899–) began to produce works which used the essentials of Indian or mestizo music, according to the personal inclinations of each composer, and thus a national style continued to form. Rolón is particularly known for his heroic poem *Cuauhtemoc* (1929), the symphonic suite *Zapotlán* (1941), and a concerto for piano and orchestra (1942); Huizar, for several symphonies, and the symphonic poems *Imágenes* (1929), *Pueblerinas* (1931), and *Surco* (1935); Revueltas, one of Mexico's most gifted composers, for the orchestral works *Cuauhnahuac* (1933), *Janitzio* (1933), and *Sensemayá* (for orchestra and chorus; 1938), and music for the film *Redes* (1935); Chávez, for his ballets *El Fuego Nuevo* (1921); *Los Cuatro Soles* (1926), and *H.P.* (for "Horsepower," 1926–1927), and the symphonies *Sinfonía de Antígona* (1933) and *Sinfonía India* (1936).

The principal works of Luis Sandi (1905–) are *Norte* and *Theme and Variations* for orchestra; *El Venado* for Mexican orchestra, performed in New York in 1940 under the title of *Yaqui Music;* the opera *Carlota,* presented in 1948; the ballet *Bonampak,* presented in 1951; as well as a string quartet, and *Troyanas* for chorus and small orchestra. With the exceptions of the last two compositions and *Carlota,* the nationalistic style predominates in Sandi's works.

The profound difference between the 20th century and previous periods is that while there were Mexican composers before the 20th century, they produced Italian, French, and German music; now Mexican musicians produce music which is increasingly Mexican in character.

During the second quarter of the century there was realized a transformation that tended to modernize the musical language of the composers and the taste of the public. Carlos Chávez, first as director (1928–1934) of the Conservatorio Nacional, and later as director of the Orquesta Sinfónica de México, besides being a notable composer, was the soul of this movement.

Among the Mexican artists most famous in Mexico are: the singers Fanny Anitúa, José Mojica, Irma González, Oralia Domínguez, and Carlos Puig; and the pianists Angélica Morales and Miguel García Mora.

Mexico has eight orchestras: the National, the University, the Mexico City, and the Chamber Orchestra of Mexico, all in the capital, and the orchestras of Jalapa, Mérida, Guadalajara, and Guanajuato; as well as five choruses: the Madrigalistas, the Conservatory Chorus, the Boys Chorus of the Conservatory, the Boys Chorus of Morelia, and the Male Chorus of the Escuela Nocturna de Música; and also the National Opera Company.

The most distinguished composers of the middle of the 20th century, in addition to those previously mentioned are: Daniel Ayala Pérez (1908–), Miguel Bernal Jiménez (1910–), Salvador Contreras (1912–), Blas Galindo (1910–), and Pablo Moncayo (1912–), who may be catalogued as belonging to the nationalistic school; Eduardo Hernández Moncada (1899–), Rodolfo Halffter (1900–), Jesús Bal y Gay (1905–), Luis Herrera de la Fuente (1916–), and Carlos Jiménez Mabarak (1916–), who follow more or less advanced modern currents; and José Francisco Vázquez (1893–), whose style may be called postromantic, as may that of Miguel Bernal Jiménez.

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21. MOTION PICTURES. The first Mexican cinematographic activities were of a documentary nature. Photographers of the turn of the century, such as Salvador Toscano (1872–1947), have left us a wealth of documentary films on the Porfirio Díaz regime and the Mexican Revolution of 1910. *El Grito de Dolores* (1910), based on the stirring appeal to revolt from Spain made by Father Miguel Hidalgo in 1810, was the first motion picture to be filmed in Mexico. Natives of the region were employed to represent the patriots and Spanish soldiers. During the actual filming

they became so imbued with their roles that near bloodshed occurred.

In the year 1916, one of the bloodiest of the revolution, the first filming company, México Lux, was founded. Sporadic and ill-directed efforts to create other filming companies had met with little success and it was not until World War I cut off the supply of European films that the Mexican film industry began to produce on a fairly healthy basis. Various other companies were founded during the war years, the most prominent being Azteca Films owned by Germán Camus, Productora Quetzal owned by Jorge Stahl, and Bandera Films. The films which received the widest acclaim and popularity abroad were *Santa* (1917), a melodrama taken from Federico Gamboa's Mexican novel; *Tabaré* (1917), an Indian story; and *El Automóvil Gris* (1919), a cops-and-robbers thriller.

With the war over, Hollywood production created a crisis in the infant motion picture industry of Mexico. This crisis was further aggravated by the introduction of the "talkies." However, this proved to be a blessing in disguise, since the Mexican movie-going public began to insist on films with dialogue spoken in their own language.

During the 1930's a vast source of potential customers was opened up among rural and village inhabitants. Many well-known cinema personalities embarked on their film careers at this time. The director Emilio Fernández (1909–); Gabriel Figueroa (1907–), cameraman of world-wide fame; the brothers Andrés (1900–), Fernando (1900–), Domingo (1901–), and Julián (1910–) Soler, actors; Jorge Negrete (1911–), Mexican singing cowboy; Andrea Palma, actress; Arturo de Córdova (1908–), actor; and Mario Moreno (1911–), known as Cantinflas, mimic and comic, imitator of the likable Mexican "low-lifer" and idol of the Mexican movie-going public, all got their start in the film industry during the 1930's.

Many Spanish-speaking actors in Hollywood were lured south of the border by the nascent Mexican filming industry. Such well-known artists as Virginia Fabregas (1880–) and José Mojica (1895–), the singer who later gave up fame and fortune to join the Franciscan Order, became leading figures in Mexican films. The greatest film presentation of this period was the cowboy musical *Allá en el Rancho Grande* (1936), the vehicle that carried Tito Guizar to success and popularity as a matinee idol. Artistically, *La Noche de los Mayas*, portraying an Indian legend, produced in 1939, was perhaps the best film of this era.

Since the Mexican film industry caters primarily to a national market, a great many of its films draw on historical or folklore themes. Mexican producers seem to have mastered this type of medium. Such fine films as *María Candelaria* (1943), dealing with the clash of urban and rural cultures in a village near Mexico City, with Dolores del Río in the stellar role, and *Río Escondido* (1947), which portrayed the repercussions arising from the introduction of a school in a Mexican village and had the lovely María Félix (1914–) as the feature star, are proofs of the excellence and high artistic quality of their productions. On universal themes, they have produced works which have received world acclaim, such as *Doña Bárbara* (1943), starring María Félix. This was based on the Venezuelan novel by Rómulo Gallegos.

With minor setbacks, the Mexican film industry has continued to expand. In 1952 Mexico occupied first place among the Spanish-speaking countries as a producer of films, followed by Argentina and Spain. Excluding the USSR, Mexico ranked fourth in world ratings as a producer of motion pictures.

FILM PRODUCTION

Year	Films Produced	Reviewed	Average Filming Cost (pesos)
1931	2	0	40,000
1932	8	4	45,000
1933	18	12	50,000
1934	25	25	55,000
1935	21	26	58,000
1936	22	18	75,000
1937	36	32	81,000
1938	50	43	128,000
1939	37	37	135,000
1940	27	32	75,000
1941	46	28	156,000
1942	49	47	278,000
1943	67	57	350,000
1944	78	63	580,000
1945	79	63	648,000
1946	74	79	579,000
1947	54	60	450,000
1948	82	72	400,000
1949	109	101	450,000
1950	125	104	480,000
1951	102	112	540,000
1952	94	99	600,000

The origin of films exhibited in Mexico is shown in the following table:

Country of Origin	1949	1950	1951	1952
United States	250	228	243	274
Mexico	101	104	112	99
France	20	23	18	22
Great Britain	17	7	3	19
Spain	20	13	16	15
Italy	6	13	10	10
Argentina	8	4	6	3

An insignificant number of Portuguese, Chilean, Russian, and Japanese films were also exhibited during these years.

The Banco Nacional Cinematográfico, a public bank founded in 1941 to assist in developing the Mexican film industry by furnishing 50 per cent of the capital, which financed 30 per cent of the films produced in 1946, classified film production as the fourth major industry in the country in the latter year. By 1951 it had declined to seventh place in importance. In 1951 there were approximately 26,000 people working in the film business, with a total investment of 618 million pesos. Approximately 50 studios are owned by Churubusco, Azteca, Clasa, San Angel Inn, and Tepeyac studios, all of which are located near Mexico City. Tepeyac boasts the largest studio in the world.

There were 130 motion picture theaters in Mexico City and 2,021 others scattered throughout the country in 1952. Mexico City theaters during the fiscal year 1950–1951 grossed 14,065,434.85 pesos and paid 2,165,013 pesos in taxes to the government.

According to data furnished by the *Anuario Estadístico*, in 1934, 70.1 per cent of all spectators attended the cinema, 22.5 per cent attended the legitimate theater, 2.4 per cent attended sports events, and 1.7 per cent attended bullfights and cockfights. In 1947 cinema attendance had increased to 92.4 per cent, while theater attendance dropped to 1.7 per cent, with sports attendance and attendance at bullfighting and cockfighting events remaining unchanged.

In world competition, Mexican films have consistently placed in the high rankings. In 1946 at

the Cannes Film Festival the photographer Gabriel Figueroa won acclaim with *María Candelaria;* in 1947 at Brussels he again triumphed with *Enamorada* (1946), a drama of the revolution. In the same year he was awarded the International Prize at Venice for *La Perla* (1945), a drama dealing with fishermen; Pedro Armendáriz (1912–) and María Elena Márquez were given trophies for their acting in this film. Figueroa also won a prize at Locarno for *La Perla* in 1947. In the next year at Madrid Figueroa won the photography prize for *Río Escondido,* while Emilio Fernández won acclaim for his direction. Figueroa and Fernández duplicated this feat at Prague in 1948. In 1950 at Madrid the first prize went to *El Dolor de los Hijos* (1950), a melodrama. Once again Figueroa's photography won a prize, for the rural drama *Pueblerina* (1948). At Venice in 1950 Figueroa gained further laurels for *La Malquerida* (1949), based on the drama by the Spaniard Jacinto Benavente. In the next year at Cannes, the Mexican-Spanish director Luis Buñuel won acclaim for *Los Olvidados* (1950), exhibited in the United States as *The Young and the Damned,* a film dealing with Mexican adolescents. In 1953 at Cannes a special prize was awarded to Emilio Fernández for *La Red,* a drama of the Pacific coast of Mexico, involving two men and a woman and the resulting play of passions.

Following an old Hollywood custom, the Academia de Artes y Ciencias Cinematográficas (founded in 1948) presents an "Ariel," which is similar to the Hollywood "Oscar," to the best director, the best photographer, and to the best actors of the year.

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22. SCIENCE AND SCIENTIFIC INSTITUTIONS. Astronomy.—There are several centers devoted to astronomy (astrophysics in particular) and related fields, such as the Tonanzintla Astrophysical Observatory, established in 1942, in the State of Puebla, where a group of workers is concentrating on the investigation of novae, spectrography of stars, and so forth, and the Observatorio Astronómico Nacional (National Astronomical Observatory), founded in 1878, in Tacubaya, near Mexico City, which for many years has been in charge of the Mexican portion of the chart of the sky. Smaller observatories at state universities and colleges carry on descriptive astronomical work. An astronomical society (Sociedad Astronómica de México) has existed in Mexico City since 1902. It maintains a small observatory for amateur study.

Geography and Geodesy.—Geodetic and geographic work is under the care of a federal government agency, the Dirección General de Geografía, Meteorología e Hidrografía, also located in Tacubaya, Federal District. Unfortunately, lack of sufficient appropriations has somewhat hampered its work, and the old charts to the scales of 1:100,000 and 1:500,000 were never finished, or contain a considerable number of blanks where modern facilities for geographic work could be employed, or more study should be done. However, very useful topographic charts for most of the states have been published, as well as other charts for different purposes. The army has a cartographic office, in charge of the new 1:100,000 map of Mexico, using air navigation charts and other data, of which 26 sheets had appeared by the beginning of 1953. The state government of Jalisco also maintains a geographic institute at Guadalajara.

The Sociedad Mexicana de Geografía y Estadística (Mexican Society of Geography and Statistics), established in 1833, and its branches in most states, have large collections of maps of all kinds, as well as much other data useful to geographers, meteorologists, and cartographers. A bulletin of a specialized nature has been published by the society at more or less regular intervals since 1839.

Geology.—The geological sciences have been taken over from the old Instituto de Geología in Mexico City (founded in 1891 and now a division of the Universidad Nacional de México) by several organizations, official and semiofficial. Large collections of rocks and fossils are kept for research at the institute, and there is a large library and other facilities for study. Its publications now reach a large number, covering all fields of geology. Structural and historical geological studies are carried out on a large scale by the government petroleum agency, Petróleos Mexicanos, geohydrological work is done by the Secretaría de Recursos Hidráulicos, a department of the federal government, and mining geological investigations are conducted by the Instituto Nacional para el Estudio de los Recursos Minerales (National Institute for the Study of Mineral Resources) established in Mexico City in 1944; all of these extend their studies to the whole country. The Bank of Mexico, through its Geological Department, has concentrated on coal and iron resources. All these agencies occasionally publish the results of their work. There is also the Sociedad Geológica Mexicana (Mexican Geological Society), in the capital, founded in 1904, and the Asociación Mexicana de Geólogos Petroleros (Mexican Association of Petroleum Geologists), organized in 1949, both with publications in the form of bulletins and maps.

Meteorology.—A new center for meteorological studies in the Gulf of Mexico was established in the port of Veracruz in 1950, in connection with the Servicio Meteorológico Mexicano (Mexican Meteorological Service), at Tacubaya, founded in 1877 by President Porfirio Díaz. Some states, like Jalisco and Yucatán, also have local networks of meteorological stations for weather forecasting. In Mexico City a meteorological chart is published daily, with forecasts for the next 24 hours in the whole country, and also a meteorological bulletin once a month, with summaries of national, state, and regional observations. The Sociedad Mexicana de Geografía y Estadística, mentioned under *Geography and Geodesy,* is also active in this field.

Physics and Chemistry.—These are the least developed branches of scientific research in Mexico, although many theoretical mathematical studies by Mexican workers on several aspects of both sciences have received international recognition. There is a Sociedad Mexicana de Física (Mexican Physics Society), founded in 1951, in the capital, with a bimonthly bulletin, and the Universidad Nacional maintains an institute in each of the corresponding fields. A small laboratory for nuclear research was established on the university campus in Mexico City in 1951. The new technological institutes in different states will undoubtedly contribute to the development of new studies. As re-

gards chemistry in particular, except for practical problems of an industrial nature, very little work of an original character has been done. Technical education and organizations are entirely professional.

Biology.—This is the best-represented field of scientific study, both in the pure and in the applied aspects. A long tradition of interest in plants and animals, coming down from pre-Hispanic days, has brought about a continuity in their investigation which other scientific studies have not enjoyed in the past. This interest in living beings includes native human populations, which offer a rich array of physical and cultural traits of great attraction to research (see section on *Anthropology*). The Sociedad Mexicana de Historia Natural (Mexican Natural History Society), in the capital, founded in 1868, embraces all fields of biological studies and publishes a well-known review. The Mexican societies of Hydrobiology (Hidrobiología) and Entomology (Entomología) organized in Mexico City in 1950 may also be mentioned among scientific organizations in this field.

Botany.—Botanical investigation of a systematic nature is done at the Herbario Nacional (National Herbarium), founded in 1788 and since 1929 a department of the Instituto de Biología of the Universidad Nacional, and at the Instituto Botánico (Botanical Institute) established in 1948 at Tuxtla Gutiérrez, Chiapas. Agricultural botany is studied in the Mexico City office of the Rockefeller Foundation, and at several less important agencies, like the Instituto Técnico Agrícola (Technological Agricultural Institute) of the sisal growers association, founded in 1934 at Mérida, Yucatán. There is also a Department of Agronomy at the Instituto Tecnólogico y de Estudios Superiores in Monterrey. Obviously cereals receive more attention in most states than other crops, but here and there small laboratories carry on research on special problems, such as pest control in citrus plants, and the like.

Forest products are most important in northern and southern Mexico, and the lumber industry maintains an interest in the study of areas in Durango and Chihuahua, in northern Mexico, as well as in the tropical rain forests in Campeche, Yucatán, and Quintana Roo, in southern Mexico. Some enterprising firms have started a scientific survey of possibilities, in the charge of properly trained staffs. There are several learned societies whose members are interested, as professionals or amateurs, in forest plants problems, and most of these organizations publish bulletins, special papers, and semitechnical information.

There are some 50 national parks in different regions of the country, largely so declared on the basis of an idealistic acceptance of the necessity of conserving natural resources rather than on a scientific understanding of the realities of Mexico. Studies of some of these national parks, like the Izta-Popo National Park, close to Mexico City, where some of the most famous volcanoes of the country are located, have been published.

Zoology.—Zoological studies are conducted in the capital at the Universidad Nacional's Instituto de Biología (founded in 1929) which has a natural history museum, at the Escuela Nacional de Ciencias Biológicas (National School of Biological Sciences), founded in 1936 and now a division of the Instituto Politécnico Nacional, and at other institutions of lesser academic standing. There are also museums of natural history in some state capitals, like Tuxtla Gutiérrez, Guanajuato, and Guadalajara, and most colleges and universities maintain collections of local interest. Applied zoology is developing swiftly in fisheries, cattle raising, and other aspects. There is an Instituto de Pesquería del Pacífico (Institute of Pacific Fisheries), founded in 1947 at Guaymas, Sonora, a Comisión Federal para el Fomento de la Piscicultura Rural (Federal Commission for the Development of Rural Pisciculture), founded in 1949 in Mexico City, and various zootechnic laboratories in the states. For the Sociedad Mexicana de Historia Natural see the section on *Biology*.

Physiology and Medicine.—There are research laboratories in several professional schools and hospitals, such as the Instituto Nacional de Cardiología (National Cardiological Institute), founded in 1946, the Instituto de Salubridad y Enfermedades Tropicales (Health and Tropical Diseases Institute), founded in 1939, and the Instituto de Higiene (Institute of Hygiene), founded in 1904. The first two are in Mexico City; the last near by at Popotla. Most hospitals maintain laboratories for special studies, and there is a great number of medical publications of all kinds, as well as societies and other groups for pure and applied research.

The Academia Nacional de Medicina de México, founded in 1864, represents the highest institution of its kind in the republic, and is housed in the old building of the medical college of the Universidad Nacional. As soon as new buildings for this school are finished, the old quarters will be turned over to medical societies in Mexico City for the establishment of a medical museum and appropriate libraries of professional character.

Anthropology.—Anthropology is centered in the Escuela Nacional de Antropología e Historia (National School of Anthropology and History), founded in 1937, in the Museo Nacional de Antropología (National Museum of Anthropology) in Mexico City, and in other agencies in that city and the state capitals. Some state governments like those of Michoacán, Veracruz, and Yucatán, maintain anthropological departments. There is a Sociedad Mexicana de Antropología, founded in 1937, in the capital, which publishes an annual review, as well as other societies for special studies. The Instituto Indigenista Interamericano (Inter-American Indian Institute), organized in 1940 in Mexico City and supported by the governments of the American republics, has several publications. The Instituto Panamericano de Geografía e Historia, founded in 1929 at Tacubaya, Federal District, also publishes a well-known annual bulletin in the field of anthropological bibliography. Lastly, there is an Instituto Nacional Indigenista (National Indian Institute), established in Mexico City in 1948, for ethnographical investigation.

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23. PHILOSOPHY. Colonial Mexico.—The cultures existing in Mexico before its conquest (1521) by the Spaniards possessed cosmic myths and moral ideas which may be considered as elements of a philosophy in the sense of *Welt-* and *Lebensanschauung* (outlooks on the universe and life), although founded neither upon scientific nor indeed upon rational bases as a philosophy in the strict sense. A philosophy in this sense was introduced into Mexico by the Spaniards, and was stimulated mainly through the foundation of the

university, Real y Pontificia Universidad (now the Universidad Nacional) de México, in 1551, and other centers of culture similar to those in Spain whose activities were partially devoted to the teaching of philosophy and to the development of scholasticism. The Spanish Augustinian monk Fray Alonso de la Veracruz (1504–1584) may be considered the father of this discipline in Mexico. He was the first professor of philosophy in the university and the author of didactic works, one of which, the *Recognitio Summularum* (1554), was the first philosophical treatise printed in the Americas.

During its first decades the colony was influenced by intellectual movements, more or less related to a philosophy in the strict sense, such as Renaissance humanism, utopianism, and Erasmism. These movements inspired works of beneficent colonization such as that performed by Bishop Vasco de Quiroga (1470–1565) in Michoacán. During these same years the colony was engaged in juridical issues and in various philosophically slanted polemics which followed in the wake of the conquest, mainly through the intervention of Fray Bartolomé de las Casas (1474–1566), the most celebrated of these polemists. However, when these influences and polemics had died out or at least had tempered themselves, the history of philosophy in Mexico until the second half of the 18th century was confined almost exclusively to the formulation of scholastic thought, although the problems, methods, and doctrines of modern science and philosophy were active in the minds of certain exceptional personalities, among them Carlos de Sigüenza y Góngora (1645–1700), who wrote on a wide variety of subjects, and the poetess Juana Inés de la Cruz (1651–1695).

At the beginning of the second half of the 18th century, a group of young Jesuits, cognizant of European philosophy and science, initiated a reform which affected mainly the teaching of natural philosophy as performed by their order. This was the introduction in their teaching of experimental and exact modern science (so-called experimental philosophy). The Jesuits Francisco Javier Clavigero (or Clavijero; 1731–1787), Francisco Javier Alegre (1729–1788), and Diego José Abad (1727–1779) were the best-known members of this group, due to the works they published in Italy (although these were not of a philosophical nature) after the expulsion of the Jesuit Order from the dominions of the Spanish crown in 1767. This expulsion, however, did not check the success of the reform, because of the zealous activity of a brilliant group of men, of whom the principal ones were disciples of the Jesuits.

With the sanction given by the university to the *Elementa recentioris philosophiae* (1774) of Juan Benito Díaz de Gamarra, a priest of the Order of the Oratory, modern philosophy and science in Mexico achieved a significant victory under the banner of an eclecticism similar to that of Europe in the 17th and 18th centuries. This eclecticism had been diffused in Spain and her colonies as a doctrine extremely well suited to the introduction of modern science and philosophy. Father José Antonio de Alzate (1729–1799), in whose honor the present Mexican Academy of Sciences was named, and others, criticized and satirized traditional scholasticism, cultivated the exact, natural, and human sciences, particularly in their relation to Mexico, and championed the cause of the scientific disciplines, principally in the practical field.

In the fulfillment of their task, the members of this group utilized cultural newspapers, among which the most renowned was Alzate's own *Gazeta de Literatura*. The scientific expeditions of Spaniards and other men of different nationalities, including that of the illustrious Alexander von Humboldt (1769–1859), stimulated their work. The foundation of new cultural centers, among which that of the Real Seminario de Minería (Royal School of Mines), in 1792, deserves mention, helped them in their activities. Thus they created a new intellectual environment in which philosophy in the full and applied sense of the 18th century had the leading part. The intellectual career of Miguel Hidalgo before his *Grito de Dolores* (1810), which launched the movement against Spain, offers convincing evidence that this philosophical movement was a decisive forerunner of Mexican independence.

Independent Mexico.—During the struggle for the consolidation of a country which had declared its independence, the philosophical tradition born of the colonial period suffered intermittent crises. The frequent closing of the academic halls of the university gave eloquent testimony to its precarious defense against the political philosophy of liberalism, the most important of the new philosophies of this period, whose main exponent was the ideologist José María Luis Mora (1794–1850). The university was definitively closed in 1865, and the triumph of the Liberals under Benito Juárez established the doctrine of positivism as the official philosophy of the country under the direction of the physician Gabino Barreda (1818–1881), founder of the Escuela Nacional Preparatoria (National Preparatory School) in 1867. This institution was responsible for the education or at least the philosophical orientation of the Mexican leaders, some of whom were members of the group known as the *científicos* ("scientists"), who preached economic progress and guided the public life of their nation during the successive regimes of Gen. Porfirio Díaz until the Revolution of 1910. During the latter year the outstanding *científico,* Justo Sierra (1848–1912), realizing that a reconciliation of the national culture and the new foreign ideological orientations was imperative, succeeded in re-establishing the university and in restoring within its walls a measure of freedom in the teaching of philosophy.

Likewise in 1910 constructive efforts to the same worthy cause were contributed by the group known as the Ateneo de la Juventud, among whose illustrious members were José Vasconcelos (1882–) and Antonio Caso (1883–1946), the two great masters of philosophy of modern Mexico, and also Alfonso Reyes (1889–). The latter is one of the most eminent of Latin American intellectuals. His ideological essays make excursions into the domain of philosophy; his *El deslinde* (1944) completely masters the realm of philosophy of literature. Caso presents in the most personal of his philosophical works, *La existencia como economía, desinterés y caridad* (3d ed. 1943), a veritable Christian existentialism, although before that term became popular. Vasconcelos has developed in his voluminous *Metafísica* (1929), *Ética* (1931), *Estética* (1935), and his later equally extensive *Lógica Orgánica* (1945), a system which fuses various philosophical influences from Plotinus to Henri Bergson into a very personal neospiritualism culminating in mystical aestheticism.

Samuel Ramos (1897–), in his *El perfil del hombre y la cultura en México* (1934), emerges as

the main forerunner of the most interesting movement in the recent development of philosophical thought in Mexico, one which tends to elaborate a philosophy of the Mexican and his culture. This movement was initiated in 1945 by the Grupo Filosófico Hyperión led by Leopoldo Zea (1912–).

In the modern intellectual life of Mexico the principal directions of contemporary philosophy are well represented, chiefly: neo-Thomism, by Oswaldo Robles (1905–); neo-Kantianism, by Francisco Larroyo (1908–) and Guillermo Hector Rodríguez (1910–); the philosophy of values, by Eduardo García Máynez (1908–), active also in the field of juridical logic, and José Romano Muñoz (1890–); also phenomenology, existentialism, and historicism by some of those already named, as well as other Mexicans, and by a group of Spaniards in exile in Mexico since 1938. These latter are working principally in the exposition and critical interpretation of the last-mentioned philosophical trends and in the history of ideas in Spain and Mexico.

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24. PREHISTORY AND PRE-HISPANIC HISTORY. Setting.—Mexico is a land of strong geographical contrasts, a fact which greatly influenced the development of native civilizations. The arid lands of the north, to the east of the Sierra Madre Occidental, offered few incentives for the establishment of farmers before the introduction of European technology. This zone was occupied in pre-Hispanic times by nomadic food gatherers, with a very scattered population and a simple culture. This also applies to Lower California. The alluvial plains of the northwest, along the coast of the Pacific Ocean and the Gulf of California, irrigated by the rivers flowing from the Sierra Madre Occidental, and the well-watered mountains themselves, are exceptions to this. These northwestern regions were occupied, at the time of the conquest, by farming peoples who formed a link between the civilized peoples to the south and the cultivators of the southwestern United States.

To the south of a line drawn roughly from the mouth of the Pánuco River, on the coast of the Gulf of Mexico in northern Veracruz, to the mouth of the Santiago River, in Nayarit on the Pacific coast, the Indians took advantage of environmental conditions more favorable to agriculture, and developed complex sedentary cultures. Within the area south of this line, including central and southern Mexico, Guatemala, British Honduras, and the western parts of Honduras and El Salvador, there are extremes of environment, ranging from tropical rain-forest lowlands, through semiarid savanna country and fertile semitropical and temperate intermountain valleys, to cool uplands. These strong contrasts of relief within small areas result in the proximity of very diverse life zones, which, being complementary from the viewpoint of natural resources, have stimulated trade and conquests. These interregional relationships contributed to the development of basically similar cultures all over this territory—notwithstanding differences in patterns of regional specialization—constituting the culture area named Meso-America by ethnologists. Some of the most advanced American Indian cultures, having reached the stage of urban civilization, flourished here.

Sources of Information.—A consistent picture of cultural development covering at most 3,000 years and ending with the Spanish conquest can be traced for only a few areas of central and southern Mexico. It is based mainly on the historical reconstruction made possible through interpretations of findings in archaeological excavations. Only for the last centuries of this period do we have information based on reliable native historical sources.

These Indian sources could be classified in three groups, as follows:

(1) Native history preserved in the original form of folded books of picture writing. Due to the pictorial character of Indian writing these books were only summaries, consisting mainly of personal names, place names, and dates, with indications of the birth, marriage, and death of the personages, conquests, and so forth. The details were filled in by an oral tradition transmitted in the form of epics. Some of these epic poems have been preserved transcribed in the histories of group 2. Only a few of these books have survived the accidents of conquests, systematic destruction by overzealous friars and priests, or the ravages of time. On the basis of a group of picture-writing books known to have been made in the northern Oaxaca-southern Puebla region, Alfonso Caso was able to compile a list of Mixtec royal genealogies, going back to 692 A.D. according to his assertion. A preliminary account of this discovery was published in Caso's "El mapa de Teozacoalco," *Cuadernos Americanos* (Mexico City, September–October 1949).

(2) Histories written down (from formal oral tradition, or as transcriptions and interpretations of picture writing) after the Spanish conquest, in the Indian languages with the Latin script, or in Spanish. Quite a few of these refer to central Mexico, but the information they provide does not go back beyond the Toltec period (c.900 A.D.–c.1200). To this group belongs the *Relación de Michoacán*, which includes data for only the last two centuries before the Spanish conquest, and also the several *Books of Chilam Balam* of Yucatán. These books include historical data going back to the 5th century A.D., but only from the 10th century onward can we derive a consistent historical picture.

(3) Interesting historical information is found scattered in the answers to inquiries made by Spanish officials in the first decades of the colonial regime (particularly in the *Relaciones Geográficas*, 1579–1582), in petitions of the Indians to the Spanish authorities, and in other sources. These are valuable in that they reflect personal memories and what the people remembered as being historically important. They represent the limited local version of events, which can be compared with official history. Of course, the data provided by sources of this type cover only the last decades before the Spanish conquest.

The deciphered inscriptions of the so-called Long Count system of the ancient Maya give us a chronological framework for the greatest part of the first millennium of our era. However, it must be noted that the correspondence between

Maya Long Count dates and our calendar has not been securely established. Several different correlations of the Long Count with the Gregorian calendar have been suggested. J. Eric S. Thompson's correlation is accepted by a majority of specialists. According to it, the Long Count inscriptions cover the period from about 300 A.D. to 900 A.D. The dates given in this article, when referring to this period, are based on that correlation. Evidence from trade relations and stylistic evidence permit the transfer of dates from the Maya area to central Mexico, where no such chronological framework exists.

The method of dating through the radioactivity of organic remains by carbon isotope 14 has been applied to Meso-American materials, but since this method is in the experimental stage, the dates produced cannot be considered as absolutely reliable. Certainly, some of the dates for central Mexico conflict with other sources of evidence.

Ancient Hunters and Plant Gatherers.—The oldest evidences of human occupation in Mexico have been found in the upper layers of a geological formation named Becerra, dating from the very end of Pleistocene times. Mammoths, American horses, and other extinct animals constituted the Becerra fauna.

In the second half of the 19th century, the French Commission Scientifique du Mexique discovered stone implements in geological formations bearing remains of fossil elephants and bisons in the region of Juchipila, Jalisco; in the State of Guanajuato; and near Tacubaya, in the Federal District. In 1946, a small waste flake of obsidian, showing apparent use by man, was found lying below the head of an imperial mammoth (*Archidiskodon imperator*) in a Becerra bed, near Tepexpan, State of Mexico. In 1947, at the same locality and in the same geological layer, was found the skeleton of a man 55 to 65 years old, but there is some controversy about the possibility of this skeleton of so-called Tepexpan man —who would have lived some 10,000 years ago— being an intrusive burial of later date. Finally, in March 1952 another *Archidiskodon* skeleton, also lying in a Becerra stratum, was excavated at Santa Isabel Ixtapan, near Tepexpan. A flint projectile point was found amid the ribs and five other flint and obsidian tools around the skeleton. The projectile point belongs to the type named Scottsbluff, also found associated with the remains of extinct fauna in the high plains region of the United States. Other cultural remains dated at Becerra times are: a fossil llama bone carved in the form of an animal head, found in 1870 near Tequixquiac, and several obsidian, chalcedony, and bone artifacts found by Helmut de Terra after 1946 at Tequixquiac, El Risco, and San Francisco Mazapan. All these localities are in the Valley of Mexico, not far from Tepexpan.

Geologists date the end of the Becerra epoch at about 10,000 years ago. The radiocarbon method yielded dates ranging from earlier than 16,000 to about 4,000 years ago for materials (wood, peat, stems, and roots of aquatic plants) found in the upper Becerra formation. The last date is much later than expected and too recent to be accepted without question. However, the dating of Scottsbluff points in the high plains in the postglacial period from 8,000 to 4,000 years ago may support a date later than 10,000 years ago for the findings at Santa Isabel Ixtapan. Other findings of human skeletal remains or stone artifacts, supposedly very ancient, have been made at different times and in different regions, but for one reason or another full evidence is lacking concerning the antiquity claimed.

For central Mexico, at present, there is a gap in our knowledge of several thousand years between the age of the hunters of mammoths and the earliest known cultures of sedentary farmers from which a continuous sequence of cultural development can be traced up to the time of the Spanish conquest. This gap may be filled by the culture represented by a great number of artifacts, predominantly made of basalt, including grinding stones, found at several places and grouped under the term "Chalco industry." It has been claimed that they represent a culture based on the gathering of wild plants rather than on hunting. Helmut de Terra, the discoverer, dated them from 10,000 to 4,000 years ago, but most of these artifacts were found on the surface, giving no basis for safe geological dating. Furthermore, the association of all these artifacts in a simple tradition of stoneworking is highly questionable. However, the surveys made in northwestern Mexico show that there was a southern extension (in Sonora and perhaps also in Chihuahua) of the prehistoric plant-gathering Cochise culture of the southwestern United States.

Archaic Farmers.—Remains representing the beginnings of agriculture and sedentary life have not yet been found in Mexico. The oldest known cultures of sedentary farmers—called by archaeologists "Archaic," "Formative," or "Middle" cultures—were already very complex. Undoubtedly they were the products of a long tradition of sedentary life and the development of crafts whose antecedents are still to be found.

Not a single complete excavation of an Archaic site has been made; however, the findings made in testing trenches and pits permit one to draw a sketchy picture of life in those times. In what follows, the Archaic cultures in the Valley of Mexico, which are the best known, will mainly be referred to.

Thick fertile alluvial soils, a temperate climate, fish in the lakes and wild fowl living along their marshy shores, and game on the wooded slopes of the surrounding mountains, made the valley very favorable to settlement. Subsistence was based upon cultivation of corn (maize). Beans and squash were probably cultivated, and the products of the agave and prickly pear were probably used. Hunting and fishing were secondary economic activities. The importance of hunting for the first part of this period is attested by the abundance of deer bones found in the middens; later, game became scarcer. Remains of cotton textiles have also been found. The Valley of Mexico is too high for the cultivation of cotton and thus its use surely indicates commercial relations with the neighboring semitropical regions of Morelos, Guerrero, or the southern part of Puebla. These relations are also proved by the distribution of pottery types and terra-cotta figurines. Also, shells from both coasts (from the Pacific in the early period, from the Gulf of Mexico later) which were used for ornaments, and jade and other fine stones from outside the valley reveal extended commercial relations. Tools were made of stone and bone. The basic technological patterns already well established in the Archaic period lasted—with few additions or modifications—until the introduction of European

techniques. Forms, techniques, and motifs of decoration in Archaic pottery are quite elaborate.

Permanent settlements inhabited over long periods of time are indicated by thick deposits of refuse. Little evidence of house types has been found; however, it seems that the walls were of wattle, daubed with mud, a type of wall still in general use in rural Mexico. It is assumed that they were covered by thatched roofs. Only for the last part of the Archaic period do we have evidence of stone building.

Nothing is known about political organization and very little about social structure. Some social differentiation can be inferred from the evidence supplied by burials. Such differentiation does not, however, seem to have attained the complexity of clear-cut class distinctions. The religious ideas of these Archaic farmers manifest themselves characteristically in a fertility cult. This seems indicated by abundant finds of female figurines of baked clay. Such a cult in all probability furnished the basis for the worship of the mother of the gods, the earth goddess, so important in late pre-Hispanic times. Two-headed figurines and above all bipartite masks—expressive of the concepts of life and death—seem to contain the germ of an idea most important in later times, the principle of duality. Conspicuously lacking are formalized representations of gods and symbols associated with a priestly cult, which achieved great development later, in the period of the Classic civilizations.

Radiocarbon dates for charcoal found in early Archaic middens would place the beginnings of this period not later than 1500 B.C. These fall several centuries earlier than the dates accepted by archaeologists before 1950. If we accept the radiocarbon dates, we are faced with a period of about 1,000 years without significant cultural development and with only very minor changes in pottery styles, evidencing a remarkably conservative culture. While this is possible, other considerations lead one to ask for further confirmation of these dates, before accepting them as definitive.

During the last few centuries before the Christian era the homogeneous peasant communities of earlier times were giving rise to more differentiated societies in most of Meso-America. Everywhere in central and southern Mexico, as well as in the highlands and on the Pacific coast of Guatemala, some villages were growing into towns at this time. In the Valley of Mexico, Tlatilco, an extensive site northwest of Mexico City, may well represent an example of this transition. Adequate information on the excavations of this site have not yet been published. Nevertheless, a careful analysis of the evidence found in its great cemetery, excavated in the 1940's, throws light on the changes in social structure corresponding to the development from the homogeneous village culture to the more differentiated and sophisticated town culture. Even before 500 B.C. (according to radiocarbon dating) some towns had enough economic power and control of human resources to build groups of large artificial mounds for religious purposes. Thus, at Cuicuilco, near Tlalpan in the south of the valley, several truncated conical platforms—the largest measuring 390 feet in diameter at the base and 75 feet in height—were raised as bases for altars. This largest mound has a solid mud nucleus and a stone-faced exterior. A large pyramidal mound at Yaxuná, in Yucatán, also belongs to this stage. Other significant new features appearing at this time are calendar and hieroglyphic writing, the earliest examples of which are found in the carved stones with calendric inscriptions uncovered under buildings of later age in the ruins of Monte Albán, near Oaxaca.

Classic Civilizations.—What archaeologists call "Classic" in Meso-America is the period from about the time of Christ, or shortly afterward, to about 900 A.D., when brilliant civilizations flourished and fell. These civilizations had no metal tools, or, for that matter, metallurgy of any kind. Only from about 750 A.D. were some metal ornaments of a gold-copper alloy traded into southern Meso-America (Honduras, El Salvador, and Guatemala) from Panama or Costa Rica.

Systems of overland transportation were poorly developed. Meso-America lacked large animals which might have been domesticated for use as pack animals, such as the Peruvian llama, or for pulling and riding. The wheel was known, but used only for toys. The prevalence of mountainous terrain may then, as now, have inhibited its use in transportation. Goods were transported overland by human carriers. The rivers of Meso-America do not constitute good waterways. Only the lake areas of the Valley of Mexico and of Michoacán (as well as Lake Atitlán in Guatemala) offered facilities for inland water transportation by canoes. This fact accounts for the importance of these areas in pre-Hispanic history. It would seem that maritime transportation along the coast was important only around the Peninsula of Yucatán. However, the productivity of agriculture was developed to the point of being able to support a dense population, part of which was concentrated around large religious centers or in true urban communities. Surplus produce allowed these communities to divert tremendous amounts of energy to the glory of the gods, to the service of their earthly representatives, and to honor the dead.

In central Mexico, the largest city that flourished during this period was Teotihuacán, whose ruins are now about 25 miles northeast of Mexico City. About 300 A.D., the urbanized area of this site covered more than 500 acres; by 700 A.D. it had expanded to cover more than 1,750 acres. We do not know how far the suburbs extended. The nucleus of the city is made up of large temples, of which the most dominant is the great pyramid (the so-called Pyramid of the Sun) which stands 64.46 meters (about 212 feet) high. The temple with the largest ground plan is the square enclosure dedicated to Quetzalcoatl, the Feathered Serpent (a symbol of the water gods), which measures 440 yards on each side. Inside this enclosure there is a pyramid which served as the base for the temple proper, a great ceremonial plaza, and the living quarters of the priests. The great Avenue of the Dead, which forms the axis of the city, and the streets were paved with mortar; there was a complete system of underground drainage. In the residential sections, buildings were densely clustered. The large number of rooms found in the relatively few houses that have been excavated, and their decoration, which often included elaborate murals, indicate that these were the dwellings of an upper class. A cluster of more than 200 rooms and courts, grouped in units of different sizes, excavated in 1935 by Sigvald Linné on the eastern periphery of the site, suggests private houses, possibly for a middle class

of merchants. We have no information about the dwellings of the lower class.

Monte Albán, located on top of a hill, was the metropolis of the central valleys of Oaxaca. Many temples and a great number of well-built tombs, built under the floors of dwellings, have been discovered there. Cobá, in Quintana Roo, was the center of a system of causeways radiating to outlying sites. The longest causeway extends 62 miles west, to Yaxuná. Other important centers of this period were El Tajín, in the coastal plain of northern Veracruz, and Palenque, in Chiapas, one of the westernmost sites of the Maya area. It seems that the flourishing epoch of the Olmec culture of southern Veracruz and western Tabasco should be placed in this period.

The monumental architecture of the Classic period implies a well-organized control of the labor force. Hieroglyphic writing, developments in mathematics such as the use of zero and the positional concept in the writing of numbers, astronomy, and the calendar, mark the achievements of intellectual culture.

Trade was very extensive. It is attested mainly for manufactured luxury items. We also have evidence for trade of either prime materials, such as obsidian, fine-quality flint, or other stones used in the production of tools, or of the finished tools themselves. A fine type of pottery, probably produced in southern Puebla, was traded as far as Teotihuacán in the Valley of Mexico, to Colima in the west, and to Copán in Honduras. Food must have been an important trade item, considering the great urban population, which could not have been self-sufficient. The supporting area of the largest centers, such as Teotihuacán and Monte Albán, must have been very large.

The importance of temples and the development of religious art (see the section *Pre-Hispanic Art*) seems to indicate that religion was the main integrating force of society. The main deities were the water gods, the gods of vegetation and corn, the god of fire, and in the southern regions (Oaxaca and the Maya area) a bat god. Noteworthy by its absence is the cult of the gods of war.

Most of the settlements are located in open ground, with obvious disregard for defense, and lacking—so far as is known—any artificial protective works. The ruins of Monte Albán are an exception to this, in that they are located on top of an easily defensible hill rising 1,300 feet above the surrounding valley. Nevertheless, the excavations have failed to produce any indication whatever that the site was selected with defensive purposes in mind or that it was at any time used as a fortress.

Transition Period.—This location of the sites and absence of defensive works and the absence of representations of warriors in art at the peak of the Classic period seem to indicate that external relations were predominantly pacific. Later, warfare acquired greater importance. Warriors and battle scenes became prominent in art. According to present evidence the earliest examples of such representations occur in the Usumacinta River drainage (western Maya area) and are dated about 630 A.D. Central Mexican tradition tells us of the conquest of Cholollan (modern Cholula, near Puebla)—formerly a center of the Teotihuacán culture—by the Olmec-Xicalanca people, about the end of the 8th century. Approximately at the same time, Teotihuacán was violently destroyed and never rebuilt. Monte Albán was abandoned, its buildings fell into ruin, and the site was subsequently used only as a burial ground. Farther south, one after another the Mayan centers of civilization in the previous centuries were also deserted. The causes of this general crisis are not yet known, but the consequences were unquestionably a change from societies patterned on a seemingly theocratic basis to more secular-militaristic ones. The settlement pattern changed accordingly. After the 9th or 10th centuries many cities and towns established in open country were protected by stone walls, or by palisades and moats. In addition, many settlements with large, permanent populations were located on hilltops and were, in most cases, solidly fortified as well.

It seems that the ruins of Xochicalco, in Morelos, correspond to the epoch of transition between this period and the following one, or about the 9th to 10th centuries. The site is composed of three parts: the acropolis, on a steep hill, a ceremonial and residential section—seemingly for the upper class—surrounded by ramparts and moats; the citadel on top of a neighboring, higher hill; and a suburban area on flat ground, protected by these hills and by deep ravines.

Toltec Period (c.900 A.D.–c.1200 A.D.)—About the beginning of the 10th century a conqueror called Ce Tecpatl Mixcoatl entered the Valley of Mexico. He was the chief of a barbarian people arriving from the northwest (possibly from Zacatecas, Jalisco, or the Lerma River basin). Mixcoatl established his capital at Culhuacán in the Valley of Mexico, and extended his conquests in the south to the neighboring Valley of Morelos and northern Guerrero. Soon, these invaders absorbed the civilization of central Mexico. Such a process of acculturation was repeated later, after the fall of Tollan, by the Aztecs and other Chichimec groups. Mixcoatl's son, Ce Acatl Topiltzin, is the most important figure in Toltec history. He was the founder of Tollan (now Tula, Hidalgo), where he established the capital of his empire. The name Toltec is derived from the name of this city. Internal disturbances put an end to the rule of Ce Acatl and he was forced into exile. A new dynasty began at Tollan, with Matlacxochitl as the first king. Famine, epidemics, and war mark the history of this period, until Tollan was destroyed and Huemac, its last king, was killed or hanged himself in a cave on the Hill of Chapultepec. A dispersion of the Toltec lords took place. They took refuge in their possessions to the south and the southeast. At that time the Chichimecs took over most of the former Toltec territories in central Mexico; however, Toltec tradition was kept alive at Culhuacán. (See also TOLTECS.)

In Yucatán, local tradition records the arrival of foreign invaders toward the end of the 10th century. Their legendary leader was named Kukulcán. This title is the literal translation in Maya of the Nahua word Quetzalcoatl (Feathered Serpent), the title of Ce Acatl Topiltzin. There is no doubt of the connection between these events and the history of Tollan. Excavations at Tula (Tollan) and at Chichén Itzá, in Yucatán, have demonstrated close cultural connections between the two sites. But there are reasons to believe that this leader was not the same Ce Acatl referred to previously. The title Quetzalcoatl or Kukulcán seems to have been applied to different men at different times.

Toltec invaders also reached the highlands of

Guatemala. They conquered the local populations belonging to the highland branch of the Maya and established dynasties which lasted until the Spanish conquest.

It would seem that during the Toltec period the valleys of Puebla and Tlaxcala, and parts of the valleys of Mexico and Morelos, were under the domination of the Olmec-Xicalanca people, mentioned above as conquerors of Cholollan about the end of the 8th century. It is believed that they were people of Chocho-Popoloca and Mixtec origin, related to or identical with the Nonoalca, one of the ethnic components of the Toltecs. In Oaxaca, Mitla, a site famous for the beautiful stone relief mosaic on the walls of the palaces, flourished during this period, after the decline of Monte Albán.

It was during the Toltec period that metallurgy became widespread in Meso-America. However, metal was used mostly for ornaments. For the epoch prior to 900 A.D., there is at present no evidence of metal in Meso-America besides that brought into the southern areas through trade with Panama, previously mentioned; however, metallurgical techniques could be older than this date in the archaeologically little-known area of western Mexico. In this area, copper (or bronze) metallurgy was well developed in later times, and cast copper bells, apparently from western Mexico, were traded as far north as southern Arizona at about 1000 A.D.

From About 1200 A.D. to the Spanish Conquest.—In central Mexico, a troubled period followed the fall of Tollan. Previous plagues and wars had resulted in serious depopulation, and the outcome of political disintegration created a chaotic situation. At that time, different peoples —collectively designated by the Indian historical sources as Chichimecs—invaded the Valley of Mexico and the neighboring regions. Among them were the Aztecs. The term "Chichimec" requires clarification. It was used to designate peoples of very different cultural types and ethnic origins, including: (1) the northern food-gathering nomads; (2) farming peoples from the north, culturally simpler than the civilized peoples of central and southern Mexico; and (3) the descendants of civilized colonists established in the northwest in former times, returning to central Mexico after the fall of Tollan. Indian history emphasizes the importance of the role played by peoples of the first type during the period of the invasions, and by their descendants in the history of the following centuries. Some modern scholars overstress this point, and the author believes that critical analysis of the historical sources will prove that most of the invaders, and certainly those who were to provide the politically dominant element of later centuries, belonged to the second and third types. As a result of the movement of peoples, northern territories previously occupied by sedentary farmers were abandoned to nomadic food gatherers. The frontier of civilization thus receded somewhat in the direction of the south.

The 13th century is an obscure period during which the newcomers established new dynasties in the Valley of Mexico and conquered the dominions of the Olmec-Xicalanca people and their allies in the southern part of the valley and in Morelos, Puebla, and Tlaxcala. Cholollan (Cholula) fell to the Chichimecs about 1292 (the traditional date, 1168, has been corrected by more recent studies in pre-Hispanic chronology), and the Olmec-Xicalanca were expelled toward the northeast and southeast.

City-States in the Valley of Mexico.—Out of this confusion emerged, at the end of the 13th century and the beginning of the 14th, several city-states in mutual competition for hegemony. There was an Otomí kingdom, with its capital at Xaltocan in the north of the Valley of Mexico, whose territories extended beyond, as far north as Oxitipan on the border of the Huastec region —the Huastecs (or Huaxtecs) being an isolated Maya tribe living in northern Veracruz. It lasted until 1395, when the Tepanecs conquered Xaltocan.

The other major powers in the valley were, at first, Culhuacán—where the last vestige of Toltec tradition and legitimacy was kept alive—and a new Chichimec kingdom, founded by the invaders, whose capital was originally established at Tenayocan (in the Valley of Mexico northwest of Mexico City) and was later moved to Tetzcoco (or Texcoco). Culhuacán was decisively defeated in 1347, and an 80-year period of Tepanec supremacy followed, with Azcapotzalco as the capital and Coatlichan, Amaquemecan (now Amecameca), Huexotzinco (now Huejotzingo), and Cuauhnahuac (now Cuernavaca) as allies; Tetzcoco being relegated to a subordinated position. The Tepanecs had arrived in the Valley of Mexico from the neighboring Valley of Toluca. Ethnically they belonged to the group Otomí-Matlatzinca-Mazahua. The core of their dominions was the regions in the northwestern section of the Valley of Mexico and north and west of it, occupied by the Otomí and related peoples. At its peak, just before its fall, the Tepanec Empire expanded to the east and south, incorporating—through conquests and political alliances—territories occupied by Nahua peoples, and covered over 15,000 square miles of central Mexico—from Itzmiquilpan (now Ixmiquilpan) in the north to Tlachco (today's Taxco) and possibly to the Balsas River in the south, and from Tollocan (modern Toluca) and Ixtlahuacan in the west to Tollantzinco (modern Tulancingo, in Hidalgo) and Huexotzinco in the east. Besides the intensively cultivated and densely populated Valley of Mexico and other plateau territories, the Tepanecs thus dominated the semitropical lands of Morelos and northern Guerrero, which supplied the plateau with cotton, not cultivated in higher altitudes, native paper, jade, copper, and feathers.

To curb the danger of rebellion of the vassal lords, Tezozomoc, only king of Azcapotzalco during the period of Tepanec supremacy, imposed several of his sons as kings of different vassal city-states, murdering the kings of local dynasties when necessary. However, at Tezozomoc's death (1427), a rebellion broke out under the leadership of Itzcoatl, king of Tenochtitlan (see AZTECS) and Nezahualcoyotl, legitimate heir to the kingdom of Tetzcoco. This rebellion had the characteristics of a civil war in that public opinion within each city-state was divided. Bitter internal fighting and political murders were the result. The success of the rebellion was favored by dynastic troubles, because Tezozomoc's son and successor, Maxtla, not being the first born, was not the legitimate heir and was considered a usurper. The rebellion had the help of the Tlaxcalans who, as eastern neighbors of the Tepanec Empire, were probably fearful of its expansion. The war began with the storming of Azcapotzalco (1428) and ended in 1431 when the rebels took Coyoacán, Maxtla's own fief, and lib-

PRE-HISPANIC MEXICO
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W
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S
Santiago R.
Pánuco R.
Tuxpan R.
CHICHIMECS
Lerma R.
L. Chapala
L. Pátzcuaro
TZINTZUNTZAN
AZCAPOTZALCO
Tollan
Teotihuacán
El Tajín
TETZCOCO
TLAXCALA
TENOCHTITLAN
Xochicalco
Cholollan
Balsas R.
THE CENTRAL PLATEAU
Tres Zapotes
Coatzacoalcos R.
La Venta
Grijalva R.
Usumacinta R.
Palenque
Piedras Negras
Yaxchilán
Bonampak
Uaxactún
Tikal
Calakmul
Río Bec
Monte Albán
Mitla
TUTUTEPEC
(Independent Mixtec Lordship)
SOCONUSCO
(Province of the Aztec Empire)
Motagua R.
Quiriguá
Copán
Ulúa R.
Kaminaljuyú
Lempa R.
GULF OF MEXICO
PACIFIC OCEAN
MAYAPÁN
Chichén Itzá
Cobá
Uxmal
Yaxuná
Jaina I.
Edzná
MAYA
MAYA
EXPLANATORY NOTES
archaeological sites.
political capitals, early 15th century.
political capitals, 1519 A.D.
BOUNDARIES
Empire of Azcapotzalco, c. 1425.
Aztec Empire, 1519.
The Isthmus of Tehuantepec and part of Chiapas, conquered by the Aztecs but not incorporated in the empire. There were Aztec garrisons, but no tribute to the empire.
Tarascan Kingdom, 1519.
Tarascan conquests in the 1460's, subsequently lost.
Northern boundary of the sedentary peoples, 1519. Nomadic food gatherers to the north, sedentary farmers south and west of the line.
Modern political frontiers.
Outline of Central Plateau.

erated Tetzcoco. As a result of the war, and to fill the political vacuum left by the destruction of the Tepanec Empire, a triple alliance was established, including the two victorious powers (Tenochtitlan and Tetzcoco) and Tlacopan, as a minor member representing the vanquished. Despite frictions between the three confederate powers this confederacy proved successful in maintaining the political stability of the valley until the coming of the Spaniards, and in uniting forces for external conquests.

Between 1431 and 1440, Nezahualcoyotl extended the power of Tetzcoco toward the northeast, to Tziuhcoac on the border of the Huastec area.

Aztec Expansion.—Itzcoatl, for his part, extended the conquests of the Aztecs toward the south, through Morelos and northern Guerrero to the Balsas River. From the rule of Montezuma I (Moteczuma Ilhuicamina; r. 1440–1468) on, the Aztecs of Tenochtitlan gained hegemony over the confederacy and subordinated the foreign policy of their allies to their own ends. Montezuma I extended his conquests up to the Gulf coast in central Veracruz. Axayacatl (r. 1469–1481) completed the encirclement of Tlaxcala and conquered the Matlatzinca territories of the Valley of Toluca in the 1470's, though he failed in his effort to invade Michoacán. Ahuitzotl (r. 1486–1502) was a great conqueror. He conquered a part of the Huastec area to the northeast. To the south, he reached the coast of Guerrero and established bases in Oaxaca which facilitated the conquests of his successor. He crossed the Isthmus of Tehuantepec, conquered the Soconusco (the Chiapas coast) and established garrisons in the Chiapas highlands up the modern Guatemalan border. Montezuma II (Moteczuma Xocoyotzin; r. 1502–1520) overcame the Mixtecs and Zapotecs of Oaxaca, with the exception of the powerful Mixtec lordship of Tututepec on the Pacific coast, which maintained its independence until the coming of the Spaniards.

Thus in less than nine decades the Aztecs and their allies built an empire which comprised about 75,000 square miles and between 5 and 6 million people. These conquests did not aim at the acquisition of land for colonization, but rather to incorporate the political and military resources of the conquered peoples into the empire, to open trade routes, to dominate markets, and to obtain tribute. The tribute books of the empire give us information about its extent, the organization of its provinces, and the heavy tribute which they had to pay. Two copies of these tribute books have been preserved. One, the *Matrícula de Tributos* in the Museo Nacional de México, was probably painted for Hernán Cortés; the other, *Codex Mendoza* in the Bodleian Library, Oxford, was painted for the first Spanish viceroy, Antonio de Mendoza.

Due to environmental and cultural factors, the Aztecs did not attempt to expand northward into Chichimec territory. Geographical conditions discouraged colonization, and it was impossible to extract tribute from the nomad hunters. Their conquests to the east and to the south were made in territory occupied by civilized groups, politically fragmented into rather small principalities. Whenever they encountered other centralized states, they met with failure.

Tlaxcalans.—For the reason just mentioned, the Tlaxcalans (or Tlaxcaltecs) to the east of the Valley of Mexico, with about 200,000 people occupying a territory of about 1,600 square miles, were successful in rebuffing the Aztec attacks. This was true in spite of the fact that over a period of about 60 years, until 1519, the Tlaxcalans were completely surrounded by provinces of the Aztec Empire, and thus subjected to a severe economic blockade and constant military pressure. Systems of fortification encircled the territory of Tlaxcala on both sides of the frontier.

Tarascans.—To the west, after the conquest of the Valley of Toluca by the Aztec king Axayacatl in the 1470's, the only enemy left was the Tarascan kingdom of Michoacán. Axayacatl's attempt to invade Tarascan territory met with a crushing defeat at Taximaroa (now Ciudad Hidalgo, Michoacán). From then on, the two states were involved in constant warfare, and systems of forts and garrisons were maintained along the disputed frontier.

At the time of the Spanish conquest, the Tarascan kingdom comprised about 25,000 square miles and a population estimated at 1,000,000. The core of the kingdom was the region of Lake Pátzcuaro and the sierra to the west of the lake. The Tarascans showed strong social and political cohesion and the same expansionist tendencies as the Aztecs, although they were less urbanized than the inhabitants of the Valley of Mexico. The integration of the Tarascan state began about 1370, under the rule of Tariacuri, who conquered northwestern Michoacán and adjacent Jalisco, as well as the middle Balsas River basin to the south. When he died the kingdom divided into three parts. Pátzcuaro, Tzintzuntzan, and Coyuca (now Coyuca de Catalán, Guerrero) were the capitals of these splinter states. King Tzitzic Pandacuare reunited the three principalities, extended his conquests toward the southwest, and reached the Pacific coast in the 1460's. He was responsible for the defeat of Axayacatl's attempted invasion at Taximaroa. Subsequently, the Tarascans lost their dominions on the Pacific coast, but proved successful against the Aztecs. In the early 1500's they threw back another attempted invasion at Indaparapeo, and exerted aggressive pressure on the southern part of the Tarascan-Aztec frontier. On the northern frontier, Tarascan activities remained limited to forays against the Chichimecs in El Bajío (chiefly the modern states of Guanajuato and Querétaro) in order to protect their border, without attempting a permanent conquest of the region.

For the history of the Maya see the separate article MAYA.

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25. SPANISH CONQUEST AND COLONY. The Spanish conquest of Mexico at first represented a cultural clash but eventually there developed an amalgamation of cultures. On the one hand was the Spanish culture, with a strong medieval tinge; on the other, the Indian, in central Mexico dominated and made homogeneous by the Aztecs. The conquerors had varied backgrounds, but most of those coming to the new world were

concerned with the dual purpose of propagating the Catholic faith and of raising themselves in the social scale. They were men of strong ambition.

The conquest started from Cuba. In 1517 the expedition of Francisco Hernández (or Fernández) de Córdoba reached Yucatán, where it was defeated in the bay called Mala Pelea (literally, bad fight), and explored the coast of Campeche. In 1518 a second expedition, under Juan de Grijalva, left Cuba and explored the coast as far north as San Juan de Ulúa, off the modern city of Veracruz.

The results obtained encouraged other adventurers who, headed by Hernán Cortés (1485–1547), took part in another expedition ordered by the Cuban governor, Diego Velázquez. Although chosen by the governor, Cortés had to balk several attempts by the former to replace him, and on Feb. 18, 1519, set sail without authorization. The stages of the voyage were: Cozumel Island, off Yucatán; the Grijalva River, Tabasco; the Isla de Sacrificios and San Juan de Ulúa; and a final landing near the site of modern Veracruz.

The Aztec emperor, Montezuma II (more correctly Moctezuma), frightened by omens and the legend of Quetzalcoatl, which prophesied a return of that god from the east, did everything short of violence to prevent Cortés from advancing inland. Cortés, however, noting the dissensions and fears within the country, proceeded to convert his expedition into an occupation.

The municipality of Veracruz was founded April 27, and communications with Velázquez were broken off. Cortés then arranged to have the municipal authorities of the new town select him captain general, and a ship was sent to Spain to secure the royal ratification. The other ships were burned and, on August 14, Cortés led his expedition inland toward the Aztec capital of Tenochtitlan, on an island in Lake Texcoco on the site of modern Mexico City, leaving a small garrison at Veracruz. During the advance, an alliance was made with the Tlaxcalans, perennial enemies of the Aztecs, who after testing the power of the Spaniards in two battles became their allies and gave a fundamental assistance to the conquest.

In October, Cortés reached Cholula, where, confronted with attempted treachery, he and his men killed many hundreds of the inhabitants. Montezuma's hopes of stopping the expedition were frustrated and he succumbed to fatalistic despair. The Spaniards reached Tenochtitlan on Nov. 8, 1519. Hoping through the emperor to control his subjects, Cortés seized Montezuma soon after, but it was clear that the Aztecs would not long submit.

When the city's population was at its most antagonistic to the Spaniards, Pánfilo de Narváez, sent by Governor Velázquez, arrived in Mexico to arrest Cortés. Leaving Pedro de Alvarado (1495?–1541) in command of Tenochtitlan, Cortés returned with a small force to Cempoala, where he surprised and captured Narváez and enlisted his men in his own force. In Tenochtitlan, meanwhile, in the mistaken belief that a gathering of Aztecs for a religious ceremonial was a prelude to an attack on the Spaniards, Alvarado had massacred a large number of Indians. Cortés returned to find the Spaniards besieged. Montezuma tried to pacify his people but was stoned and killed.

On the night of June 30–July 1, 1520, the Spaniards and Tlaxcalans, carrying away much of its wealth, fought their way out of the city over the causeways which connected it to Tlacopan on the mainland, with the loss of many men. Those taken prisoner were sacrificed. Cortés wept over his losses on what is remembered as *la noche triste* (the dismal night), and the Spaniards retreated to Tlaxcala.

Montezuma's brother, Cuitlahuac, defender of Tenochtitlan, became emperor. He renewed his alliances with the Indian lords, but the populace was weakened by epidemics, in one of which Cuitlahuac died. He was succeeded by the last of the emperors, Cuauhtemoc.

Cortés made several expeditions to prepare the taking of Tenochtitlan; the first from Segura de la Frontera (now Tepeaca, Puebla), the second from Texcoco, the last from south of Tenochtitlan. Having done this preparatory work, the next year, with forces enlarged by groups recently arrived from Cuba, he again attacked the Aztec capital. The siege began on May 26, 1521, lasting until August 13, and destroying the city. Cuauhtemoc was captured, and later taken as a hostage by Cortés on his expedition to Honduras in the course of which he was executed (1525).

Once Tenochtitlan had been taken, Spanish expansion spread in several directions—to the north with the expedition (1522) of Cortés to the Pánuco River; to the west with the expedition (1522–1524) of Cristóbal de Olid into Colima and Jalisco; and to the northwest with the expedition (1535) of Cortés to Lower California. The areas of modern Guatemala and El Salvador 1526. Olid led an expedition into Honduras (1524), where he came in conflict with Spaniards advancing from the south. Having overcome these, he renounced his allegiance to Cortés, but was defeated by Francisco de las Casas and killed. Cortés himself then undertook an arduous expedition to Honduras, 1524–1526. Numerous expewere conquered by Pedro de Alvarado in 1524–ditions were made against the Maya in Yucatán, but they were not conquered until the campaigns of Francisco de Montejo the Younger in 1540–1546.

COLONY

The conquest did not end with the epic period; part of the Central Plateau and the northern part of the country remained to be settled. The dynamics of the movements which occupied these regions grew out of the characteristics of the colonizing groups. Because the traditions of inheritance within the Spanish family, based on primogeniture as well as custom, offered little hope for the younger sons, these tended to become adventurers. Land grants given by the crown covered a vast territory, sparsely populated. Those unable to obtain grants moved on still farther to unclaimed land.

Social and Economic Organization.—The Spanish colonizer tended to superimpose, both physically and socially, his community on the native ones. He subordinated the Indian population to his own juridical and economic institutions, placing it at the bottom of the seigniorial organization, topped by himself. Since the colonizer had come to America in search of social betterment, which in 15th and 16th century Europe was based on the seigniorial system, labor was performed by the lower strata, with the upper classes supervising or performing military duties.

These upper classes also included the missionaries and governmental officers, generally from Spain.

When the territory had been conquered, it was organized in conformity with contracts made between the king and the conquerors. Booty obtained directly from war, such as Indian slaves, pearls, gold, and feathers, must be differentiated from the lasting privileges, such as the marquisates, *encomiendas,* and *repartimientos* granted by the king. Holders of such privileges had the double duty of exploiting the Indians and of giving them a tie with the colony. They were charged with assimilating the Indians into the new social and economic order, besides converting them to the faith.

Indian Labor and the Problem of Conscience.—Labor for agriculture, mining, industry, and construction in the colony was always supplied principally by the Indians, although Negro slaves and mestizos (persons of mixed Spanish and Indian blood) were also used. Much of the profuse labor legislation was designed to protect these laborers against abuse.

Indian enslavement was one of the important results of the conquest, and was considered its logical consequence; but while the Spaniards applied the Roman concept, under which a slave was equivalent to a "thing," slavery among the Indians consisted of various grades of liberty, only seldom (in the case of slaves sold in the markets) descending to the Roman concept. The abuses of the conquerors and these differences in concepts of slavery led to protests being sent to the king by ecclesiastical groups, government officials, and soldiers. The missionary and historian Fray Bartolomé de las Casas (1474–1566) should be remembered among the distinguished leaders in this struggle for Indian freedom.

The Spanish crown was exposed to pressures from conflicting sides. On the one hand it was sympathetic to the spiritual and religious viewpoint; on the other, it saw the material value of slavery as an economic factor. The crown hesitated until Nov. 20, 1542, when the Leyes Nuevas (New Laws) established freedom as a principle and forbade the acceptance of slaves sold by Indians. Even "just" wars were no longer to be considered legal sources of slaves and the slavery of women and children was forbidden. The institution endured as a punishment for those who resisted the colonial system. The Indian remained as a serf, tied by the obligations of paying tribute and providing personal service. The comparative liberty of the Indian, however, furthered the slavery of the Negroes, who were brought to New Spain by foreign traders to supply the need for labor.

Up to 1549, the principal device for utilizing Indian labor was the *encomienda.* This was a royal concession granting a Spaniard (usually one of the conquerors) part of the tribute in goods and labor that was due the king from a particular group of Indians, in return for which the *encomendero* was obligated to protect his Indians, supervise their education and religious indoctrination, and provide vocational training. Indians rendered personal services to the *encomendero* for no more than 20 days consecutively, with a month elapsing between each period of service. All women, and children under 12, were exempt from personal service.

First introduced into the Antilles, with disastrous consequences to the Indian population, the *encomienda* as organized by Cortés in New Spain was designed to avoid the worst abuses of the Antilles. In any case, some means of utilizing Indian labor was necessary if the colony were to be maintained, and for their part, the conquered Indians needed protectors who had a personal interest in their welfare.

Nevertheless, the extension of the *encomienda* system in New Spain was opposed by the crown both in the name of humanity and because, with its feudal implications, it challenged the growing concept of centralized absolute power. On June 20, 1523, Charles V issued the Cédula de Valladolid, designed to bring the *encomiendas* to an abrupt end, but enforcement was impossible in the face of furious colonial opposition and the order was nullified.

A similar attempt was made in the Leyes Nuevas of Nov. 20, 1542, which forbade the granting of new *encomiendas,* canceled those that were held without legal title and those held by viceroys, governors, royal officials, prelates, monasteries, and hospitals. *Encomiendas* were no longer to be passed on by inheritance; on the death of the *encomendero,* his *encomienda* was to revert to the crown. The intent was the complete abolition of the system in a generation, but again the royal commands were not enforced. With the *Cédulas de Malinas* of Oct. 20, 1545, Charles retreated from his position, but did insist on abolishing personal services to the *encomendero.*

After 1573, the privileges of an *encomendero* were reduced to the right to collect a tribute from his Indians. He was still obligated to protect and instruct them, but no longer had seigniorial power over them. The *encomiendas* that remained were extinguished during the 18th century.

As the *encomienda* system was whittled away, it was replaced by a forced *repartimiento.* Under this ancient Spanish method of recruiting labor, the Indians were forced to work at agriculture, mining, and construction, but their services were on a temporary basis, under contract, and the employer to whom they were consigned had to pay wages.

Government.—At first, the government was subordinate to the Audiencia of Santo Domingo. But this changed when Spanish dominion extended throughout the continent and the home government began to centralize. Cortés organized the colony on Oct. 30, 1520, naming it Nueva España (New Spain), and in 1522 was named governor and captain general. Its center was erected on the site of modern Mexico City and it included all of modern Mexico, somewhat later the captaincy general of Guatemala, and after the discovery of the western shores of the modern United States it extended northward as far as Alaska.

Royal treasury officials took over the government during Cortés' expedition to Hibueras (Honduras), which began on Oct. 12, 1524. During his absence a conflict broke out between his followers and more newly arrived officials. This subsided upon his return in 1526, but late in the next year he returned to Spain to defend himself before the king.

The first *audiencia,* a supreme court with executive functions, was sent from Spain and assumed the conduct of public affairs from December 1528 to the end of 1530, a period noted in the history of Mexico for its destructiveness. These first *oidores* (members of the *audiencia*) were its president, Beltrán Nuño de Guzmán, and Alonso Parada, Francisco Maldonado, Juan

Ortíz de Matienzo, and Diego Delgadillo. Parada and Maldonado died shortly after reaching Mexico. Guzmán, Matienzo, and Delgadillo remained, and made themselves wealthy by despoiling Cortés, his captains, and his soldiers, and by exploiting the Indians without restraint. They appropriated 100,000 Indians in *encomienda* and levied such heavy tributes on them that, besides storing up great wealth for themselves, the exploiters had enough grain and clothing left over to sell to the public.

Cortés returned to New Spain in 1530, no longer as governor, but only captain general and marquis of the Valley of Oaxaca, and the next year saw the arrival of the second *audiencia* to replace the first. More carefully selected than their predecessors, its *oidores* were Sebastián Ramírez de Fuenleal, bishop of Santo Domingo, Juan Salmerón, Francisco Ceynos, the celebrated Vasco de Quiroga, and Alonso Maldonado. All worked in cooperation with the first bishop of Mexico, Juan de Zumárraga (1468–1548), who had opposed the excesses of the first *audiencia*. Aside from their regular duties, they conducted trials of *residencia* to hear charges against the first *audiencia*, and took a census of Cortés' approximately 23,000 vassals, as well as making a general inquiry into the complicated activities of the conqueror of Mexico. The *oidores* were in the position of defenders of the crown's interests against the ambitions of Cortés, but on the whole they performed this duty without resorting to the violence that had marked the actions of their predecessors. In 1540, after a long conflict with the first viceroy, Cortés left New Spain, never to return.

Viceroyalty.—The first viceroy of New Spain, Antonio de Mendoza, was appointed in 1529 and held office from November 1535 to October 1550.

Although the viceroys seldom held office for more than six years, the frequent turnover was offset by the strictness of the system, which provided for a trial of *residencia* at the end of each viceroy's term. A new viceroy followed the *relación* (report) of his predecessor and heard the opinion of the *oidores*. He presided over the *audiencia*, and his functions were those of governor, superintendent of the royal treasury, and vice patron of the church.

The *audiencia* was an important juridical institution. Its decisions in relatively important cases were final; in cases of great importance an appeal could be made to the Council of the Indies in Spain. Its president, or all its members, substituted when the viceroy was absent, to maintain the administrative functions.

Lower levels of government were administered by provincial governors, and by *corregidores* and *alcaldes mayores*, officials with similar functions, who represented the royal authority in smaller districts. Special *corregidores* were appointed to govern the Indian towns. In addition there were the autonomous *municipios* (municipalities) governed by their own councils (*ayuntamientos*).

The personalities of the viceroys are important because they were the direct representatives of the king, in whose person was centered all government power, legislative, judicial, and administrative. Since the king was recognized as God's representative, the government's right to rule was considered both natural and divine.

Antonio de Mendoza made an auspicious beginning and set an impressive example for his successors. He worked closely with the second *audiencia*, and on the whole his government was marked by justice and order, establishing an important tradition of orderly administration in New Spain. Mendoza also waged several difficult Indian wars, notably the one called the Mixton War (1541) in Jalisco, and in 1540 sent a futile expedition under Francisco Vázquez Coronado in search of the legendary Seven Cities of Cíbola.

His successor, Luis de Velasco, in office October 1550–July 1564, was outstanding in promoting the spread of Spanish civilization northward, and his protection of Indian rights earned him the title "Father of the Indians."

Another noteworthy viceroy was Fray Payo Enríquez de Rivera, in office 1673–1680. Although his administration was routine and unexciting, it was just and progressive. Significant material gains were made and the viceroy was well loved.

Royal Control.—The viceroy was the king's personal representative in New Spain. Generally, the king governed his colonies through the Council of the Indies (Consejo de Indias), but at times he sent direct royal orders. Organized by Charles V in 1524 to advise him on matters concerning the Indies, the council came to exercise supreme legislative, executive, and judicial power over the colonies until the creation of the Universal Secretariat of the Indies in 1714 reduced it to the functions of a supreme court. While the Spanish Constitution of Cádiz was in force (1812–1814, 1820–1824), the council disappeared, but it was re-established for ten years, 1824 to 1834.

The Casa de Contratación (House of Trade) was another institution fundamental to the administration of the colony. Founded in 1503, little by little it assumed the management of all commerce in the Indies, as well as immigration, exploration, and legal problems involving merchants and shippers. Situated in Seville, the only port in Spain legally authorized to handle shipping to and from the Indies, the Casa had absolute control over all legitimate colonial commerce. The ports of entry in New Spain were Veracruz on the Gulf and Acapulco on the Pacific. The result of this monopoly was harmful to the Spanish Empire, since large-scale smuggling by both Spaniards and foreigners flourished, and a consequent contempt for law and authority was fostered. The Casa de Contratación was transferred to Cádiz in 1717.

The exploration activities of the Casa de Contratación were also of great importance. Its navigation school was directed by Amerigo Vespucci (1451–1512), who was assisted and succeeded by other world-renowned seamen. The merchant tribunals known as *consulados*, which were established in Spanish America and later throughout the world, developed out of the Casa de Contratación.

Mining.—This industry was fundamental to the prosperity of New Spain, as well as old Spain. It was the output of American mines that made Spain the first power of the Western World. All mines and subsoil rights belonged to the crown, but were rented to those who discovered them, the crown obtaining a fifth (the royal *quinto*) of the output. Failure to work the mine was grounds for expropriation.

Mineowners were a favored class, enjoying numerous political and social privileges. All the prime materials for mining were tax-free. Mercury, essential for the extraction of silver by the

patio process, was allotted in proportion to ore production. To expedite their affairs, the mine-owners formed the Cuerpo de la Minería de la Nueva España on May 4, 1774. The organization conducted a court, a bank (Banco de Avío), and in 1792 established a college of mining (Real Seminario de Minería de México) to train technicians. A mining code, the Ordenanzas de Minería, was formulated May 22, 1783, while José de Gálvez was minister of the Indies, under the wise direction of Joaquín Velázquez de León.

Of the 500 mines in New Spain, the richest was La Valenciana in Guanajuato, which at its peak in 1800 produced some 3 million pounds troy of silver. Total production of the mines of New Spain from 1537 to 1821 was 2,151,581,961 pesos, with the peso during that period roughly equivalent to a dollar.

Church.—One of the major objectives of the Spanish crown in undertaking the conquest of the Americas was the conversion of the natives to Catholicism. In addition, the clergy, particularly the great religious orders, was the main source of education in the colonies, both secular and spiritual education being dependent on the development of religious institutions.

In order to coordinate ecclesiastical administration and relations between church and state, problems closely intertwined in colonial development, the Spanish rulers Ferdinand and Isabella obtained the right to control the relations between the papacy and the church in America. This important concession, known as the *patronato real* (royal patronage), was granted by the Vatican in several bulls between 1493 and 1508. Later, sweeping concessions allowed royal intervention in parish policies, church doctrine, administration of the sacrament, choral services in the cathedrals, rules of religious orders, church elections, and in general in all matters except those referring to faith and general discipline. In spite of this unusual distribution of authority, relations between church and state were usually amicable during the colonial period.

The first Catholic diocese was established at Tlaxcala in 1527, upon the arrival of its bishop, Julian Garcés, a Dominican. Subsequently, ten more were established. These dioceses, working through their parishes, which nearly always had a hospital and a school, were centers of education, public welfare, and social life. At the end of the 16th century, there were 474 parishes, and by 1810 there were 1,070.

The main task of the ordinary clergy was the establishment of the regular church in New Spain, while members of the various religious orders busied themselves with the conversion of the Indians. A good many of the methods used by religious missionaries originated in New Spain and were, little by little, adopted by the lay clergy.

Franciscans.—This order was the first to reach New Spain. Three Franciscan friars of Flemish origin arrived at Veracruz on Aug. 13, 1523: Juan de Tecto (Dekkers), Juan de Aora (Van Den Auwera), and the noted educator, Pedro de Gante (that is "of Ghent"). They quickly applied themselves to learning the Indian languages, and another famous group, known as "the Twelve," reached Veracruz on May 13, 1524, entrusted with a mission from Pope Adrian VI. They were Martín de Valencia, their leader; Martín de Jesús (or de la Coruña), who later led the missionaries who with Cortés attempted to colonize Lower California in 1535–1536; Francisco de Soto, Francisco Jiménez, Juan de Ribas, Juan Suárez, Antonio de Ciudad Rodrigo, Toribio de Benavente (known as Motolinia), who was known for his charity and poverty, later a historian and one of the founders of Puebla; García de Cisneros, and Luis de Fuensalida, accompanied by two lay brothers, Andrés de Córdoba and Juan de Palos.

In New Spain the order was organized in five "provinces": Santo Evangelio in the capital (founded 1535), San José of Yucatán (1539), San Pedro y San Pablo of Michoacán (1565), Santiago of Jalisco (1606), and San Francisco of Zacatecas (1606). Until they became provinces, the *custodias* of Yucatán, Michoacán, Jalisco, and Zacatecas were subordinate to the Province of Santo Evangelio. Similarly dependent were the *custodias* of Peru, Nicaragua, Guatemala, and Florida. The Franciscans carried Christianity to almost all of the country and provided missionaries of high qualities. Besides contributing such noted men as Juan de Zumárraga, first bishop of Mexico, and the saintly Marcos Ramírez de Prado, bishop of Michoacán from 1640 to 1666, they wrote many of the basic works on history and the Indian languages.

Dominicans.—The first Dominicans to reach New Spain were twelve that arrived in company with a royal official, Luis Ponce de León, July 2, 1526. Five died the first year, and four returned to Spain. Gradually, they renewed and increased their forces and established four provinces: Santiago of Mexico (1532), San Vicente of Chiapas and Guatemala (1551), San Hipólito of Oaxaca (1595), and the Province of Puebla (1656). In a famous controversy over the nature of the Indians—were they rational human beings with souls to be saved, or a nonhuman species?—the Dominicans were furiously involved under the leadership of Bartolomé de las Casas in defense of Indian rationality. Although it converted Indians on a mass basis, the order later entertained doubts concerning the religious capacity of the Indian population.

Through the University of Mexico and the Inquisition, the Dominicans displayed their characteristic orthodoxy and mastery of doctrine. Prominent leaders of the order were Las Casas, Bishop Garcés, and Antonio Alcalde, who became bishop of Yucatán in 1767, and in 1771 bishop of Guadalajara, where he founded the university and charitable institutions.

Augustinians.—The first Augustinians landed at San Juan de Ulúa on May 22, 1533. Two provinces were established: El Santo Nombre de Jesús of Mexico (1587) and San Nicolás de Tolentino of Michoacán (1602). The special role of the Augustianians was the organization and direction of Indian communities. They did valuable missionary work and were distinguished as teachers in the University of Mexico.

Jesuits.—The Jesuit Province of Mexico was founded by 17 men who reached Mexico on Sept. 28, 1572. The province lasted 195 years, a brief life compared to those of the other orders. The important influence of the Jesuits was exerted through the colleges of San Pedro y San Pablo (1573) and San Gregorio Magno (1586) in the capital, and through a network of colleges and residences in the center of the country, which were dedicated to raising the cultural, moral, and religious level of the ruling class, both the Spanish-born *Peninsulares* and colonials

of pure Spanish blood (*Criollos*). A group of missions in the northwest sought to save Indian souls while improving their material welfare. Intellectually, the Jesuits contributed to the knowledge of linguistics and other sciences. In 1767 they were expelled by Charles III from all Spanish territory and the order was suppressed by Pope Clement XIV in 1773.

Other Orders.—The Alcantarines (1580) erected the Custodia of San Diego de Alcalá, making it a province in 1599; the Carmelites established themselves in 1585; the Mercedarians, in 1589; and the Benedictines, in 1602.

The Mexican Order of St. Philip installed its first oratory in 1702. Besides these, there were other masculine orders as well as orders for women, such as the Conceptionists (1540), the Dominican nuns (1580), the Poor Clares (1570), and the Capuchin nuns (1704), the Brigittines (1743), and the Company of Mary (1754).

Education.—The clergy was the chief source of education in New Spain. It must be remembered that in the 16th century education was for the upper class. Therefore, in the towns the priests generally taught religion only—since it was felt that the Indian population had no need of other knowledge—but, at times, European trades were taught to Indians in the parishes. Vasco de Quiroga, who was bishop of Michoacán from 1538 to 1565, put into practice an important educational experiment when, inspired by Thomas More's *Utopia,* he organized Michoacán into units, the inhabitants of each unit being instructed in a different trade.

When monastic schools developed, they showed a tendency to turn into universities, but the University of Mexico itself was founded by royal decree in 1551 and opened its doors in 1553. The others that appeared were colleges, with university standing, organized according to medieval ideas.

A great many institutions appeared independently of the university in the 17th century, and were the vehicles for the absorption of the Enlightenment and rationalism, philosophic theories which later inspired the groups that prepared the independence of Mexico.

Press.—The introduction of the printing press in 1535 was a cultural factor of importance. The oldest book known to have been printed by Juan Pablos, owner of the second press brought to New Spain, describes itself as "Short and most complete Christian doctrine in the Mexican and Castilian language, which contains the things most necessary to our holy Catholic Faith, for the profit of the indigenous Indians and the salvation of their souls." This book was published in 1539.

Among the first printers of note (with the dates they were active) were Pedro Balli (1574–1608), Pedro Ocharte (1562–1592), Antonio Espinosa (1558–1576), Diego López Dávalos (1601–1611), and the Calderóns: Bernardo; his wife, Paula Benavides; his son, Antonio Calderón; his father-in-law, Juan de Ribera; and his granddaughter, María de la Rivera Calderón Benavides. Of all those of the viceregal period, the Calderón imprint survived longest (1631–1768). Printing houses were numerous in the 18th century.

In Puebla, the press was first used in 1640; in Oaxaca, in 1720; in Guadalajara, in 1793; and in Veracruz, in 1794. One of the Mexican printing presses, that of Father Juan José Eguiara (d. 1763), had Greek and Hebrew types. A total of some 12,000 works was published in the colonial era.

Newspapers, published as broadsides by the viceroyalty, appeared as early as the 16th century. The first *Gaceta de México* (founded 1667), of irregular publication, was followed by the *Mercurio de México.* The second *Gaceta de México* (1784–1809) was directed by Manuel Valadés. It was replaced in 1810 by the *Gaceta del Gobierno de México.*

Bourbon Era.—The entrance of the Bourbons into Spain (1700), in the person of Philip V, grandson of the French king Louis XIV, greatly changed Spanish thought. Centralism in the French style was emphasized, and rights of autonomy and liberties that might diminish the royal power were rejected. Difficulties with the Jesuits increased until finally, in 1767, they were expelled. The concept of wealth changed, new values being placed on the potentialities of production. Work was honored, science was applied, and social legislation was drafted.

Viceroys.—The first viceroy of the Bourbon kings, Fernando de Alencastre Noroña y Silva, duke of Linares and marquis of Valdefuentes, was in office from 1711 to 1716. First of the great viceroys of the new epoch, his work in collaboration with the tribunal of the *acordada,* which devoted itself to making the highways safe, ended an epidemic of highway robbery that had been a grave problem of the viceroyalty. In the capital he constructed the aqueduct of the Arcos de Belén. He also established cities in the north, and made an excellent study of ecclesiastical and state officials, a frank appraisal of faults, virtues, and procedures, which facilitated the work of later viceroys.

Juan de Acuña, marquis of Casa Fuerte (1722–1734), was called "the Great Governor." He ordered a survey of fortifications in the interior provinces of the north, which extended over four years. In the capital, he constructed the treasury and customhouse buildings.

Antonio María Bucareli y Ursúa (1771–1779) was conspicuous for his personal integrity and administrative ability. As an example of the former, he submitted his luggage to the customs inspection in Mexico City and courteously refused the gift traditionally offered by the city to new viceroys. As an administrator, he succeeded in balancing the budget. Impressed by the fall of Havana to the British in 1762, he organized the defense of New Spain, completing the fortress of San Carlos de Perote near Jalapa, building a fort at Acapulco, and reinforcing the defenses of San Juan de Ulúa at Veracruz. He reorganized the army and collected a gift of 1,299,000 pesos from private individuals to build warships. He established new charitable institutions, started primary schools, and accelerated the teaching of Spanish to the Indians.

Juan Vicente de Güemes Pacheco y Padilla, second Count of Revillagigedo (1789–1794), was an effective administrator who governed with intelligence and strength. He initiated the lighting and paving of the streets of Mexico City.

Transition.—The ideological change introduced by the Bourbons reached the colony in the middle of the 18th century, beginning with the arrival of such capable viceroys as Bucareli and Revillagigedo, who showed genuine concern for the welfare of the colony. In 1786, the French concept of colonial structure brought the subdivision of New Spain into 12 *intendencias,*

headed by officers responsible only to the crown, which strengthened Spanish control over the colony in the face of foreign threats. Despite the abolition of *encomiendas* and *repartimientos,* and the *corregidores* of the Indian towns, many of whom had become miniature despots, social and administrative reforms reached the colony too late to satisfy it.

A spirit of restlessness already prevailed. Viceroy Miguel de la Grúa Talamanca y Branciforte, marquis of Branciforte, who had succeeded Revillagigedo, opposed without success the entrance of the ideology of the French Revolution, and, paradoxically, through exiles from his regime who went to the United States, he prepared the way for the introduction of that country's constitutional ideas into the colony.

Disintegration.—Definite political disintegration arrived in 1808, with the Napoleonic invasion of Spain. As a result of the imprisonment of Charles IV and his son, Ferdinand VII, which raised the problem of sovereignty, the Spaniards in rebellion against the French created municipal juntas (councils) dedicated to the restoration of Ferdinand to the throne. A similar movement took place in Mexico City, where the *ayuntamiento* decreed that in the absence of the king Viceroy José de Iturrigaray was to rule without superior orders.

Taking the opposite view, the members of the *audiencia* (all Spaniards) declared that they represented the will of the populace. Iturrigaray was replaced by Viceroy Pedro de Garibay, and the *audiencia* put itself forward as the representative of the people.

From this issue evolved the first independence movement. Beginning with opposition to French orders and a determination to hold the throne for Ferdinand, it reached a climax with the declaration of absolute independence by the priest Miguel Hidalgo in the town of Dolores, Guanajuato, Sept. 16, 1810.

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26. MEXICO FROM 1810 TO 1910. It was in an atmosphere propitious to rebellion that news of the Napoleonic invasion of Spain and the abdications of Charles IV and his son, Ferdinand VII, reached Mexico in 1808. Joseph Bonaparte sat on the Spanish throne, but the Spanish colonies in America refused to recognize him.

In Mexico, the *Criollos,* native-born persons of Spanish ancestry, asserted that sovereignty had devolved on the people, while the *Peninsulares,* persons born in Spain, who feared a movement for independence, supported the juntas (councils) which governed the parts of Spain not occupied by the French. The viceroy, José de Iturrigaray, who for reasons of personal ambition favored the *Criollos,* was seized by a group of wealthy *Peninsulares* on the night of Sept. 15-16, 1808, and replaced by a provisional viceroy, Pedro de Garibay. Nevertheless, the lack of legitimate authorities and the ideological restlessness of the times continued to encourage a revolt.

Garibay was replaced by Archbishop Francisco Javier de Lizana later in the same year, and on Sept. 14, 1810, only two days before the movement for independence was launched by the *Grito de Dolores,* Francisco Javier Venegas, a viceroy sent by the regency formed by the juntas in Spain, took office in Mexico.

Declaration of Independence.—At Querétaro, a modest group of *Criollo* and mestizo intellectuals and military men was preparing a conspiracy. Among them, Miguel Hidalgo (1753–1811), parish priest of Dolores and father of Mexican independence, represented revolutionary thought; Ignacio Allende (1779–1811), captain of the Queen's Regiment, the military. Their attempts to convert others came to the attention of the government and orders were issued for their arrest. Warned in time, by a bold stroke at dawn on Sept. 16, 1810, in the town of Dolores (now Dolores Hidalgo, Guanajuato), Hidalgo proclaimed the independence in the so-called *Grito de* (Cry of) *Dolores.* With the title of general, and leading an improvised army of his Indian parishioners, which grew in size as it advanced, he began a campaign of liberation. The revolt quickly became an uprising of the oppressed masses, dreadful because of the passions it unleashed, and as a consequence the wealthy *Criollos* were driven to support the government. Hidalgo captured Celaya, next the rich city of Guanajuato, and then Valladolid (now Morelia), where he proclaimed the abolition of slavery. The cities of Zacatecas, San Luis Potosí, Guadalajara, and Saltillo were taken by other groups of insurgents.

Hidalgo then continued toward the capital. Nevertheless, after a victory of his ill-organized army, which then numbered about 80,000 men, over some 7,000 Spanish troops at Monte de las Cruces between the valleys of Toluca and Mexico, Oct. 30, 1810, he turned back to Valladolid and finally established his government at Guadalajara. His soldiers now began to leave him.

Felix Calleja, the cleverest and most illustrious of the royal officers, recaptured Guanajuato from Allende, and when the latter joined Hidalgo at Guadalajara, he decisively defeated the insurgent army at the bridge of Calderón on the banks of the Lerma River, Jan. 17, 1811. Hidalgo and Allende escaped toward the north, trying to reach the border of the United States, but were captured at Acatita de Baján, Coahuila, on March 21. Hidalgo was tried and shot at Chihuahua, July 30, 1811.

Morelos.—The first destructive impetus of the insurrection was followed by a desire to justify it. The priest José María Morelos (1765–1815), who continued the movement begun by Hidalgo, is known both for his political and his military activities. Morelos had raised an army of some 9,000 men in what is now the State of Guerrero. Among his able subordinates were Mariano Matamoros (1770?–1814) and Vicente Guerrero (1783–1831). As chief of the insurgent forces, Morelos carried the war into the modern states of Guerrero, Oaxaca, and Morelos, while other insurgents fought in the Central Plateau and other areas.

Calleja was occupied in putting down the insurrection in the north and Michoacán, but early in 1812 he turned south. Morelos resisted him

at the memorable siege of Cuautla, in the modern State of Morelos, March 5-May 2, 1812; then fought his way out. When Calleja returned to the capital, Morelos reoccupied Cuautla and undertook a campaign in east central Mexico, taking Orizaba and other towns west of Veracruz. The meeting of a national congress at Chilpancingo in 1813, which issued a declaration of independence and published the Constitution of Apatzingán, Oct. 22, 1814, was made possible by his zeal and decision.

In February 1813, however, Venegas returned to Spain, and Calleja replaced him as viceroy. The exhaustion of the country now turned more and more people in favor of the government. Morelos was defeated in attempting to capture Valladolid, mainly through the efforts of a royalist officer, Agustín de Iturbide, and again defeated at Puruarán, where Matamoros was captured and later shot. Oaxaca, Cuautla, and Chilpancingo fell to the royalists, and Morelos, heart of the rebellion, was himself captured following a defeat at Tezmalaca, Guerrero, while conducting the national congress to Tehuacán. He was tried and shot at San Cristóbal Ecatepec, near the capital, on Dec. 22, 1815.

With the death of Morelos, the few remaining rebellious groups, led by Guerrero, were restricted to the mountains of the south and Guanajuato.

In 1816 Calleja was replaced as viceroy by Juan de Apodaca, who granted pardons from the Spanish crown to all who would submit, and the new viceroy almost managed to pacify the country. In 1817, only the Spaniard Francisco Javier Mina (1789–1817), a true example of the militant liberal, who had come from Spain to fight for the insurgents in Guanajuato, menaced the peace of the viceroyalty, from April until October, when he too was captured and shot.

Iturbide.—In 1820, at Cádiz, Spain, Gen. Rafael del Riego rebelled against the absolutist regime of Ferdinand VII, and the king was forced to swear to abide by the liberal Constitution of 1812 in order to retain his throne. This political change in the mother country had important repercussions in Mexico. The *Peninsulares* feared the liberal reforms, while the Mexican insurgents saw the possibility of finally reaching an agreement with Spain.

Agustín de Iturbide, former royalist commander in the Bajío region, who in 1820 was appointed to end Vicente Guerrero's rebellion in the south, saw an opportunity of conciliating the dissimilar interests of Mexico's political parties, now tired of the armed struggle. He succeeded in gaining the confidence of Guerrero, the support of the clergy—who feared that the Spanish liberal government would disentail the church properties held in mortmain—and acceptance by the *Criollos*. Iturbide adopted the Plan of Iguala, Feb. 24, 1821, which was agreed to by Guerrero. This was a program of reforms or political changes, also called the Three Guaranties: the independence of Mexico; the union of *Peninsulares* and Americans; and one religion, Catholicism. By the summer of 1821 nearly all Mexico had rallied to the plan.

On July 30, a liberal viceroy, Juan O'Donojú, arrived at Veracruz to succeed Apodaca. Iturbide was fortunate in being able to place his army between the new viceroy and the capital, and obtained his acquiescence to the Plan of Iguala in the Convention of Córdoba, Aug. 24, 1821. Thus after an active military and propaganda campaign, Iturbide's triumphant army entered the capital of the new country on Sept. 27, 1821.

The Captaincy General of Guatemala, comprising Chiapas and the five modern nations between Mexico and Panama, had also declared its independence in 1821 and in the next year was incorporated in Iturbide's empire. Many difficulties were found in annexation, however, and following Iturbide's abdication all but Chiapas separated from Mexico in 1823.

Struggle for Shaping the State.—During the next 36 years the Mexicans were resolutely to seek institutions to change the former colonial political body. Carried away by the promises of political liberalism and the ideals of freedom and equality, in a struggle against reality, they were to experience many disappointments before arriving at the Constitution of 1857.

Which form of government was to inaugurate Mexico's life as an independent nation? Iturbide, backed by the royalists and clergy, favored a constitutional monarchy, since it was believed that the political habits of the country were more in accordance with a monarchy than a republic. The people welcomed the consummation of independence with great enthusiasm, but soon realized that their difficulties were not over and that the situation of their country was difficult and full of danger. The heavy loss in lives and property occasioned by the separation from Spain was forgotten for the moment, but soon poverty, disorder, and unrest again brought the governing groups into conflict.

Spain refused to recognize the Convention of Córdoba, and free trade, the substitute for Spanish commercial policies so anxiously awaited, and in which so much hope had been placed, could not be regularized. An exhausted exchequer and an undisciplined, hungry populace complicated the administrative task.

In hope of bringing order to the nation, the army proclaimed Iturbide emperor on May 18, 1822. Congress was dissolved, and the farce of setting up an imperial court increased the national expenses. Almost immediately, those favoring a popular representative government rose in rebellion; in December, Gen. Antonio López de Santa Anna proclaimed the republic in Veracruz and was joined by many of Mexico's former leaders in the war against Spain, including Guerrero. Iturbide could not curb the new revolution. He abdicated, March 19, 1823, and left for exile. A congressional decree outlawed him if he should return to the country, and when, hoping to regain his prestige and ascendency, he landed at Soto La Marina the next year, this decree was used to condemn him. He was shot at Padilla on July 19, 1824.

Once the monarchy had been discarded, the struggle continued over the question of whether Mexico was to be a federal or a centralized republic. It was believed that federation was a magic formula to bring happiness to the people, but few serious attempts at decentralization were actually carried out. The federal Constitution of Jan. 31, 1824 was the result of temporizations by the liberals, the army, and the clergy. It was in force until 1836, after which there followed in quick succession various experiments in centralized and federal forms of government (see also the section *Government*).

The political parties defined their views under the names of Liberals, who were generally federalists and in favor of reducing the power

of the church; and Conservatives, who were generally centralists, sometimes royalists, and were supported by the great landowners. Freemasons were active politically, those of the Scottish rite enlisting in the Conservative Party; those of the York rite, in the Liberal. Neither party, however, was able to unify the country's opinion and support behind it. In this situation appeared the military *caudillos,* who supported this or that regime according to their preferences.

The first president was a veteran of the struggle for independence, Guadalupe Victoria, who was in office from 1824 to 1829, when following a revolt, Vicente Guerrero was installed. Within a few months Guerrero was overthrown by his vice president, Anastasio Bustamante (1829), and in 1832 the latter was put out of office by Santa Anna, the most prominent of the *caudillos,* who in 1829 at Tampico had received the surrender of King Ferdinand's last attempt to reconquer Mexico.

Santa Anna left the powers of his office to his vice president, Valentín Gómez Farías, under whom took place the so-called Reform of 1833, which separated church and state and provided for secular education. The next year, however, Santa Anna assumed power on behalf of the Conservatives, and the reform was largely nullified. A new constitution (the so-called Seven Constitutional Laws), centralizing the government, was promulgated on Dec. 29, 1836. This, and the activities of settlers from the United States in Texas led to the secession of that province in the same year. Santa Anna was unable to put down the rebellion and retired to his estate in Veracruz.

After a short interim, Bustamante again became president (1837–1841). In 1838 a French fleet attacked and occupied the port of Veracruz with the object of collecting indemnities claimed by its nationals. Santa Anna, who participated in the defense, regained some of his former popularity and was able to make himself president again in 1841–1842. On June 12, 1843 a highly centralized constitution (the so-called Bases Orgánicas) was adopted, and Santa Anna was president under it in 1844. He was overthrown and was succeeded by José Joaquín Herrera (1844–1845). The latter was replaced in 1846 by Mariano Paredes, under whom war began with the United States.

During this chaotic period agriculture was neglected, mining could not be made to prosper, and the incipient industrialization could not be protected. The greater part of the governmental receipts went to the army, which had to be paid to prevent insurrections. The treasury was bolstered by internal and foreign loans which tied up the customs revenues, and the urgent financial needs of succeeding governments made dishonest transactions very easy. This difficult situation was exploited by a group of foreign traders and speculators. Some measure of Mexico's difficulties may be seen in the fact that the country had some 30 changes of chief executives between 1824 and 1848.

The war with the United States in 1846–1848, a conflict which had been maturing since the early years of the century, caught the country in complete prostration. The military campaign showed the Mexicans how disorganized and weak they were. By the Treaty of Guadalupe Hidalgo, Feb. 2, 1848, Mexico was forced to cede half her territory to the United States. (See also MEXICAN WAR; and the section *Relations with the United States.*)

Decisive Decade (1857–1867).—The federalist Constitution of 1824 had been restored following the fall of Paredes in 1846, in an effort to unify the people during the war. After Santa Anna, who had returned to fight, had left the country in 1848, José Joaquín Herrera again became president (1848–1851) and was succeeded, peacefully for the first time in Mexico's history, by Mariano Arista (1851–1853). The latter, however, was driven from office by the Conservatives, who then restored Santa Anna as dictator. But the political problem was now reaching a climax.

In 1855 Santa Anna was overthrown for the last time by a group under the leadership of Juan Álvarez, once a lieutenant of Morelos, and Ignacio Comonfort, with the Plan of Ayutla, March 10, 1854, which called for a federal constitution. The accumulated demands for an end to privilege and oligarchical groups mark the succeeding period as one of social revolution.

While Álvarez was acting president, August to December 1855, his minister of justice, Benito Juárez, abolished the privileges of the army and clergy by means of the Ley (Law) Juárez. Álvarez was then succeeded by Comonfort, whose secretary of the treasury, Miguel Lerdo de Tejada, set forth the Ley Lerdo of 1856, disentailing properties in order to put the holdings of religious communities into circulation. These laws were to be the basis for the economic and political regeneration of the country.

Meanwhile a constituent congress had drafted a new constitution, which was promulgated on Feb. 5, 1857. The principles it proclaimed were considered too bold and too advanced by some, and it was also prejudicial to an important social group, encountering the open opposition of the Conservatives. President Comonfort himself soon turned against the constitution and a Conservative coup was executed in the capital by Gen. Félix Zuloaga. Comonfort's defection began the so-called War of the Reform (1858–1861).

The duty of defending the Liberal institutions fell upon Benito Juárez (1806–1872), as president of the Supreme Court of Justice. His government was pursued by the Conservatives, led by Zuloaga and Gen. Miguel Miramón, until it was established at Veracruz, where Juárez promulgated the Leyes de Reforma (Reform Laws), 1859–1860, as an extreme means of achieving the economic and social policy of the Liberals. These laws included the nationalization of property owned by the church, the establishment of civil marriage, the secularization of cemeteries, the abolition of monastic orders, the separation of church and state, and the establishment of freedom of worship. While Veracruz proved impregnable against Miramón, Santos Degollado and Jesús González Ortega led the Liberal Army to success. After the latter's victory over Miramón in the Battle of Calpulálpam, Dec. 22, 1860, the Liberal troops again occupied the capital, and Juárez was elected president in March 1861.

After this three-year war, the task of reorganizing the country was difficult. Some Conservative groups were still fighting in various regions, and traffic through the country was insecure due to gangs of highway bandits. The expenses of the war and the destruction of national wealth had exhausted the treasury, and

Juárez found it necessary to suspend payment on the public debt (Decree of July 17, 1861).

Encouraged by Mexican Conservatives, France and Spain joined England in a triple alliance (Treaty of London, Oct. 31, 1861) under the pretext of demanding payment of the debt. Napoleon III, however, planned to intervene directly in Mexico, since he could then aid the Confederacy in the Civil War being fought in the United States, and could, furthermore, establish a European prince on the throne of Mexico. When the foreign troops arrived at Veracruz (December 1861 to January 1862), Juárez sent delegates to discuss their differences within the limits of honor. The Spanish and English representatives, Juan Prim and Sir Charles Wyke, recognized Mexico's rights and re-embarked their troops. Only the French failed to come to an agreement and revealed their true intentions by invading the country. The clerical and Conservative group joined them. The French marched toward the capital, but were defeated at Puebla, May 5, 1862, in a famous battle which greatly surprised the foreign countries and covered Mexican arms with glory. As Napoleon III was now compelled to send re-enforcements to conquer the country, his help to the Confederacy was delayed, thus benefiting the Union cause. The re-enforced French soldiers under generals Élie Frédéric Forey and Achille Bazaine defeated the Mexicans, and entered the capital in June 1863. Juárez' government was pursued northward, through San Luis Potosí, Saltillo, and Monterrey, finally reaching Paso del Norte (now Ciudad Juárez).

The so-called Junta de Notables (Assembly of Notables) made up of rich Mexican Conservatives, in agreement with Napoleon III, then offered Archduke Maximilian of Austria a throne in Mexico, assuring him that all Mexicans wanted him for their monarch. This prince renounced his rights in Europe and made burdensome concessions to Napoleon in exchange for his support. He and his wife Carlota still believed that they had been summoned by all Mexico, but were disillusioned by their cold reception in June 1864.

At first, Maximilian had the support of the Conservatives, but as he wished to follow a policy of adjustment and moderation and did not revoke the Reform Laws, he lost their backing and that of the clergy. Nor could the country's rebelliousness be brought to an end; where least expected, groups of patriots would appear.

The enterprise thus became long and expensive for the French. All their hopes for gaining important commercial advantages failed. Following the Union victory in the United States (1865), the Monroe Doctrine was invoked, and Napoleon III abandoned his Mexican adventure in 1866. To keep their throne, Maximilian and Carlota appealed to the courts of Europe, and even tried to come to an agreement with Juárez. The latter obtained the help of the United States and little by little his generals defeated the imperial forces. Maximilian surrendered at Querétaro, May 14, 1867, and on June 19 was shot, to the amazement of Europe.

Republic Restored.—On July 15, 1867, Benito Juárez announced to the nation that the enemy had been defeated, and declared that "among individuals as among nations the respect for the rights of others is peace." Again Juárez was faced with a postwar problem, which meant the liquidation of rebel groups, the enactment of the Constitution of 1857 and the Reform Laws, and the start of a "progressive revolution" that would inaugurate a new era in Mexico.

In the elections of 1867, Juárez defeated one of his generals, Porfirio Díaz (1830–1915), and in those of 1871 he again triumphed over Díaz and Sebastián Lerdo de Tejada (1825–1889). Díaz, dissatisfied with the returns of the election, rebelled with the Plan of La Noria (1871), condemning the re-election of the president. Juárez' prestige proved greater than the armed revolt, but a short time later Juárez died (July 18, 1872). He was succeeded by Sebastián Lerdo de Tejada, president of the Supreme Court of Justice, a man of great talent and a distinguished Liberal, who had followed Juárez during the French intervention. At first, Lerdo's government was very popular. He incorporated the Reform Laws in the constitution and halted railroad construction for fear of United States imperialism. But his intellectual rectitude prevented him from following a policy of conciliation and his somewhat haughty manner made enemies of his former sympathizers. When he announced that he would seek re-election, Díaz revolted, with the Plan of Tuxtepec (1876), again condemning the re-election of the president. After the Battle of Tecoac, in which Gen. Manuel González destroyed Lerdo's forces, Díaz triumphantly entered the capital on Dec. 23, 1876.

Porfirian Era.—Porfirio Díaz promised order and peace. He was a good administrator, a famous officer, and a lover of progress. Upon being elected to the presidency, he inaugurated a long regime that was to change the aspect of the country. Following his first presidential term he entrusted the post to Gen. Manuel González (1880–1884); afterward, he had the constitution reformed so as to re-elect himself indefinitely. In 1904 the office of vice president was created, for which Díaz chose Ramón Corral.

The dictatorship of Díaz welcomed foreign investment, encouraged railroad construction, and entered into commercial treaties; in general, under the direction of Finance Minister José Limantour, it ended the colonial economic regime. It expedited laws for colonization and land surveys, but without effectively benefiting immigration or the protection of agriculture. In mining, the principles of concession and the denunciation of unworked properties were kept. Petroleum, however, was now granted as the property of the owner of the land, a principle which was to have far-reaching consequences in post-Porfirian Mexico. Industry prospered, principally with English capital, and material improvements, such as the construction of harbors, canals, and buildings, were of great importance.

Education was carried forward in secular institutions through application of the Law of Public Instruction of 1867, which was based on the doctrines of French positivism. Toward the end of the Díaz regime ambitious cultural works were undertaken, existing facilities, such as the National Library and the National Museum, were improved, and numerous writers and poets contributed to the Europeanization of Porfirian culture.

The material progress of the country was evident, but the dictatorship nullified political progress, and the creation of a new wealthy class postponed the solution of the social problem. The work of progress did not reach the immense Indian population, living in poverty

and debt peonage in the fields. Great numbers of the communal lands (*ejidos*) owned by Indian villages had been alienated, and the ownership of land had been concentrated in fewer and fewer hands.

General Díaz and his ministers grew old in power, opposition increased, and the disorder that the dictator's death might bring was feared. A vice president more popular than Corral was wanted. This was one of the themes of a notable book of the time, *La sucesión presidencial en 1910* (1908), written by a member of a wealthy family of Coahuila, Francisco Madero (1873–1913). Madero, representing the popular restlessness, ran for election in 1910, but Díaz reelected himself, again naming Ramón Corral as vice president. On Nov. 20, 1910, Madero revolted, inaugurating the overthrow of the regime.

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27. MODERN MEXICO. Outbreak of the Revolution.—Francisco Madero pointed out his reasons for beginning the armed movement against the Díaz regime in his Plan of San Luis Potosí (dated Oct. 5, 1910): an intolerable tyranny in exchange for a shameful peace imposed by force, which had favored only a few; a complete contempt of the country's constitution; a mercenary justice; a congress at the dictator's orders; everything arranged so that Díaz could maintain himself in power. This political retrogression had produced a deep ill feeling in the country, intensified in 1910 with the naming of Ramón Corral to the vice presidency. On the social side, there was the problem of the land and the peons.

Madero's party adopted the slogan, "Sufragio Efectivo, No Reelección" (Effective Suffrage, No Re-election). Their leader declared that he had entered the political struggle honestly and would have been elected president but for electoral frauds. In so doing he put himself at the head of all the Mexicans who wanted to protest with guns in their hands against the illegality of the elections and the violation of the national will.

The revolution thus began spread rapidly. In Santa Clara, Puebla, Aquiles Serdán proclaimed the revolt in November 1910, but was killed almost immediately. At about the same time Pascual Orozco proclaimed it in Ciudad Guerrero, Chihuahua. The revolt in the north was joined by Francisco Villa. In March 1911 Emiliano Zapata rose in rebellion in Morelos, demanding land and better living conditions for the peons.

The Federal Army, commanded by Díaz' generals, could not contain the uprisings. On May 21, 1911 an armistice was signed between the Federal forces and the revolutionaries. Díaz sent a delegate to sign an agreement with the rebels, then renounced the presidency, May 25. The secretary of foreign affairs, Francisco León de la Barra, was named provisional president. In special elections, in October 1911, Francisco Madero was elected president and was sworn into office on November 6.

Madero had been elected with the strictest legality—but there were other questions besides that of democratic suffrage. The new president came to terms with the moneyed classes and other influential groups of the Porfirian regime, and thus the social, economic, and religious questions were left unsolved, and the revolutionary groups remained in arms.

The Zapata revolutionaries in Morelos, dissatisfied because Madero had not carried further the revolution begun with such success, protested energetically in the Plan of Ayala of Nov. 25, 1911. Their slogan was "Tierra y Libertad" (Land and Liberty), and it proposed the complete destruction of the Porfirian system and an agrarian reform. Pascual Orozco rebelled against Madero in March 1912, but was driven out of Mexico by Gen. Victoriano Huerta. Bernardo Reyes attempted to revolt in Nuevo León, and Félix Díaz, a nephew of the former dictator, rose in Veracruz, but these also were put down.

The delicate international situation was another of Madero's problems. The United States remained vigilant, watching events, especially along the border, but its ambassador, Henry Lane Wilson, favored active military intervention against Madero's government. In April 1912, Wilson entered a claim for damages for injury to lives and properties of American citizens resulting from the revolutionary fighting, and he did everything in his power to cause the intervention of his country in the internal affairs of Mexico.

On Feb. 9, 1913, Félix Díaz and General Reyes, who had been imprisoned in the capital, were freed by troops who had rebelled against Madero. Reyes was killed, but Díaz and the rebels took refuge in the Ciudadela (Citadel). There followed ten days of uncertainty, intrigue, and fighting in the city, known as the "Tragic Ten Days." Madero's commander, Huerta, taking advantage of the bloody fighting, arrested the president and Vice President José María Pino Suárez on February 18, obtained their resignations, and on February 22 had them shot while they were being transported from the National Palace to the penitentiary. The usurper Victoriano Huerta, supported by Ambassador Wilson and the reactionary Porfirian group, then took over the presidency. His government was recognized by Great Britain and several other countries, but not by the United States.

Carranza.—Huerta's treason angered the governor of Coahuila, Venustiano Carranza, who was to be the organizer of the revolution, as well as Zapata, Villa, and other revolutionaries. Supported by numerous military leaders, Carranza launched the Plan of Guadalupe of March 26, 1913, disowning the government of Huerta. The latter lost Wilson's backing when the ambassador resigned his post following the election of President Wilson in the United States.

On April 9, 1914, some United States sailors landed in Tampico in search of provisions. They were arrested by Mexican soldiers and later released upon proving their nationality. This incident provoked an exchange of notes between Mexico and the United States. Huerta adopted

a provocative attitude, the result of which was that the new government of the United States broke off relations with his government and in February lifted the arms embargo to authorize the sending of munitions to the usurper's enemies. Later, it ordered United States marines to land in Veracruz (April 21, 1914). This intervention and invasion caused an energetic patriotic reaction in Mexico.

Meanwhile other revolutionary groups had joined Carranza, declaring him chief of the Constitutionalist Army. In March 1914 they attacked the city of Torreón, and their capture of Zacatecas in June was the decisive blow against Huerta's forces. From there, Gen. Alvaro Obregón of the Constitutionalist Army advanced to Teoloyucan, near Mexico City, where the rest of the Federal Army surrendered. Huerta abandoned the capital on July 15, 1914, and went into exile. When Carranza entered Mexico City in August, he had to face the difficulties with the United States. Since these had concerned the usurping government, he demanded that the United States forces leave Veracruz, and the port was evacuated in November 1914.

Villa, who enjoyed great popularity in the north, and Zapata, who was fighting for his ideals in the south, had been unwilling to recognize Carranza's leadership, since it seemed to them that he was interested only in the political part of the revolution, rather than its social and economic causes. The partisans of Villa and Carranza thereupon decided to call a convention to agree on a plan of future reforms. The convention met briefly in Mexico City, and later at Aguascalientes, a neutral city, in October 1914, but Villa, distrustful of Carranza, then disowned his authority and marched on Mexico City.

Carranza was obliged to leave the capital for Veracruz; nevertheless, this port city was a more favorable location, since it was beyond reach of his enemies, and the customs duties provided funds. In Veracruz, Carranza began to organize the revolutionary government, and initiated the agrarian reform with the law of Jan. 6, 1915. Meanwhile, his generals were fighting the partisans of Villa and Zapata. These groups attempted to establish a national government in the capital, and discussed social and agrarian reform at sessions of the Supreme Revolutionary Convention. They were driven from Mexico City in January 1915, however, and Alvaro Obregón decisively defeated Villa in the Battle of Celaya in March, forcing him to retreat to the north. The Supreme Revolutionary Convention, subjected to the hazards of war, finally took refuge in Morelos, where it was dissolved when Carranza's troops marched in. Zapata continued his resistance until he was killed in 1919.

The United States recognized the government of Carranza in October 1915. Frustrated in his ambitions, and unable to obtain arms from the United States on account of this recognition, Villa had a group of United States citizens shot in January 1916 and on March 9 attacked the town of Columbus, New Mexico. The United States then sent Gen. John Pershing on a punitive expedition. Carranza ordered the defense of Mexican territory, thus creating a very difficult situation. Nor would he enter into any agreement as long as United States troops remained in Mexico. When, in February 1917, the troops finally left the country, the two governments had not reached an agreement, and Pershing's troops had not been able to capture Villa.

In order to restore constitutional methods in Mexico, Carranza called elections, in September 1916, for a constituent congress, thus fulfilling promises made in the Plan of Guadalupe and providing for the incorporation of revolutionary legislation in the Constitution of 1857. This congress met in the city of Querétaro from Dec. 1, 1916 to Jan. 31, 1917, and formulated a new constitution, which was promulgated on Feb. 5, 1917. Once the triumph of the Constitutionalist forces had been consolidated, Carranza called special elections for president, representatives (*diputados*), and senators; being himself elected president of the republic.

The Constitution of 1917 established a representative, democratic, federal republic. Some of its articles represent very advanced social tendencies, as well as the outlines for a national utilization of the national wealth. Articles 5, 27, 123, and 130 are especially important because of the reforms they envisaged and because of their consequences in national and international politics.

Article 5 established the principle that no one may be forced to render personal services without just compensation and without his full consent. Article 130 undertakes the difficult problem of relations between the state and the church, and grants the federal authorities the right to oversee religious worship and the relations between the church and the people. Article 27 is the basis of the agrarian reform and of regulations for the exploitation of the subsoil. Article 123 refers to labor and social planning, and establishes the basis for labor contracts. (Details of Articles 27 and 123 are given in the section *Economic, Agricultural, Industrial, and Financial Factors*—Modern Economic Policy).

The history of Mexico after 1917 may be viewed as an effort to carry out the principles and lines of policy laid down by this constitution. The effort has not always been constant and sustained. Often violated by personal ambition, foreign pressure, or the avarice of various social groups, it has nevertheless triumphed over other social and political policies which have been proposed for the country.

One of Carranza's measures was his decree of Feb. 19, 1918, declaring Mexican petroleum to be an inalienable national resource and beginning a long struggle to bring petroleum under Mexican control.

Post-Revolutionary Governments. — Carranza attempted to impose Ignacio Bonillas as his successor in the elections of 1920, but Alvaro Obregón, a leader of Carranza's partisans, used the old procedure of seizing power by armed force. He rose with the Plan of Agua Prieta (April 23, 1920) in defense of popular suffrage, and was joined by others of the military, notably generals Plutarco Elías Calles and Adolfo de la Huerta. Carranza, fleeing from the capital, was murdered at Tlaxcalantongo, Puebla, May 21, 1920. De la Huerta then became provisional president, and the remnants of other anti-Carranza forces abandoned the struggle. On July 27, 1920, Villa, who had maintained a futile opposition in the north, surrendered to the new government. The few followers of Zapata who had remained in arms in Morelos also came to terms.

Obregón was elected president on September 5, and took office on Dec. 1, 1920.

Obregón.—Prosperity increased under Obregón, and labor unions flourished, particularly the Confederación Regional de Obreros Mexicanos, which had been organized in 1918. Obregón's administration also marks the beginning of modern Mexican education, in the hands of José Vasconcelos, secretary of public education from 1921 to 1924. Elementary education was increased, and literacy campaigns and school-building programs were undertaken. Rural instruction carried a hope of social change through education to the most distant villages. (See also the article *Education.*)

With the encouragement of Vasconcelos there also arose from the revolutionary movement an art expressing the drama of the Mexican people. Diego Rivera, José Clemente Orozco, and David Alfaro Siqueiros, at the head of many others, have shown the world the problems of modern Mexico.

During 1923, Obregón antagonized the clergy when he expelled the apostolic delegate for transgressing the laws. Catholics openly objected to this measure, but the real conflict was delayed until the administration of Calles, to whom Obregón left the presidency at the end of his term in 1924, but not without having overcome a revolt by de la Huerta in 1923–1924.

Calles.—Under the new administration prosperity continued, and the labor movement attracted increasing numbers of workers. The fiscal system was put on a sound basis in 1925, when nonproductive taxes were abolished and government income was increased by the levy of an income tax. The Banco de México was also founded in that year. Due to programs of material improvement, dating from Calles' administration and thereafter, means of transportation and communication have brought towns and villages which had been isolated for centuries into contact with the rest of the country, and schools, public buildings, and hospitals have changed the colonial or Porfirian appearance of many cities.

In 1925–1926 the Congress passed laws enforcing the provisions of the Constitution of 1917 in regard to foreign-owned land and Mexican mineral resources. This led to a diplomatic conflict with the United States, which alleged that the laws were confiscatory. The dispute was settled in 1927, but the Mexican goverment did not retreat from its stand on any of the basic questions.

In February 1927 the church publicly repudiated the Constitution of 1917. Calles faced the ensuing conflict by putting the anticlerical measures of 1917 into effect. Ecclesiastical property was nationalized and foreign priests and the archbishop were expelled, together with other prelates. In October the so-called *Cristeros* rose in arms to fight for *Cristo Rey* (Christ the King). The revolt was centered in Jalisco and Guanajuato; there, and in other states there were bloody persecutions and reprisals.

At the end of Calles' term, the constitutional provision against re-election was set aside, and Obregón ran again. He was re-elected, but before taking office was assassinated, July 17, 1928, by the Catholic fanatic León Toral. A lawyer, Emilio Portes Gil, was elected by Congress as provisional president.

Portes Gil.—Relations between the government and the church became more conciliatory in 1929. The provisional presidency of Portes Gil is also noteworthy for the foundation by Calles in March 1929 of the political party successively called Partido Nacional Revolucionario, Partido de la Revolución Mexicana, and Partido Revolucionario Institucional, an intimate part of the government, and the party to which all presidents after Portes Gil belonged. Its first nominee, Pascual Ortiz Rubio, defeated José Vasconcelos in special elections held in 1929.

Ortiz Rubio and Rodríguez.—After the new president had taken office, Mexico entered the worst of the world depression. The economic situation and a conflict within his administration, in which he was opposed by Calles, led to the president's resignation, Sept. 3, 1932. Gen. Abelardo Rodríguez was elected by Congress to fill out the remainder of the term. The Nacional Financiera, an institution of great importance, through which the government later promoted many industries of special utility to the nation, was founded in 1933.

Cárdenas.—In 1934 Lázaro Cárdenas was elected to a six-year term, in accordance with a constitutional reform of April 29, 1933. Social legislation, agrarian reform, and economic development received a new impetus from Cárdenas, who represented the more liberal wing of the official party. The president came into conflict with Calles in 1935 and in the next year Calles was deported.

An important pillar of the Cárdenas regime was the Confederación de Trabajadores Mexicanos, a new labor organization founded in 1936 in opposition to the older C.R.O.M. and led by Vicente Lombardo Toledano. The circle of the official party was widened in 1938 to include workers and peasants, in order to bring them into participation in the political and economic direction of the country.

In 1936, when Cárdenas decided to reform Article 3 of the constitution, dealing with education, the religious situation again became critical, but relations between church and state thereafter were improved, due less to changes in legislation than to a conciliatory attitude on the part of the government. (See also the article *Church and State.*)

A major objective of the Cárdenas administration was agrarian reform. To this end the distribution of lands, which had been somewhat in abeyance, was increased, and various institutions through which farmers could obtain credit were established.

A significant development took place in 1938, when the government completed the long-standing effort to bring Mexican petroleum resources under national control by expropriating foreign-owned oil companies. (Details are given in the section on *Economic, Industrial, Agricultural, and Financial Factors.*) This important move aroused great popular enthusiasm in Mexico and led to a diplomatic controversy with Great Britain and the United States, which was finally settled after an agreement for indemnifying the owners had been reached in 1944.

Ávila Camacho.—In the elections of 1940, Gen. Manuel Ávila Camacho was victorious over Gen. Juan Andreu Almazán. The new administration was notable for an increasing rate of industrialization and the entrance into Mexico of large amounts of refugee capital from Europe during World War II. The government severed diplomatic relations with Japan on Dec. 8, 1941,

a day after the attack on Pearl Harbor, and with Germany and Italy on December 11. War against all three Axis powers was declared on May 28, 1942. Mexico became a member of the United Nations on Nov. 7, 1947.

Alemán.—Miguel Alemán, a lawyer, succeeded Ávila Camacho in 1946. Mexican industrialization rose sharply in the postwar period and Mexican capital became more and more evident in new industries. In 1952 Alemán was succeeded by a new president, also a civilian, Adolfo Ruiz Cortines.

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28. RELATIONS WITH THE UNITED STATES. Early Relations and Border Problems.—The independence of Latin America early in the 19th century forced England and the United States into a new field of rivalry. The English, who had traded illegally with the Spanish colonies, signed treaties of friendship, commerce, and navigation with them after their declarations of independence. For its part, the United States felt the threat of European influence to its interests in the Western Hemisphere.

During its colonial past, New Spain (Mexico) had had border friction with its northern neighbor. This was intensified by the vague borders of the Louisiana Territory, sold by the French to the United States in 1803, after being acquired from Spain. The Spanish authorities considered the Mississippi River as the limit of the territory, while the United States insisted on the Rio Grande. The discussion lasted several years, and was ended by the Adams-Onís Treaty of Feb. 22, 1819, under the terms of which Spanish claims in Florida were exchanged with the United States for its claims to the territory lying between the Rio Grande and the Sabine River. This treaty established the boundary line as follows: from the Gulf of Mexico at the mouth of the Sabine River, north along the west bank of the Sabine to latitude 32°N.; due north from this point to the Red River; west along the Red to longitude 100°W.; north along this meridian to the Arkansas River; west along the southern bank of the Arkansas to its source; due north from this point to latitude 42°N.; and west along this line to the Pacific.

The Treaty of 1819, however, had been arranged between the United States and Spain, not with Mexico, which in 1821 became independent. Thus, the new republic inherited the problem. Mexico also inherited the problems of colonizing its frontier territories and of conducting trade with the United States. This trade went between Santa Fe, then in northern Mexico, and the area centering around St. Louis, and was complicated by numberless smuggling and hunting expeditions which violated the border in both directions.

A further troublesome inheritance was the threat of United States expansion westward and southward, one reason for which was the plantation economy of the southern United States, with its dependence on slave labor and large expanses of agricultural territory. Southern desire to extend its way of life into new territories, to counterbalance the extension of nonslave territory in the North, influenced United States policy along its borders with Mexico, and naturally aroused Mexican suspicion and resistance. United States insistence on the need for new land in the southwest seemed all the less reasonable to Mexico because of the still huge undeveloped areas in the western United States.

England, shrewdly realizing that it was in a position to develop commercial relations with Mexico without becoming involved in political or territorial disagreements, improved its position in proportion as Mexican-United States relations deteriorated. The most significant reflection of United States concern over the position it felt England was attaining was contained in the declaration of the Monroe Doctrine of Dec. 2, 1823, calling a halt to European expansion in the Western Hemisphere. Although directed chiefly against Spain and Russia, the doctrine was also an effort by the United States to accomplish in the field of politics what it could not at the time accomplish in the field of trade. Pending the time when it could compete with the trade of Europe, particularly that of England, the United States wished to keep the Latin American market as open as possible. Attainment of the necessary commercial vigor and a sufficiently expanding economy to develop this market fully did not come until after the Civil War.

Indian tribes, frontiersmen, and traders moved back and forth across the border, and such American colonizers as Stephen Austin settled in Texas (in 1821) on Mexican territory. Mexico made efforts to define her frontiers in conformity with the Adams-Onís Treaty of 1819, but the United States refused to acknowledge that the treaty was valid with Mexico unless further border modifications were made.

In the time of Iturbide's empire (1822–1823), immediately after independence, Mexico attempted to win full *de jure* recognition of her government by the United States. Iturbide sent Manuel Zozaya, with full diplomatic powers, as first Mexican minister to Washington. Since in spite of this, between 1822 and 1825 no treaty was ratified between Mexico and the United States, and in light of the expansionism of the latter country, the original Mexican good feeling turned against her northern neighbor. "In time," wrote Zozaya of the United States, "they will be our sworn enemies, and foreseeing this we should treat them as such from the present day." Zozaya's viewpoint shaped the Mexican attitude.

Under the Constitution of 1824, Mexico became a federal republic. Joel Roberts Poinsett was sent as the first American minister in 1825. Poinsett seemed to have real qualifications for the position, but most of his recommendations were rejected by Mexico. He proposed construction of a new road between Santa Fe and St. Louis to make possible the passage of wagon trains, a treaty which would recognize the borders of the Treaty of 1819, and a "most favored nation" tariff agreement between the two nations. Yielding to Mexican opposition to these plans, however, he accepted the Mexican terms and in January 1826 signed a treaty of friendship, trade, and navigation, by which Mexico was recognized by the United States, but which bypassed a settlement of the frontier question.

The situation remained static until the end of Poinsett's mission in 1829, despite his government's insistence on frontier changes, because the Mexican government recalled Zozaya's warning and it seemed that any change in the position of the border would set a dangerous precedent. As a result, the United States refused to ratify the Treaty of 1819 on borders and Mexico did not ratify Poinsett's treaty of friendship, trade, and navigation.

Poinsett's efforts to exert political influence in Mexico in order to obtain the privileges desired by the United States, since the volume of trade with his country was not sufficient to impose its conditions, were sharply criticized by the Mexicans and led to disputes between Poinsett and the British minister, Henry George Ward. When Poinsett assisted in the formation of a lodge of York Rite Freemasons, which promptly became a Mexican political party (the *Yorkinos*), he aroused so much enmity that he was forced to leave the country. After his departure, bad feeling was further aggravated, at times because of lack of tact on the part of succeeding ministers, who insisted on border changes, and by violations of the Mexican border and abuses of Mexican custom officials.

Texas Question and Mexican War.—Above all, bad feeling was created by the part played by the United States in Texan independence, the basis of which was the effort of the Southern states to expand slave territory. The constant and often violent changes of government in Mexico did not help matters, and the anarchy which frequently prevailed encouraged American diplomatic representatives to seek settlement of the frontier question by influencing Mexican government officials. Anthony Butler, who was United States minister from October 1829 to January 1836, for example, tried to obtain the cession of Texas by strategically distributing 100,000 pesos among government officials. Butler suggested extending the southwestern border of the United States all the way to the Pacific, arguing that this was necessary so that a fishing industry could be established in the vicinity of San Francisco and transcontinental communications facilitated.

When Texas, defying the Mexican government, proclaimed its independence in 1836, Mexico tried to reconquer it. The campaign of reconquest was led by Gen. Antonio López Santa Anna, who won the Battle of the Alamo (March 6, 1836) but lost the decisive Battle of San Jacinto (April 21, 1836).

With the independence of Texas, which claimed the Rio Grande as its southern boundary, established by force but not legally recognized by Mexico, Mexican-United States relations were placed under an increased strain. The United States recognized Texas as a new nation in 1837, and other nations followed its lead in granting recognition. Mexico nevertheless continued to insist on its sovereignty over Texas and considered as unfriendly any intervention between itself and its rebellious state.

The problem came to a head in November 1844 after a heated discussion in Mexico City between José María Bocanegra and Manuel Crescencio Rejón for Mexico, and Benjamin Edwards Green and Wilson Shannon for the United States. Rejón analyzed the policies of the United States and charged that its preconceived objective had been to obtain Texas. In January 1845 he said that annexation of Texas by the United States would be considered as a declaration of war against Mexico. Despite this serious position, Mexico was unable to mobilize because of the anarchy and confusion reigning at the time.

The Texas question, as it involved Mexico and the United States, was approaching a climax. Diplomatic relations were broken off in January 1846 and Mexico stopped payment on claims that, despite the work of two arbitration conventions (1839 and 1843), were still pending.

When war came in May 1846, the United States based its declaration of war on the claim that Mexico had begun hostilities by invading United States territory (that is, territory north of the Rio Grande previously claimed by Texas), and "shedding American blood." Mexico, however, denied any invasion and based its stand on the question of Texas. The war is still a matter of great controversy, but at the time many persons in the United States felt it unjustified, and two later presidents, Lincoln and Grant, publicly deplored the action of their country.

Because of internal weakness, Mexico was not able to oppose the United States armies effectively, but spectacular battles were fought (see MEXICAN WAR).

Final peace, sealed by the Treaty of Guadalupe Hidalgo (Feb. 2, 1848), was signed on behalf of the United States by Nicholas Philip Trist, who disregarded his instructions to accept terms regarded by some in the United States as too lenient. Through the treaty, however, Mexico lost half of her territory, including New Mexico, Arizona, all of Upper California, and parts of what are now other states. This treaty established a new boundary line as follows: from the Gulf of Mexico three leagues from land opposite the mouth of the Rio Grande, following the middle of that river to the southern boundary of New Mexico; thence west along that boundary to its western end; north along the western boundary of New Mexico to the first branch of the Gila River; west along the middle of that branch and the middle of the Gila to its junction with the Colorado; thence west along the division between Upper and Lower California to the Pacific Ocean.

Gadsden Purchase.—The peace treaty of 1848 did not solve the problems between the two countries, and the actual position of the southern boundary of New Mexico remained in dispute until the Gadsden Purchase. The southwest border of the United States still was not drawn far enough south to satisfy the promoters of a coast-to-coast railroad, who feared having their trains run too close to the border. Indians from the United States continued to attack Mexican territory and the responsibility of checking them, accepted by the United States in Article 11 of the Treaty of Guadalupe Hidalgo, proved so heavy that that government tried to revoke the clause. Projects for building a canal or railroad across the Isthmus of Tehuantepec were also pending, and were further complicated by concessions made by the Mexican government to individuals, who in turn passed them on to British subjects.

Still desiring more territory, the United States took advantage of the Mexican government's chronic need for money to negotiate the Gadsden Purchase (Treaty of Mesilla) of Dec. 30, 1853, by which Article 11 of the previous treaty was abrogated, the border moved to its present position (for which see UNITED STATES—*Area and*

Boundaries), and the building of the Southern Pacific Railroad was made possible.

Relations with the United States After 1853.—A few years later, the United States fought its Civil War, emerging from the struggle in 1865 with an economic, political, and social structure based on an industrial system which had been ripening in the North and which demanded foreign markets and new fields for investment of capital. Confirmation of industrialism as the national pattern was quickly reflected in United States foreign policy.

During the Civil War, the French invasion of Mexico had installed Maximilian as emperor (1864–1867), in defiance of the Monroe Doctrine. The end of the Civil War, and Mexican resistance led by Benito Juárez, ended the French experiment and Maximilian's life. The re-established Mexican republic received United States support.

During the prolonged presidency (1876–1880 and 1884–1911) of Porfirio Díaz, development of United States industrialization fitted in with material betterment in Mexico, and United States as well as European capital flowed into the country. Through investments, and indirect political influence designed to protect its investors, the United States gained considerable control over the Mexican economy during the Porfirian era. But the material progress made under Díaz was not matched by proportionate social progress, and eventually this pressure produced the Revolution of 1910 and the overthrow of the regime.

The United States began to become aware of the social and economic problems that foreign investment brought to Mexico, and modified its policies so that, despite such incidents during the revolution as the bombardment and occupation of Veracruz by United States Marines in 1914 and Francisco Villa's raid on Columbus, N. M., in 1916, relations were improved.

After the revolution, the most important in Mexico's history, nationalism increased, some foreign properties were expropriated, and foreign investments in major industries were limited.

Then came the era of the Good Neighbor policy, inaugurated in 1933, with hope for understanding based on something more than merely material concerns, and even the acceptance by the United States of the principle that Mexico was entitled to limit economic penetration by foreign capital. (See section *Economic, Industrial, Agricultural, and Financial Factors.*)

Efforts toward mutual understanding seem to have smoothed out the major causes of friction, and *rapprochement* has been strengthened by intellectual movements which began in various universities, and extended through private scientific institutions which have financed exchange students, researchers, and teachers, who contribute to the cause by studying each other's country.

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MEXICO, mĕk'sĭ-kō (Span. mĕ'hĕ-kô), state of the Republic of Mexico. Located in the south central section, it is the central portion of a plateau rising 8,000 feet above sea level. Running from northwest to southeast through the center of the state is a range of well-wooded mountains which separate the Valley of Mexico from a second plateau area in which is located the state capital, Toluca.

The state is one of the richest in the republic. Agriculture and mining are equally well developed and there is an increasing amount of industry. Cereals, sugar, the maguey cactus, fruit, dairy products, and livestock are the main products of agriculture, while silver, gold, copper and lead are mined in quantity. Manufactures are concentrated mainly in the area immediately north of the Federal District, an expansion of industries from Mexico City. Cotton and woolen goods, fibers, paper, flour, glass, pottery and bricks, wines and spirits, and metal products are produced. The area of the state is 8,286 square miles; pop. (1950 preliminary) 1,392,623, of which 73.6 per cent was rural.

MEXICO, city, Missouri, seat of Audrain County, is located on Salt River, 25 miles northeast of Columbia, on the Wabash, the Gulf, Mobile and Ohio and the Burlington Route railroads. It is in a farming area raising grains and soybeans, and is noted as a mule market and horse breeding center. There are large deposits of fine fire clay in the county, and the city's manufactured products include fire brick, stove linings, flour, shoes, and soybean products. Missouri Military Academy is here. The city was settled in 1833, incorporated in 1862, and has a council-manager form of government. Pop. (1950) 11,623.

MEXICO, Federal District of (Span. Distrito Federal), area, Republic of Mexico, which is set aside for the exclusive use of the federal government, so that government will not be hampered by state interference. In this it is like the District of Columbia in the United States. The Federal District was created in 1824. The State of Mexico, of which it was formerly a part, bounds it on the east, north, and west; on the south it is bounded by Morelos.

It is the southeastern portion of the Valley of Mexico, and contains Mexico City, the national capital, which is also the capital of the Federal District. The district is smaller than any of the Mexican states or territories, but has a greater population. In 1950 only 5.43 per cent of the population was rural. The most important manufactures are concentrated in Mexico City and its suburbs. Area 573 square miles; pop. (1950 preliminary) 3,062,205. See also Mexico City.

MEXICO, Gulf of, an arm of the Atlantic Ocean, bounded on the north by the United States and on the south and west by Mexico. It is oval in form; its greatest length is, from east to west, about 1,000 miles; from north to south, about 800 miles; area about 716,000 square miles. It has a continuous coastline of about 3,000 miles. Its maximum depth (Sigsbee Deep) is about 12,425 feet, and the average depth is about 4,700 feet. The outlet of the gulf is on the east, between the peninsulas of Yucatán and Florida, a distance of about 475 miles. In this outlet is the island of Cuba, which is separated from Florida by the Straits of Florida, 110 miles wide, and from Yucatán by the Yucatán Channel, 120 miles wide.

The Yucatán Channel opens into the Caribbean Sea, and the Straits of Florida into the Atlantic.

The temperature of the gulf is from eight degrees to nine degrees higher than in the Atlantic in the same latitude. The temperature at the point of greatest depth is 39½°. The range of the tides is small: from about two and a half feet at the neap tides to about four feet in the spring. The chief current is a branch of the Equatorial Current which enters the gulf through the Yucatán Channel, circles the interior, and exits through the Straits of Florida to form the beginning of the Gulf Stream. The winds are about as on other parts of the globe where north-equatorial conditions exist; the prevailing winds from the north blow from September to March, and from the south from March to September. The severe gales are in the winter, and hurricanes may be encountered in late summer or early autumn.

The northern part of the gulf, from Mexico to Florida, is really a coastal plain averaging from 40 to 100 miles wide. The basin off the Mexican coast sinks rapidly to the submarine plain, and a short distance from shore reaches the maximum depth. The Bay of Campeche is the largest indentation.

The chief ports are Havana, Cuba; Veracruz and Tampico, Mexico; and Galveston, Houston, Port Arthur, Beaumont, New Orleans, Mobile, and Tampa, in the United States.

MEXICO CITY (known to the Mexicans simply as "México," mĕ'hĕ-kō), city, capital of the Republic of Mexico. At the time of the census of 1950 it was the second most populous city of the Spanish-speaking world, exceeded only by Buenos Aires, and was the third most populous city in North America, exceeded by New York and Chicago. At the beginning of the 19th century Mexico City was the largest city in the Western Hemisphere. Today it is the political, commercial, financial, and cultural center of the republic, indeed, the focus of every line of national activity.

Mexico City is situated in latitude 19° 26′ 5″ N., 99° 6′ 45″ W. from Greenwich, at an altitude of 7,415 feet above the level of the sea, near the center of the Valley of Mexico and in the political subdivision of the republic known as the Federal District. The climate of the city is mild. The temperature ranges from 35° to 90° Fahrenheit, but the annual average range is from 54° to 65°, the average being 60°. The nights and mornings are cool throughout the year, the hottest months being April and May, which are followed by the rainy season, late May to early October. The average annual rainfall is 23.4 inches, of which an average of 17.8 inches falls from June through September.

The capital is connected with most other Mexican cities by highway or railroad, and with all important ones by air. It is connected with the United States by air, three railroad lines (to Laredo and El Paso, Texas, and Nogales, Arizona), and several highway routes, and with Guatemala by the same three forms of transportation. Mexico City's chief port is Veracruz, some 200 miles east-southeast on the gulf, with which it has rail, highway, and air connections.

Streets, Parks, and Public Buildings.—The streets of the older part of the city, laid out by the Spaniards on a gridiron pattern, are straight, running north and south, and east and west, and intersecting at right angles. In the newer portions, chiefly west and southwest of the old city, there are some diagonal avenues, but the gridiron pattern has generally been maintained, although the north-south orientation is not always followed. The principal avenues and streets are broad, paved with asphalt, and bordered with good sidewalks; many of the streets in the older section are narrow.

The principal square is the Zócalo or Plaza Mayor (officially, the Plaza de la Constitución), situated in the center of the old city. It covers 14 acres, but is only part of the ground enclosed by the walls of the *teocalli* (main temple) of the ancient Aztec city of Tenochtitlan. The entire eastern side of the plaza is bounded by the Palacio Nacional (National Palace), which is said to occupy the site of Montezuma's new palace. The present building was begun in 1692 and has been added to from time to time until now it has a frontage of 675 feet. It is two stories high, long, low, and plain. Originally it was the residence of the Spanish viceroys, but for many years has been devoted to housing some of the executive departments of the national government, including the president's offices.

Over the main entrance hangs the Liberty Bell, with which, in his church at Dolores, the father of Mexican independence, the priest Miguel Hidalgo, called his people to arms on Sept. 16, 1810. It was moved to its present location in 1896, and since then, a feature of every celebration of the anniversary of independence is the ringing of this bell by the president. On the north side of the Zócalo is the cathedral, the city's chief architectural feature, its most majestic, most imposing colonial edifice. The walls are gray stone. From the sides of the façade rise two bell towers 203 feet in height, which command a superb view of the city and the surrounding valley. The cornerstone was laid in 1573; the walls were finished in 1615, and the roof completed in 1623, when the first Mass was said. It was dedicated in 1667, but was not entirely finished until 1791. It occupies an area of 374 by 198 feet and is of composite architecture, blending the Corinthian, Doric, and Ionic.

The interior contains some exquisite wood carving, and some excellent paintings. In this cathedral in 1822 Agustín de Iturbide was crowned emperor of Mexico, and here he is buried, his coffin bearing simply these words: "The Liberator." Here, too, in 1864 the Austrian Archduke Maximilian and his wife Carlota were crowned emperor and empress of Mexico.

Adjoining the National Palace on the north is the National Museum of Archaeology and Anthropology, containing an outstanding collection of Mexican archaeological treasures. Most of these are Aztec in origin and were excavated in or around Mexico City, but there are also many from nearby Teotihuacán and from Palenque, Yucatán, and other areas. The so-called Aztec Calendar Stone is here. The National School of Fine Arts, formerly the San Carlos Academy, is close to the National Palace, on the east. It contains a valuable collection of paintings, mainly Mexican or Spanish in origin.

On the south side of the Zócalo is the City Hall (Palacio Municipal), which was established in 1532. The present building, in colonial style, dates from 1720–1724 (with additions in 1909), and has a valuable archives section.

East and north of the Zócalo are the old

headquarters of the Universidad Nacional, for which the University City on the outskirts of the capital was dedicated in 1952; the baroque Escuela Nacional Preparatoria (National Preparatory School); and the Secretaría de Educación Pública (Department of Public Education), which occupies a building erected in 1922. Nearly every modern Mexican artist of renown has contributed to the murals in one or more of these buildings. The old building of the Escuela Nacional de Medicina, dating from 1736 and formerly the headquarters of the Inquisition, is near the Secretaría de Educación Pública.

Among the many churches in this area are those of La Santísima Trinidad, dating from 1677, with a fine Churrigueresque façade; La Soledad de la Santa Cruz, completed in 1731; Loreto (1809–1816), by the architect Manuel Tolsá; and Santo Domingo, dedicated in 1736, with a baroque exterior and Churrigueresque interior.

The Avenida Madero and the Avenida Cinco de Mayo, two important business thoroughfares, extend parallel westward from the Zócalo, leading to the Palacio de Bellas Artes. This ornate, white marble building contains the Teatro Nacional, smaller auditoriums, and galleries. The Teatro Nacional, used for concerts and plays, contains a well-known curtain of glass mosaic designed by Dr. Atl (Gerardo Murillo), depicting the panorama of the Valley of Mexico overlooked by Popocatepetl and Ixtaccihuatl.

The Alameda, the largest and most beautiful of the public parks, covering some 40 acres, begins on the western side of the Palacio de Bellas Artes. It is intersected by pleasant walks, shaded by trees, and adorned with flower beds and fountains.

The southern side of the Alameda is bordered by the Avenida Juárez, in effect a continuation of the Avenida Madero and like it lined with fashionable shops, hotels, and office buildings, many of radically modern architecture, although interspersed with older structures. The monument to Benito Juárez, erected in 1910, is at the midpoint of this side of the Alameda, facing the Avenida Juárez. At the end of the latter avenue is the *glorieta* (circle) containing an equestrian statue of Charles IV of Spain, by Manuel Tolsá.

A few blocks north of this point are the bulky Monument to the Revolution, and facing it, the Frontón México, center for *aficionados* of pelota or jai alai, and also the railroad stations.

Running southwest from the *glorieta* of Charles IV is the Paseo de la Reforma, one of the most beautiful avenues in the world. It was designed by Maximilian, who named it the Boulevarde Imperiale. The Paseo is the fashionable afternoon drive and promenade. It is over two miles long and is lined on each side by double rows of trees, beneath which are footways and at their sides stone benches. It expands at regular intervals into three other *glorietas* containing statues of Columbus, Cuauhtemoc, last of the Aztec emperors, and a monument to the independence of Mexico. The houses, hotels, and apartment buildings along the Paseo are almost exclusively of modern architecture.

The Paseo extends to the foot of Chapultepec, a rocky height rising abruptly from the level of the surrounding valley. A beautiful park, set with gigantic trees, encircles the base of the rock. The castle crowning the hill was built between 1785 and 1840, and was occupied by Maximilian and Carlota and was long the official home of presidents. It contains the National Historical Museum, with post-Hispanic historical collections, relics of Cortés, Hidalgo, Juárez, and Maximilian, among others, and portraits of the Spanish viceroys. The view from the front is regarded as one of the most beautiful in the world—the long vista of the Paseo to the city standing in the center of the valley encircled by high mountains from which rise the snow-capped peaks, Ixtaccihuatl and Popocatepetl. In the park at the base of the rock there is a monument to the Mexican cadets who fell in 1847 while defending the hill from the assault of United States troops.

Suburbs.—Besides a number of residential and industrial suburbs, several are of special interest. Guadalupe Hidalgo (officially Gustavo A. Madero), two miles north of the capital, contains the celebrated shrine of the Virgin of Guadalupe, the patron saint of Mexico. Here the treaty of peace following the war with the United States was signed in 1848. At Popotla, west of the city, is the famous Tree of the Dismal Night, beneath which Cortés is said to have sat and wept over his losses after fighting his way out of Tenochtitlan in 1520. Coyoacán, south of the capital, is even older than Mexico City. Cortés made it the seat of government while he superintended the rebuilding of the conquered city. The house in which he lived is still standing. At Xochimilco, also south of the city, are the famous floating gardens.

Drainage Problem.—Mexico City is built on the site of settlements by the Aztecs, which were on islands in shallow Lake Texcoco at nearly the lowest point in the valley. From the earliest times, therefore, there has been danger of inundation, and the sponginess of the subsoil presents a special building problem.

There were five lakes within the valley, all of which, with the exception of Texcoco, were above the level of the city. In times of heavy rains their waters sometimes overflowed the banks and, having no outlet through the surrounding mountains, found their way to Lake Texcoco which, being only two or three feet below the level of the city, rose sufficiently to flood it. Before the Spanish conquest and for some time afterward dikes were built about the city to keep the flood waters out, but these proved ineffective. Inundations occurred on an average once in 25 years. In 1607, the Tajo de (Cut of) Nochistongo was begun through the mountains, as an outlet for the flood waters of the highest lake in the valley which was 13 feet above the level of the city. In 1629 there was another flood and the city was flooded until 1634. Not until 1789, when the Tajo de Nochistongo was completed, was the city freed from the menace of deluges, but the menace of malaria and epidemics remained.

In 1885 a gigantic canal and tunnel project was jointly undertaken by the city and national government. It was designed to serve a twofold purpose: to control the waters of Lake Texcoco, thus removing all possibility of future inundations, and to be a continuation of the city's sewerage system. It starts just east of the city, where it joins the network of city sewers. It extends to the mountains, a distance of 43 miles, connecting with Lake Texcoco on its way. It pierces the mountains by a tunnel nearly seven miles long, and beyond the mountains is continued as a canal for several miles, finally emptying into a tributary of the Pánuco, which carries the city waste to

the gulf. This gigantic undertaking was completed in 1900 and ranks among the truly great enterprises of modern engineering. The city can never again be seriously inundated and it is now provided with an effective sewerage system.

The water supply is taken mainly from the western mountains and from several natural springs at the foothills to the south of the city. The latter supply is now largely used as potable water. There are also a thousand or more artesian wells, mainly privately owned.

Due to the softness of the subsoil, many of the heavier buildings have sunk or sagged, a process intensified by draining the waterlogged soil of its fluid. This is true not only of such older buildings as the cathedral, but also of the Palacio de Bellas Artes, which was begun in 1900 and has sunk about six feet. Tall modern buildings, such as apartment houses, are being built on the displacement principle, so that they "float" in the soft soil.

Industry.—There are hundreds of industrial establishments, most of which have sprung up since the advent of electric power, there being no other cheap fuel, or waterpower, available. The main industries are iron foundries, tanneries, manufactures of glass, paper, cement, textiles, tobacco products, chemicals, and petroleum products, automotive assembly plants and tire factories, and food processing and canning.

History.—The history of Mexico City begins with the foundation of Tenochtitlan by the Aztecs, who settled on islands in Lake Texcoco in the early part of the 13th century (see AZTECS). According to tradition, they were directed by an oracle to settle where they saw an eagle perched on a cactus, devouring a serpent; hence this scene on the national coat of arms.

In the center of Tenochtitlan was the great temple, approximately on the site of today's Zócalo. Before the arrival of the Spaniards the first rude houses, standing on piles and built of mud and rushes, had been replaced by buildings of stone, and Tenochtitlan had become the chief city of an extensive empire (see MEXICO—*Prehistory and Pre-Hispanic History*).

It has been estimated that this city had a radius of over a mile. It was intersected by canals, and connected with the mainland by causeways. During its conquest by Hernán Cortés in 1521, it was largely destroyed. No trustworthy record exists as to the size of the population at this time. One contemporary writer states that it was 500,000; another, 30,000.

On the same site in 1522, Cortés began the building of the Spanish city. But so many changes have been made since then that the city of today retains hardly a trace of the city founded by Cortés. In 1600 its population consisted of 7,000 Spaniards and 8,000 Indians. In 1746 it had a population of 90,000; 50 years later one of 113,000.

Under the Spaniards, Mexico City was the capital of perhaps the wealthiest province of the Spanish Empire; mansions, churches, and public buildings were erected in profusion and lavishly embellished.

So completely has the capital dominated the country during the colonial and independent periods that the history of Mexico City is practically the history of Mexico. It has ever been the object of contending parties; yet during the struggle for independence it was almost untouched, Agustín de Iturbide, making his entrance peacefully in 1821 at the head of the insurgent forces. Even during the chaotic period which followed, the capital suffered little, as regime followed regime. In 1847 there was severe fighting between United States and Mexican forces at Churubusco, Molino del Rey, and Chapultepec, south and west of the city, but Gen. Winfield Scott entered the city practically without opposition on Sept. 14, 1847.

It was captured by the French in June 1863, and Maximilian was installed by them as emperor soon after. The Mexican Liberals recaptured the city in June 1867, bringing the empire to an end.

The present aspect of much of the city is due chiefly to Maximilian's projects for beautifying his capital, to buildings and improvements during the long regime of Porfirio Díaz (1884–1911), and to the expansion, increasing prosperity, and building programs dating from the middle and late 1920's, the period following the Revolution of 1910, and thereafter.

During this revolutionary period, in 1913, the city was the battleground between followers of Francisco Madero and anti-Madero revolutionists, and a limited number of buildings suffered during ten days' shelling and street fighting, February 9 to 18.

MEXICO CITY CONFERENCE. See PACTS AND CONFERENCES: WORLD WAR II.

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Arctic
Baffin Bay
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N
TIERRA del FUEGO
S. GEORGIA
S. ORKNEYS
S. SHETLAND IS.
PALMER PENINSULA
ANTARCTICA

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Caspian S.
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Tashkent
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